Understanding and Optimizing the Sustainability and Sustainment of Newly Implemented Evidence-Based Practices in Rehabilitation

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Abbreviations

Abbreviation	Meaning
BRILLIANT	Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies
CFIR	Consolidated Framework for Implementation Research
CFIR 2.0	Consolidated Framework for Implementation Research version 2
CLMM	Cumulative Link Mixed Model
CI	Confidence Interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CISSS	Centre intégrés de santé et de services sociaux
CIUSSS	Centres intégrés universitaires de santé et de services sociaux
CMOC	Context-Mechanism-Outcome Configuration
COSMIN	COnsensus-based Standards for the selection of health Measurement INstruments
CRIR	Centre for Interdisciplinary Research in Rehabilitation of Greater Montréal
CSAT	Clinical Sustainability Assessment Tool
EBP	Evidence-Based Practice
ICC	Interclass Correlation Coefficient
IKT	Integrated Knowledge Translation
INESSS	Institut national d'excellence en santé et services sociaux
KT	Knowledge Translation
MEDLINE	Medical Literature Analysis and Retrieval System Online
MOHO	Model Of Human Occupation
MPAI-4	Mayo-Portland Adaptability Inventory – version 4 (MPAI-4)
MSSS	Ministère de la Santé et des Services sociaux
NPT	Normalization Process Theory
NWKM	New World Kirkpatrick Model
OM	Outcome Measure
OR	Odds Ratio

OT	Occupational Therapist
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	The International Prospective Register of Systematic Reviews
PT	Physiotherapist
PUR	Pôle universitaire en réadaptation
RE-AIM	Reach Effectiveness Adoption Implementation Maintenance Framework
SLP	Speech-Language Pathologist
TPB	Theory of Planned Behaviour
VAS	Visual Analog Scale

Abstract

To optimize quality of care, evidence-based practices are implemented into routine rehabilitation practice. A growing body of research suggests that newly implemented evidence-based practices are only sustained post-implementation 40-60% of the time. Poor sustainment can result in a loss of potential improvements in quality of care and patient outcomes.

Although descriptions of the contextual factors that affect sustainability and sustainability strategies exist, there is a paucity of evidence on how (i.e., mechanisms by which) certain sustainability strategies and contextual features produce sustainability outcomes. The lack of research linking sustainability strategies, context and outcomes means that there is little guidance on how to optimize sustainment. The overall aim of this doctoral research was to understand and optimize the sustainability and sustainment of a newly implemented evidence-based practice in three rehabilitation centers.

To operationalize the overarching aim, this thesis is composed of four projects. All projects were informed by an integrated knowledge translation approach whereby researchers and diverse clinical stakeholders actively collaborated to optimize implementation and research success.

Project 1: To understand how (mechanisms) and in what circumstances (context) a rehabilitation practice is sustained, or not (outcome) I conducted a realist review. The program theory generated in this review proposes three patterns: (1) implementation and sustainability phases are interconnected, (2) the continued use of the evidence-based practice can be interpreted as the critical sustainability outcome, and (3) intermediate sustainability outcomes (i.e., fit/alignment, financial support, benefits, expertise) can become contextual features influencing other sustainability outcomes.

Project 2: To describe the collaborative sustainability planning process for an outcome measure I conducted a qualitative description study. Sustainability planning was guided by the program theory generated in project 1. Three themes captured the collaborative sustainability planning process: (1) collaboration as a driver for sustainability, (2) co-creation of a sustainability plan to achieve shared objectives, and (3) the iterative nature of sustainability planning.

Project 3: To understand how (mechanisms) and in what circumstances (context) a rehabilitation outcome measure is sustained, or not (outcome) I conducted a realist evaluation using a mixed method, embedded single case study design. The program theory developed in project 1 was tested and refined, resulting in four patterns: (1) implementation and sustainability phases are interconnected, (2) outcomes build on each other cyclically with patient benefits as the keystone outcome, (3) sustainment is achieved to varying levels across different sustainability outcomes, and (4) the work of sustaining the outcome measure is divided amongst stakeholders.

Project 4: To evaluate clinician's reaction, learning and behavioural intent to a collaboratively developed training session for an outcome measure, I used an explanatory sequential mixed method design. Survey participants rated themselves higher on most learning outcomes (knowledge, confidence, and skill) and some behavioural intent outcomes between pre-training and post-training. Interview participants substantiated survey results, including: 1) positive reactions to the training session, and its learning and behavioural impacts, 2) participant negative attitudes and commitment towards the outcome measure being due to perceived limitations in the measure and, 3) the training session's impacts being affected by contextual factors such as a provincial mandate for the outcome measure.

This thesis work advances our understanding of sustainability and sustainment of outcome measures used in rehabilitation settings. Researchers can continue to test and refine the program theories, while implementation teams can apply these findings to optimize their success, ultimately contributing to sustained high quality care and optimized patient outcomes.

Keywords: sustainability; clinical / practice guidelines; innovation; change management; quality improvement; implementation science; qualitative studies; case studies; rehabilitation medicine; stroke

Abrégé

Pour optimiser la qualité des soins, des pratiques fondées sur des données probantes sont mises en œuvre dans la pratique de la réadaptation. De plus en plus d'études suggèrent que les pratiques fondées sur des données probantes nouvellement mises en œuvre ne sont pérennisées que dans 40-60% des cas. Une pérennisation insuffisante peut entraîner une perte des améliorations potentielles de la qualité des soins et des résultats pour les patients.

Bien qu'il existe des descriptions des facteurs contextuels qui affectent la pérennité et les stratégies de pérennité, il y a peu de preuves sur la façon (c'est-à-dire les mécanismes par lesquels) certaines stratégies de pérennité et caractéristiques contextuelles produisent des résultats de pérennité. Le manque de recherche reliant les stratégies de pérennité, le contexte et les résultats signifie qu'il y a peu de conseils sur la façon d'optimiser la pérennité. L'objectif global de cette thèse est de comprendre et d'optimiser la pérennité et la pérennisation d'une pratique fondée sur des données probantes récemment mise en œuvre dans trois centres de réadaptation.

Pour concrétiser l'objectif général, cette thèse est composée de quatre projets. Tous les projets ont été guidés par une approche intégrée de l'application des connaissances dans laquelle les chercheurs et les diverses parties prenantes cliniques ont activement collaboré pour optimiser la mise en œuvre et le succès de la recherche.

Projet 1: Pour comprendre comment (mécanismes) et dans quelles circonstances (contexte) une pratique de réadaptation est pérennisée ou non (résultat), j'ai mené une revue réaliste. La théorie du programme générée par cet examen propose trois tendances : (1) les phases de mise en œuvre et de pérennité sont interconnectées, (2) l'utilisation continue de la pratique fondée sur des données probantes peut être interprétée comme le résultat critique de la pérennité, et (3) les résultats intermédiaires de la pérennité (c'est-à-dire l'adéquation/l'alignement, le soutien financier, les avantages, l'expertise) peuvent devenir des caractéristiques contextuelles qui influencent d'autres résultats de la pérennité.

Projet 2 : Pour décrire le processus de planification collaborative de la pérennité en vue d'une mesure des résultats, j'ai mené une étude descriptive qualitative. La

planification a été guidée par la théorie du programme. Trois thèmes ont permis d'appréhender le processus de planification collaborative de la pérennité : (1) la collaboration en tant que moteur de la pérennité (2) la co-création d'un plan de pérennité pour atteindre des objectifs communs et (3) la nature itérative de la planification de la pérennité.

Projet 3 : Pour comprendre comment (mécanismes) et dans quelles circonstances (contexte) une mesure des résultats de la réadaptation est pérennisée ou non (résultat), j'ai mené une évaluation réaliste utilisant une seule étude de cas à méthode mixte. La théorie du programme développée dans le projet 1 a été testée et affinée, ce qui a permis de dégager quatre modèles : (1) les phases de mise en œuvre et de pérennité sont interconnectées, (2) les résultats se construisent les uns sur les autres de manière cyclique, les bénéfices pour les patients étant le résultat clé, (3) la pérennisation est atteinte à des niveaux variables à travers différents résultats de pérennité et (4) le travail de pérennité du MPAI-4 est partagé entre les parties prenantes.

Projet 4 : Pour évaluer la réaction, les apprentissages et les intentions comportementales des cliniciens à l'égard d'une session de formation élaborée en collaboration pour une mesure des résultats, j'ai utilisé une méthode mixte séquentielle explicative. Les participants au sondage se sont mieux évalués pour la plupart des résultats d'apprentissage (connaissances, confiance et compétences) et ont noté leur intention comportementale entre une semaine avant la formation et une semaine et huit semaines après la formation. Les participants aux entretiens ont expliqué ces résultats du sondage: 1) en soutenant les réactions positives à la session de formation et ses impacts sur l'apprentissage et le comportement, 2) en indiquant que leurs attitudes négatives et leur engagement sont dus aux limites de la mesure des résultats, et 3) en expliquant que les impacts ont été affectés par des facteurs contextuels.

Ce travail de thèse fait progresser notre compréhension de la pérennité et de la pérennisation, en particulier les outils de mesures. Les chercheurs peuvent continuer à tester et à affiner les théories du programme, tandis que les équipes de mise en œuvre peuvent appliquer les conclusions de la thèse pour optimiser leur succès, contribuant ainsi à la pérennisation des soins de haute qualité et à l'optimisation des résultats pour les patients.

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Throughout my doctoral journey I have been surrounded by an incredible community of people – mentors, coaches, teammates, managers, and friends. You have celebrated my wins, helped me navigate the obstacles and raised me up when I felt overwhelmed throughout the rollercoaster ride that is a PhD.

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incredible patience as I learned the process of platform development on the job; Rola El Halabieh for being an unflappable program officer for BRILLIANT.

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Preface

Statement of Originality

This thesis describes the steps taken towards understanding and optimizing the sustainability and sustainment of newly implemented evidence-based practices (EBPs) in rehabilitation. I first became interested in the field of knowledge translation (KT) when I worked as a lecturer at the University of Waterloo and as a Registered Kinesiologist (R.Kin) in Ontario. As I gained experience teaching students and healthcare professionals, I encountered a troubling pattern that was also reflected in my clinical experiences – namely, there was often a gap between research evidence and its use in clinical practice. When I searched for strategies to narrow this gap and sustain the use of research evidence, I encountered literature in the field of KT. This literature opened my eyes to the myriad factors beyond education that affect the use of research evidence in clinical practice and inspired me to tackle this issue more intentionally. I recognized that I needed additional training to accomplish my goal. I decided to pursue my doctoral training with Drs. Aliki Thomas and Sara Ahmed as my supervisor and co-supervisor, respectively.

I started my PhD journey with the intention to investigate the sustainability and sustainment of EBPs specifically, perceiving that much of the frustration I and other clinicians had experienced in leveraging research evidence in clinical practice arose not from a lack of implementation effort, but from an unsustained implementation effort. The specific projects began to be developed during supervisory meeting discussions with Drs. Thomas and Ahmed. During these preliminary discussions it became clear that embedding my doctoral thesis within the implementation project for the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) led by my supervisors would be advantageous. The projects within this dissertation were developed to complement the MPAI-4 implementation research projects for which they received funding.

In line with the doctoral dissertation that was taking shape embedded within the MPAI-4 implementation project, Dr. Michelle McKerral was invited to join my doctoral committee with to provide expertise on the MPAI-4 and share her experience of implementing the MPAI-4 in traumatic brain injury rehabilitation programs in Québec,

amongst her other skills. Not long after, Dr. Whitney Berta was invited to join my committee to provide guidance concerning sustainability and sustainment, complementing the general expertise in implementation science of the other committee members.

The original contribution of this thesis lies with it being amongst the few studies that have sought understand sustainability and sustainment by linking influential factors to sustainability outcomes. This contribution to the literature and the direct application of this knowledge to the MPAI-4 implementation project has resulted in important theoretical, methodological, and practical contributions to the field of implementation science, especially in rehabilitation.

Although this research could not have been conducted without the guidance of my committee members, this statement attests that this doctoral dissertation is my own original work. The assistance that I received in carrying out this research has been acknowledged. Except for the chapters representing manuscripts that are either published or under review in peer-reviewed, scientific journals, this dissertation has not been published or otherwise disseminated. An external editor was not engaged as part of the process of writing this thesis.

Contribution of Authors

The manuscripts in this dissertation are the work of Rebecca Ataman with guidance from all committee members concerning their conceptualization and design. In all four manuscripts, the ethics application (when relevant), participant recruitment, data collection, data analysis, data integration (where relevant), interpretation of results and manuscript writing were conducted by the doctoral candidate with guidance from Drs. Aliki Thomas and Sara Ahmed. The doctoral candidate was responsible for the originality of the ideas, the scientific quality of the research and for the quality of the reporting across all manuscripts in this dissertation, under the advisement of the thesis committee. Each of the four manuscripts includes statements of all committee members' roles as co-authors or recognizes their contributions in the acknowledgements.

As primary supervisor, Aliki Thomas oversaw the entirety of this thesis, provided expertise in implementation science, integrated knowledge translation, and mixed and

qualitative methods. She also provided extensive editing and feedback on all chapters of this thesis. She is a co-author on all four manuscripts.

As co-supervisor, Sara Ahmed oversaw the entirety of this thesis, provided expertise in implementation science, evaluation and psychometric properties, and provided feedback on all chapters of this thesis. She is a co-author on all four manuscripts.

As committee members, Drs/ Michelle McKerral and Whitney Berta provided content and editorial feedback on all chapters of this thesis. Whitney Berta is a co-author on *manuscripts 2, 3* and *4* and Michelle McKerral is an author on *manuscript 4.* Both are acknowledged for their contributions to *manuscript 1*.

Ahlam Zidan (PhD candidate) contributed to *manuscript 1's* data collection and analysis, and provided critical review and approval of the final manuscript, and is a co-author on this manuscript.

In *manuscript 4*, Dr. Claudine Auger, Dr. Dorra Rakia Allegue and Alice Misana contributed to the conceptualization and design of the training session delivery and it's evaluation. Dorra Rakia Allegue provided further support in data analysis. Dr. Ali Filali helped select, conduct, and draft the statistical analysis (cumulative link mixed models) within *manuscript 4*. All five are co-authors on this manuscript.

There are several individuals who are acknowledged for their contributions to each manuscript but who are not co-authors. Across all manuscripts the clinical teams at each site were instrumental to the success of the research project, in particular the managers and administrators (Kim Singerman, Nancy Cox, Dana Benoit, Manon Parisien, Sébastien Pelletier, Gabrielle Cousineau-Daoust), the care coordinators (Julie Piché, Suzanne Desparois, Heather Stiglitz, George Roumeliotis, Maude Robitaille, Viviane Nhu Tram Trinh, Miriam Vaillancourt) and the clinical research coordinators (Loredana Caputo, Shabnam Taherian, Filomena Pietrangelo, Andréanne Guidon, Lucas Gomes Souza, Frédéric Messier). Important contributions to the feasibility of the projects also came from professionals in IT (Dr. Samir Sangani) and project management (Rola El Halabieh). Finally, contributions from individuals with key research expertise was also important to dissertation projects, including Jill Boruff contributing to the peer review of the search strategy in *manuscript 1* in her capacity as a medical research librarian and

Marco Zaccagnini (PhD candidate) contributing to the analysis in *manuscript 2* as an independent coder based on his expertise in qualitative research.

Thesis Organization and Overview

This dissertation consists of four manuscripts, the first of which is already published in a peer-reviewed scientific journal. In alignment with the *Graduate and Postdoctoral Studies* regulations at McGill University, introductory chapters, bridging chapters between the four manuscripts and a concluding, integrated discussion chapter compose this dissertation. Due to this dissertation format, some information may be repeated between chapters. The following consists of a brief outline of this dissertation.

Chapter 1 introduces this doctoral work, consisting of a literature review introducing key concepts including the state of sustainability and sustainment of newly implemented EBPs in rehabilitation. The theoretical, methodological and practice gaps in this field are highlighted. Finally, the rationale for this research and the objectives of each manuscript are presented.

Chapter 2 presents information concerning the thesis setting, including information on the participants and sites recruited for this dissertation, and of the MPAI-4 implementation project within which this dissertation takes place. A historical view of the MPAI-4 implementation project is presented, highlighting the changes in the project since its inception in 2019 and their impacts on this dissertation.

Chapter 3 conveys information related to the doctoral candidate's reflexivity throughout this thesis.

Chapter 4 consists of *manuscript 1*, entitled *Understanding How Newly Implemented Rehabilitation Best Practices Are Sustained: A Realist Review* reporting the program theory explaining the sustainability and sustainment of EBPs in rehabilitation.

Chapter 5 links the first and second manuscript to one another.

Chapter 6 consists of *manuscript 2*, entitled *Collaborative sustainability planning for the newly implemented Mayo-Portland Adaptability Inventory-version 4 in outpatient stroke rehabilitation: A qualitative description study*, describes the process of collaborative sustainability planning in the MPAI-4 implementation project.

Chapter 7 links the third manuscript to both the first and second manuscripts.

Chapter 8 consists of *manuscript 3*, entitled *Sustainability of an outcome measure in outpatient stroke rehabilitation: A realist evaluation*, reporting the program theory explaining the sustainability and sustainment of the MPAI-4.

Chapter 9 links the fourth manuscript both the second and third manuscripts.

Chapter 10 consists of *manuscript 4*, entitled *Development and Evaluation of Tailored, Theory-informed Training Sessions: an explanatory sequential mixed methods study*, and describes participant's reaction, and impacts on their learning and behavioural intent at each of the participating sites.

Chapter 11 is the integrated discussion chapter which includes a brief summary of the main findings of this doctoral research, it's theoretical, methodological, and practical contributions, strengths and limitations, promising areas for future research and a concluding statement.

Tables and figures are presented within each manuscript. References and appendices for all chapters are found after each chapter. Reference styles were based the *Vancouver Style*, except in *manuscript 1* which is presented as published in the journal's style. All projects requiring ethics approval were approved by the *Research Ethics Board for Rehabilitation and Physical Disability* associated with the Centre for Interdisciplinary Research in Rehabilitation of Greater Montréal (CRIR). All participants provided informed consent.

Chapter 1.

Introduction

1.1. Evidence-Based Practice in Outpatient Stroke Rehabilitation

Rehabilitation care is considered an *"essential component of universal health coverage"* (1). Rehabilitation clinicians (e.g., occupational therapists (OT), physiotherapists (PT), speech-language pathologists (SL-P), etc.) help enable individuals to function independently in their daily lives, to reintegrate into the community and fully participate in the activities that are meaningful to them (2,3).

Stroke survivors and their families are one population that can benefit from rehabilitation services (4). Each year, nearly 20,000 people in Québec and more than 62,000 people in Canada have a stroke (5–7). In Canada, stroke is the tenth main contributor to years of life lost due to ill health, disability, or early death, and the second largest contributor of any brain injury or disease (8). Stroke survivors often experience disabling limitations such as depression (9), loss of motor function (10) and vision loss (11). These deficits negatively impact daily activities and meaningful participation in society; an estimated 60-70% of stroke survivors need support from family and friends to complete daily activities when discharged home (5). Once discharged, many stroke survivors require outpatient stroke rehabilitation to reduce the impact of deficits and optimize activities and participation (12,13).

Evidence-based outpatient stroke rehabilitation has been shown to be effective at improving stroke outcomes (i.e., impairments, activities, and participation) (14,15). For example, the results of a Cochrane review of the effectiveness of incorporating physical fitness training into stroke rehabilitation found that disability scores were improved by cardiorespiratory training (standardized mean difference (SMD) 0.52, 95% CI 0.19 to 0.84; 8 studies, 462 participants; $p = 0.002$; moderate-certainty evidence) and mixed training (SMD 0.23, 95% CI 0.03 to 0.42; 9 studies, 604 participants; $p = 0.02$; low-certainty evidence) when compared to usual care (16). The results of other Cochrane reviews demonstrate the effectiveness of practices such as multidisciplinary teams (14)

and exercise-based rehabilitation approaches (4,17) in outpatient stroke rehabilitation on outcomes including independence in daily activities.

Although there is evidence of the effectiveness of many stroke assessments and treatment interventions, there are instances where evidence-based practices (EBPs) are underutilized in rehabilitation. The underutilization of standardized outcome measures is particularly persistent (18–21). A systematic review of barriers to the use of outcome measures by physiotherapists, occupational therapists, and speech-language pathologists includes a lack of clinician and/or manager knowledge and skill related to standardized outcome measurement, the time required to learn and administer outcome measures, and the availability of equipment including electronic databases (22). These barriers negatively affect the use of standardized outcome measures despite empirical evidence that measures enhance care processes and patient outcomes (23,24) and the acknowledgment of their benefits by clinicians (18), managers, and policymakers (25,26). Benefits for patients can be realized by using measures for clinical evaluation at program admission to predict which patients may benefit most from an intervention, and to evaluate patients at post-intervention, discharge, or follow-up. Results from clinical evaluation measures can be pooled and compared to evaluate program-level rehabilitation outcomes (27–30).

Policymakers have begun mandating the standardized measurement of outpatient stroke outcomes including impairments, activities, and participation for the purpose of clinical and program evaluation (27–30). Specifically, evidence-based stroke outcome measurement is being standardized via mandatory reporting in outcome databases, including the National Outcome Info database (USA) (27) and United Kingdom Rehabilitation Outcomes Collaborative (28). Similarly, the Ministère de la Santé et des Services Sociaux (MSSS) of Québec released new stroke service requirements in 2018 which include standardized outpatient outcome measurement (29). As indicated by these directives, there is now an initiative from a policy level to implement evidence-based outcome measurement in outpatient stroke rehabilitation.

1.2. Collaborative Implementation

Implementation refers to the process of integrating an EBP within a setting (31,32). Implementation consists of two key components (33) – an EBP that has demonstrated effectiveness and any combination of implementation strategies (e.g., audit and feedback, and educational meetings (34,35)). Although passive and unidirectional (i.e., push, pipeline) approaches where researchers inform stakeholders (e.g., clinicians, managers, patients) about an EBP are more common (36,37), collaborative implementation approaches are gaining momentum in health care (38–41).

Collaborative implementation has the potential to increase the likelihood that new EBPs will be more relevant and meaningful to the end users (42,43). In collaborative approaches to implementation, the core assumption is that stakeholders will be more likely to use an EBP that is relevant to them, or "*both scientifically and socially robust"* (44). To increase the relevance of research findings to practice, stakeholders (i.e., researchers, clinicians, managers, administrators, and patients) actively collaborate with researchers as equitable members of the team throughout the entire research process (38,45,46). Active collaboration requires a meaningful partnership between researchers and knowledge users characterized by a bidirectional exchange of knowledge and mutual learning built on trust, respect and power sharing (38,43,45,47–49). There is growing evidence that EBP is more likely to be successfully implemented when knowledge users have meaningful partnerships with researchers (41,50–58). Accordingly, authors of recent research agendas on the integrated knowledge translation (IKT) approach in healthcare have recommended the increased use of collaborative approaches in implementation (59,60).

There are many collaborative approaches to research, including engaged scholarship, mode 2 research, co-production, participatory action research, and IKT (41,46,49,61). Experts in these collaborative approaches have indicated that there are some crucial, nuanced differences between them. It is the specificities of the IKT approach which make it particularly well-tailored to implementation research. In IKT, stakeholders have considerable decision-making authority in their clinical milieu, including the authority to implement changes and facilitate the use of EBP (49,62).

Collaborating with stakeholders who have this authority contrasts with other collaborative approaches (e.g., participatory action research) where a major focus of the collaboration is often the empowerment and capacity building of vulnerable communities or those with little decision-making power (49,63). Thus, involving stakeholders with authority is crucial for successful implementation and the continuation of the EBP over the long term – or its sustainability.

1.3. Conceptualizing Sustainability and Sustainment

1.3.1. Sustainability

Sustainability is not a new concept. It was first described by Lewin in 1947 in his freeze-change-refreeze model, in which sustainability is the process of 'refreezing' tasks after a change has taken place (64). Lewin's work was so influential, that for over 50 years sustainability was largely conceptualized according to his change theory. Lewin's theory of change includes (64–67):

- viewing organizations as static in that they did not change in other ways during the change process.
- considering fidelity to the change to be paramount (i.e., any adaptation or deviation was an implementation failure).
- viewing sustainability as the final stage in a linear process.
- putting emphasis on an organizational change plan without considering the behaviour change of individuals.

It wasn't until the early 2000s that other theories began to penetrate the implementation literature, thereby changing the conceptualization of sustainability.

Three major perspectives have had a particular influence on the conceptualization of sustainability. The first perspective came from theories of behaviour change which include the Theory of Planned Behaviour (TPB) (68) and social cognitive theory (69), amongst many others (70,71). Collectively, integrating behaviour change theories into implementation science encouraged planning for implementation and sustainability at the individual level, in addition to the organizational and systems levels. Concrete effects on sustainability included a greater focus on addressing the needs and motivations of various

stakeholders by actively collaborating with them and/or using strategies like data monitoring and direct feedback on an ongoing basis (72,73).

The second influential perspective was Roger's Diffusion of Innovations (74). This theory is usually applied to explain the adoption and spread of new EBPs. Adoption refers to the initial uptake of a practice while spread is the expansion of a practice outward to new individuals and contexts (74,75). When applied to sustainability, Diffusion of Innovations proposes that adaptations are essential to sustaining the practice through a better fit with the practice environment within an organization, and the users and/or client's needs, despite the potential for an adaptation to lessen the effectiveness of the practice. Thus, Diffusion of Innovations encouraged the rejection of absolute fidelity in favour of balancing fit and effectiveness (74–76).

The third perspective originated from organizational theories, which explain organizational-level sustainability. Most prominent (73) are complexity theory (77), ecological theory (78) and open systems theory (79). Complexity theory explains that sustainability is a nonlinear process where change, adaptation, and uncertainty are expected. Furthermore, it highlights how ongoing, complex interactions between an initiative, the individuals involved, the organization and the sociocultural context impact sustained change (73,77). Ecological theory stresses sustainability as being dynamic and requiring continuous adaptation to achieve sustainment (80). Open systems theory proposes that sustainment by an organization is both facilitated and hindered by its environment (79). Thus, via organizational theories, sustainability is conceptualized as an iterative cycle influenced by changing contexts (73). This conceptualization is perhaps best put by the Greek philosopher Heraclitus, who stated*, "there is nothing permanent except change"* (as quoted by Plato in Cratylus, 402 BCE).

A modern conceptualization of sustainability as espoused by these theories was made explicit in the influential Dynamic Sustainability Framework (DSF) published in 2013. According to the DSF, sustainability is an iterative, ongoing process that involves adaptation to optimize the fit between EBPs and multi-level contexts, and expectations for ongoing improvement as opposed to diminishing outcomes over time (76). Sustainability may be usefully thought of as a trajectory that weaves through other implementation phases. In fact, distinct sustainability processes occur before, during, and

after implementation. For example, in pre-implementation sustainability planning takes place concurrently with implementation planning (81,82). During implementation, attention begins to shift to sustainability even though implementation supports such as an external facilitator linger (34,82,83). Finally, post-implementation, sustainability outcomes are evaluated as they temporally follow implementation outcomes (34,82,83).

Since sustainability is its own unique process, the contextual factors (i.e., multi-level features of the practice environment (32)) and mechanisms (i.e., social processes such as decision-making) that make an EBP more or less likely to be sustained differ from those of other implementation phases (82,84,85). For example, authors of a qualitative descriptive study exploring the contextual factors important to developing, implementing, and sustaining functional maintenance initiatives delivered by rehabilitation professionals in acute hospitals reported both overlap and differences between contextual factors for these phases. Prioritization by the organization, and staff and management support were found to be important during all phases, whereas staff retention was noted as highly influential during sustainability in particular (86).

1.3.2. Sustainment

Similarly, sustainability outcomes are unique compared to outcomes from other implementation phases (e.g., feasibility, reach) (87–89). Thus, researchers have attempted to identify and define key sustainability outcomes or indicators of sustainment (82,90–94). That is, sustainment is the output of a sustainability effort (94). Over the past five years, various definitions of sustainment have been developed from a synthesis of the empirical literature (95), healthcare managers' perceptions of sustainment (96) and a systematic review of sustainability approaches (73). Combining this work results in sustainment being defined as:after a defined period of time:

1. the evidence-based clinical practice and strategies continue to be delivered
2. individual behavior change (i.e., clinician, patient) is maintained
3. the capacity for the practice is maintained
4. the clinical practice and individual behavior change may evolve or adapt
5. benefits continue for individuals, organizations and/or systems
6. financial viability is maintained

Experts have noted that sustainability outcomes change over time (82,97) as the context changes (98–100). Furthermore, outcomes have relationships with each other (96). For example, according to the authors of the study exploring healthcare managers' perceptions of sustainment, continued benefits need to be produced for other sustainability outcomes to occur (e.g., for the clinical practice to be continued) (96). Thus, conceptualizations of sustainability and sustainment have undergone recent and rapid change. While these concepts are complex, there is growing clarity for researchers to employ a shared conceptualization for research purposes.

1.4. Importance of Sustainability and Sustainment

In the wider healthcare literature, implementation teams have noted that the resource intensive nature of implementation projects makes them worthwhile only if the EBP is sustained over time (99,101,102). However, sustainment is often poor. Results from three systematic reviews suggest that only 40-60% of EBPs are sustained (102–104). Furthermore, sustained practices often operate at a reduced level (e.g., 50% EBP use instead of 80% seen in implementation (104)). Reported estimates of sustainment may even be considered high, as many authors evaluated short-term sustainability as early as 6 months post-implementation and longer-term sustainability for those implementation projects has not been reported (105–108). The 2020 update of the RE-AIM framework recommends that sustainability be evaluated at least 1-year post-implementation (82), while other experts have recommended at least 2 years (95).

Some practices become obsolete and should not be sustained. For example, those which are not producing the expected benefits or those that are discontinued (i.e., de-implemented) as part of the implementation of a new, updated practice (109). However, in many cases, there are negative consequences of poor sustainment of a practice that is beneficial and therefore should be sustained. First, there is a loss of the investment in human resources, research, and implementation for the practice (84,110,111). Second, there is a loss of potential improvement in the quality of care and patient outcomes because the implementation of the EBP was expected (or evaluated) to result in benefits (99). This can cause inequity in the healthcare system when the lack of sustainment of an EBP results in variations in care across similar services (82,110,111). Finally, poor

sustainment may contribute to a culture or expectation of failed implementation. Individuals' experiences with previous implementation projects will shape how they view future opportunities. Negative experiences may discourage stakeholders from getting involved in future work (99,112,113).

1.5. Knowledge Gaps in the Sustainability Literature

Though the sustainment of EBPs is necessary, this literature has matured slowly (84,101,114,115). In recent years, the literature has reached a point where there has been a proliferation of sustainability knowledge syntheses (i.e. scoping reviews (116,117), systematic reviews (65,73,102,104,118–126) and narrative reviews (93,110,127,128)) providing a comprehensive description of sustainability strategies (102,110,118,120,128,129), influential contextual factors (65,73,102,110,119,121,122,125,127,128), outcomes (65,73,102,104,110,116,118,121,127–129), and theories, models and frameworks (73,119). Other than a recent citation analysis of the Knowledge-to-Action Framework in which the authors identified general sustainability activities (e.g., seven included studies measured sustainability outcomes (130)), there have been no syntheses on EBP sustainability in rehabilitation. However, authors have reported similar findings concerning sustainability in rehabilitation compared to other healthcare settings. For example, a failure to provide standard documentation procedures caused reduced sustainment in rehabilitation (105) and health promotion (101). Thus, information across the sustainability literature can be transferable to rehabilitation, and vice versa.

Per the extensive series of reviews, sustainability strategies, influential contextual factors, and sustainability outcomes have been well described in the broader healthcare literature. What is not yet known are the mechanisms that link contextual factors, strategies and outcomes to explain how sustainability works (84). This gap has been consistently reported throughout the last 10 years (84,91,99,102). A recent research agenda developed by Shelton and colleagues called for research to better understand sustainability (91). Without a theoretically driven understanding of how sustainability works, researchers and implementation teams will be ill-prepared to design and implement interventions that can be sustained over time (131,132). The following

sections highlight specific practice, theory, and methodological gaps that must be addressed to better understand how sustainability works.

1.5.1. Practice Gaps

For over 20 years, experts have stated that sustainability planning enhances sustainment (84,99,110,133). Sustainability planning includes the identification of influential contextual factors and the subsequent selection of strategies to optimize sustainment. Planning for sustainability early in the implementation process (ideally concurrently with implementation planning) may be a key factor in predicting whether an EBP will be sustained (110,134–136). However, there is little guidance on how to plan for sustainability (137) and, consequently, it is relatively uncommon. It has been noted that sustainability is primarily investigated retrospectively only, usually at the end of the initial funding period (138–140).

Sustainability planning may change the nature of the EBP (133), and the dose and nature of strategies selected to promote both the implementation and sustainment of the EBP (82). For example, sustainability planning following the implementation of a balance training program delivered by physiotherapists (141) led to such large changes that a follow-up study testing the effectiveness of the altered program was conducted (142). In another instance, authors reporting concurrent implementation and sustainability planning for an exercise training intervention in organ transplant rehabilitation noted that they primarily considered educational strategies such as conducting webinars through a dissemination website, as opposed to creating educational materials or conducting training sessions that could not be ‘re-used’ (143). These examples indicate that sustainability planning can have a large impact on implementation processes as well as sustainability outcomes.

Educational strategies are among the key strategies that many implementation teams in rehabilitation select during implementation and sustainability planning (144). Authors of the Expert Recommendations for Implementing Change (ERIC) taxonomy identified 11 discrete educational strategies, including conducting educational meetings and ongoing training, shadowing other experts, and distributing educational materials (33,145). Authors of a 2017 systematic review of the implementation of outcome

measures in rehabilitation found that of the 11 included articles, 10 used educational strategies. Educational strategies seem to be a successful approach, as five articles reported increased perceived use of the measure and four reported increased actual use, while one reported no increase in use (146). Similarly, a 2022 study of the implementation of a three-measure gait assessment battery at one rehabilitation site demonstrated that a multi-component educational strategy can sustain the use of standardized outcome measures for up to four years. Their multi-component strategy included basic and advanced interpretation training sessions, orientation and booster training, informal discussions, emails, and 'cheat sheets' for measure interpretation (147). Thus, educational strategies are an important component of implementing and sustaining standardized outcome measures in rehabilitation.

Despite educational strategies being used across most outcome measure implementation projects in rehabilitation (146), it is currently unclear how they work, and thus, what the best practices are for education on standardized outcome measures as part of implementation projects. Following the authors' findings regarding their inability to provide strong recommendations in their 2017 systematic review of the implementation of outcome measures in rehabilitation, they noted *"[studies] with stronger causal designs and more detailed intervention descriptions are…urgently required*" (146). The authors also suggested that the collaborative development of educational strategies with stakeholders based on known barriers would be beneficial.

Although authors of implementation studies for outcome measures in rehabilitation published since the systematic review have adhered to some of these recommendations (i.e., collaborative approach (147), linked to known barriers (147,148), well-described, theory-informed design (149)), there do not appear to be studies which adhered to all recommendations while also having evaluated the educational strategy. In the absence of clear reporting and linking a context-tailored, theory-informed educational strategy to evaluated impacts, it is unclear how the strategy works. Further, it becomes challenging to adapt the strategy or apply insights to new contexts (150,151) (this limitation was explicitly acknowledged in at least one article (147)). Authors of implementation projects for direct interventions in rehabilitation have used and evaluated theory-informed educational strategies (e.g., pain self-management (152–154), ward

active patient practice (155,156), and upper limb exercise (157)). These authors have demonstrated that the use of theory can provide guidance for the development and adaptation of the educational strategy to other contexts, explain the educational strategy's outcomes and impacts, and help identify the strategy's active ingredients and fit within the larger implementation project (158). There is a need to use theory to the same effect for standardized outcome measures to address their underutilization in rehabilitation (146).

Research agendas developed in consultation with healthcare stakeholders have highlighted the need to provide descriptions of sustainability planning (84,91) including details on key educational strategies (84). The lack of sustainability planning across healthcare (84,159) and descriptions and accompanying evaluations for educational strategies (and therefore specific guidance or examples) may be hindering planning and the delivery of educational strategies for standardized outcome measures in practice. Without systematic sustainability planning and educational strategy development, the relationship between strategies, identified contextual factors and predicted outcomes is tenuous at best. This impedes our understanding of how sustainability works (133,160,161).

Finally, in terms of practice gaps, implementation teams across healthcare fields rarely evaluate sustainability – there are far more implementation than sustainability studies available. When implementation teams do evaluate sustainability, they do not always adhere to recommendations from experts (91,127) or evaluative frameworks (82) that longitudinal sustainment data be collected due to its dynamic nature (82,91,162). Longitudinal sustainability data are relatively rare; of the 61 implementation projects in the realist review, only 13 (21%) measured sustainment over time (144). Furthermore, sustainment should be measured on a continuum as opposed to as a binary variable (i.e. levels of sustainment as opposed to sustained versus unsustained), but authors rarely report or interpret their results in this manner (81,162,163). An understanding of the effect of time on a variety of non-binary sustainability outcomes is essential to understand how sustainability works.

1.5.2. Theory Gaps

Theories are used to explain the sustainability process (164) and "are needed to suggest strategies for promoting EBP sustainment" (pg 2, 165). A recent systematic review (166) and umbrella review (165) identified over a dozen commonly used theories that explain sustainability. By applying criteria from the implementation theory comparison and selection tool (T-CaST) (e.g., containing sustainment as an outcome, providing an explanation of relationships between constructs that are logically consistent and plausible) authors of the umbrella review reported the theories which are most appropriate to explain sustainability (167). No sustainability theories achieved a perfect score of six when all the criteria were applied (165,167). The highest ranked theories achieved a score of four out of six, and include TPB, Diffusion of Innovations and open systems theory amongst others, suggesting that further theory development is needed (78).

To further develop theories in implementation science, Kislov and colleagues encourage theory development to shift from a top-down, static process, to an empirical, iterative process which critiques and refines theories based on evidence from the local environment (168). To achieve iterative theory development, Kislov and colleagues propose the use of middle range theories to bridge implementation theory and practice (168). Middle range theories, developed from empirical evidence, are specific enough to explain empirical findings, yet abstract enough to be transferable to other, related contexts (169–171). Despite Kislov and colleagues' recommendation, sustainability theories have not been developed in this iterative manner. Research agendas developed by leading implementation experts in 2015 (84) and 2019 (91) both highlighted the need to test existing sustainability theories and better understand causal mechanisms.

Iterative Theory Testing using a Realist Philosophy

The testing and subsequent refinement of middle range theories to explain sustainability is not an easy undertaking. Not only does a researcher need to collect, analyze, and synthesize information on the mechanism, but also on the influential contextual features and strategies that interact with it, and the outcome that is subsequently generated. Connecting all these concepts in a causal chain is essential to

holistically explaining sustainability. It is difficult to test a theory with so many variables and infinite combinations of causal chains. However, certain scientific paradigms, or distinct worldviews comprised of a researcher's beliefs and understandings (172), are tailored for the purpose of theory building and testing in complex settings.

A scientific paradigm that has been strongly recommended for the purpose of theory testing and refinement in implementation science is realism (36,173–175). The realist philosophy takes its roots from ideas advanced by a diverse array of philosophers and sociologists, mapping to Roy Bhaskar (176,177), Rom Harré (178) and Andrew Collier (179), amongst others. Realism draws on aspects of more common paradigms, especially post-positivism and constructivism, so it can be thought of as being situated between the two (180–182). However, since a realist paradigm both draws on and rejects core tenants from post-positivism and constructivism, and also subscribes to core tenants that are novel to each (180,183–185), realism has been repeatedly recognized as a difficult paradigm to learn and work within (186–188).

There are many subclasses of realism which differ in small but key ways. The two most popular are critical realism (176,189–191) and what was termed as scientific realism in the foundational text (183), but is now referred to as Pawson and Tilley's realism, or realist evaluation and realist synthesis – identical in name to the methodologies developed by the same authors (183,192–194). Although there is debate as to how, and the extent to which critical realism and Pawson and Tilley's realism differ (as in this extended string of commentaries, letters to the editor and responses between Pawson and Porter (190,195–198)) researchers agree that there are differences (189,199). Depending on the extent to which more recent additions to the critical realist literature are integrated (189,191), researchers working within Pawson and Tilley's realism and critical realism may be more or less apart in their worldview (i.e., it is not a dichotomy so much as a continuum) (**Table 1-1**). Both critical realism (174,200) and Pawson and Tilley's realism (201,202) have been applied to understand how certain healthcare interventions are sustained. The choice of a realist paradigm to situate one's work is based on the researcher's ideology as it relates to ontology, epistemology and axiology, and their alignment with the questions they wish to answer.

Table 1-1: Comparison of Pawson and Tilley's Realism and Critical Realism per Bhaskar and Archer

	Pawson & Tilley's Realism	Critical Realism (Bhaskar, Archer)
Ontology: nature of reality	• Single, objective reality • Reality stratified into 3 layers: real, actual, empirical • Open system – external factors always present • Self-transforming reality – everchanging reality due to interaction between people, society and culture (i.e., morphogenesis) • Research will only allow for understanding of portions of reality (i.e., demi-regularities), it takes many iterative cycles to get closer to the full reality	
Epistemology: nature of knowledge	• Knowledge of how something works according to the interaction of context and mechanisms (i.e., context + mechanism = outcome) • Generative view of causation • Mechanisms are social in nature • Focus on culture, agency and societal structures and the interplay between them s recommended, but not required if it doesn't fit the circumstance	• Knowledge of how something works according to the interaction of context and mechanisms (i.e., context + mechanism = outcome) • Generative view of causation • Mechanisms are social in nature • Focus on culture, agency and societal structures is necessary
Axiology: values	• Opposes dominant forms of research, especially forms of positivism • Focus on issues in which there is a lack of evidence to guide evidence based practice • Critical focus = empirical testing and cross-validation • Subscribe to values prominent within the evaluation literature (e.g., Iron Law of Evaluation)	• Opposes dominant forms of research, especially forms of positivism • Emancipation, a focus on issues of equality and inequality • Critical focus = moral/normative judgements
Methodology: approach	• Realist evaluations • Realist reviews	

The realist ontology, or what realists believe the nature of reality to be, is the same along the entire realist continuum. Realists believe that there is an external, objective reality that is independent of what people may believe or understand it to be. This reality is divided into three overlapping layers (i.e., empirical, actual, and real), each of which are distinct in their properties but are all part of an interactive whole (176). Furthermore, reality is an open system in that events are affected by contextual factors that cannot be isolated from the event itself (203). Finally, realists believe that reality is self-transforming, meaning that it is constantly changing due to feedback loops between people and the social structures that they live within (176,177,183,191). Taking these views of reality together, realists believe that scientific theories provide true explanations of unobservable entities and processes. However, since reality is influenced by countless external factors and is constantly changing, these theories are not laws but rather patterns (i.e., demi-regularities) (180,193). Thus, realists acknowledge that it will take iterative testing to get closer to explaining the objective reality that they believe exists (193,204).

In terms of epistemology (i.e., the nature of knowledge), realists seek explanations as to how unobservable social processes (mechanisms) cause observable events (outcomes) in certain circumstances (context) (198,205,206). Explanations are generative as opposed to successionist. In other words, it is the combination of context and mechanisms which together generate an outcome as opposed to simply a mechanism causing an outcome (193,194,207). Furthermore, explanations are always at the level of the middle range. These core components of the realist epistemology are congruent with the theoretical gaps in the sustainability literature.

While both critical realism and Pawson's and Tilley's realism privilege middle range explanations, they differ in the key concepts which are expected to be a part of these explanations. In critical realism, it is very common for researchers to apply Archer's morphogenesis in which there is an explicit focus on culture, agency and societal structures (177,191,199). In Pawson and Tilley's realism, researchers focus on concepts stressed by the domain theory they select to inform their work (e.g., behaviour when using TPB). Concepts can include those stressed by Archer, but they do not have to (194).

Researchers working within critical realism and Pawson and Tilley's realism share a key research value and purpose (i.e., axiological stance) with one another – they both position themselves as explicitly opposing successionist views of causation (208). In other words, the view that causation can be understood externally by describing constant associations between events (i.e., correlations). Beyond this, the values underlying critical realism and Pawson and Tilley's realism diverge. A core purpose of critical realist research is to remedy current problems and gaps, especially those due to power imbalances shaped by culture and structures. Researchers are committed to emancipation as they focus on issues of inequality, questioning the status quo, and challenging dominant beliefs and ideology (209). In contrast, Pawson and Tilley explicitly distanced themselves from the normative critique of critical realism. When discussing the purpose of realist methodologies to address evidence-based policy requirements, Pawson noted that making moral judgements based on an analyst's privileged understanding was 'precisely the political embrace from which evidence-based policy is trying to escape' (page 19, 171). Instead, within Pawson and Tilley's realism, a researcher seeks to be as objective as possible with the understanding that objectivity is a value, not a state (210). To accomplish this, the critical focus in Pawson and Tilley's realism centers on being critical in a cognitive sense per Popper and Campbell. Specifically, Popper's principle of falsification in which he states that for a theory to be considered scientific it must be able to be tested and conceivably proven false (211) and Campbell's method for iterative theory testing (212). Applying Popper and Campbell's 'critical lens' means that researchers should be critical towards each other to create an environment of cross-validation to get them closer to the truth (194,204). For this process to be most effective, middle range theories should be generated that could conceivably be proven false (183,193,194,211).

1.5.3. Methodological Gaps

It has been suggested that both methodological gaps and methodological difficulties have been large contributors to the lack of published sustainability literature in key practice and theory areas (84,114). The most significant methodological gap is the lack of pragmatic sustainability measures (84,124,126,213). Since 2020, three measures

that assess different dimensions of sustainability and sustainment have been published (92,214,215). Of these, both the Clinical Sustainability Assessment Tool (CSAT) (137) and the Provider REport of Sustainment Scale (PRESS) (92) were developed for use across clinical settings. The PRESS is meant replace the measurement of sustained use by chart audit or self-report and has not yet been used in rehabilitation. The CSAT measures the sustainability capacity for an EBP and has been used in rehabilitation at least once – in an evaluation of the sustainment of proactive physical therapy for individuals with Parkinson's disease (216). In a 2022 systematic review of sustainability measures, both the CSAT and PRESS were recommended by authors (217).

It is methodologically difficult to employ complex research designs such as mixed methods, especially while following recommendations to understand processes, estimate outcomes and contextualize their findings (84,91,168,218–220). However, using qualitative and quantitative methods in combination can lead to a better understanding of causal pathways and influential new constructs than the use of either method alone (82,218). Due to the importance of contextual factors on sustainment, authors in the field have also explicitly recommended mixed method case study designs (99) and multisite studies (91) to allow for detailed investigations of context and comparisons across sites (221). Furthermore, although evaluations within a realist paradigm have been proven to be challenging for implementation researchers (188) they have been increasingly recommended within the field (36,188,222). Thus, the use of a combination of these complex designs may result in findings that address gaps in the literature that require urgent attention.

1.6. Summary of Rationale and Overall Thesis Objective

Implementation experts have stated that "sustainability is one of the most significant translational research problems of our time" (page 2, 83). There are major practice, theory and methodological gaps that must be addressed to better understand how sustainability works in healthcare generally, and rehabilitation specifically. This is best achieved by iteratively refining an explanation which is developed using robust measurement tools where relevant and possible. A better understanding of sustainability is critical to develop and apply strategies that promote enduring change (91,102,223).

Thus, the overall aim of this doctoral research is to understand and optimize the sustainability and sustainment of the MPAI-4 in three health regions in Québec.

1.7. Specific Objectives

To achieve the overall aim, *manuscripts 2, 3* and *4* in this thesis were conducted according to an IKT approach whereby managers, researchers, and clinicians worked together throughout the entire research process. Furthermore, the studies reported in manuscripts 2-4 were conducted within the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) implementation project, in which this standardized outcome measure was put into outpatient stroke rehabilitation practice in three health regions in Québec (**Figure 1-1**).

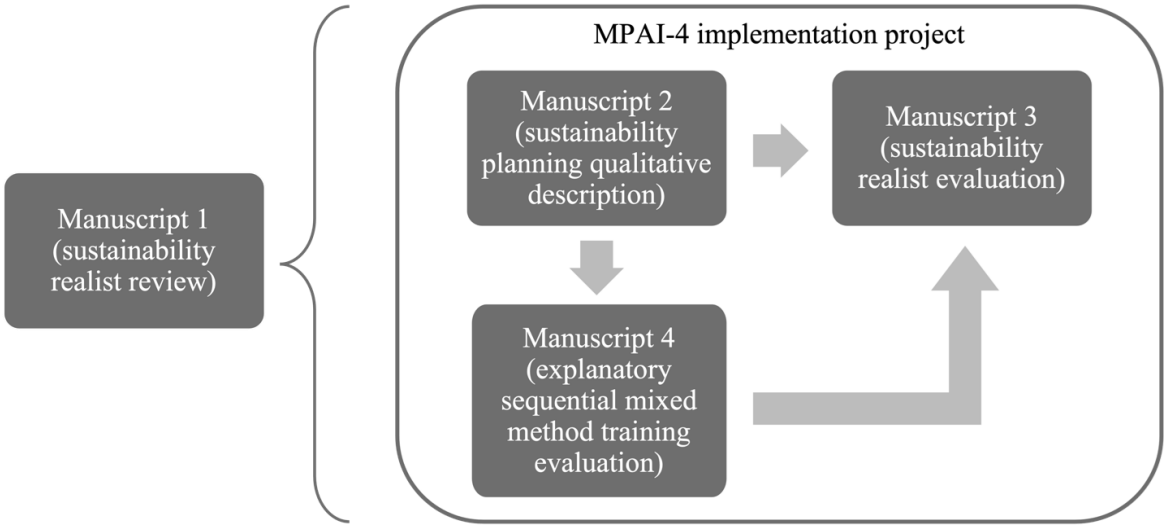

Figure 1-1: Thesis Projects

The aim of the research reported in the first manuscript was to understand how (mechanisms) and in what circumstances (context) rehabilitation practices are sustained (outcome) by conducting a realist review. The resulting program theory links strategies, context, and outcomes via mechanisms to explain how rehabilitation practices are sustained. In addition to its theoretical contribution, the program theory informs sustainability planning (*manuscript 2*) including the decision to deliver an advanced MPAI-4 training session (*manuscript 4*) and guides the design and analysis of the sustainability evaluation (*manuscript 3*).

The aim of the research reported in the second manuscript was to document and describe the MPAI-4 sustainability planning process across the three participating health regions. This qualitative description study produced preliminary guidance for sustainability planning and provided an opportunity to apply practical guidance developed in the realist review in sustainability planning practice. The results of this study informed the development of the initial program theory in *manuscript 3* and prompted the development and delivery of an advanced training session (*manuscript 4*).

The aim of the research reported in the third manuscript was to understand how (mechanisms), in what circumstances (context) and for what duration the MPAI-4 is sustained (outcome) in one health region. This realist evaluation using a mixed method single case study design empirically tested *manuscript 1's* realist theory, which resulted in a stronger understanding of how the MPAI-4 is sustained that may be transferable to other rehabilitation practices.

Finally, the aim of the research reported in the fourth manuscript was to develop a tailored, theory-informed advanced training session for the MPAI-4, and evaluate its impacts on clinician's reaction, learning and intent to start or continue to use the MPAI-4. This explanatory sequential mixed method evaluation demonstrated a rigorous method of training development for standardized outcome measures that the evaluation confirmed was effective and adaptable between different settings. The results from this manuscript informed the development of the initial program theory in *manuscript 3.*

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Chapter 2.
Thesis Setting

2.1. Overview

The Pôle Universitaire en Réadaptation (PUR) oversees the governance of the Centre for Interdisciplinary Research in Rehabilitation of Greater Montréal (CRIR) and its four affiliated health regions. Since 2000, the CRIR has promoted excellence in rehabilitation research through its interdisciplinary, intersectoral and knowledge mobilization initiatives across the affiliated health regions. The CRIR has 95 researchers and 460 students within more than 50 research laboratories embedded in its various sites. Three of my committee members are (Dr. Ahmed, 2013-present) or recently were (Drs. Thomas 2018-2021 and McKerral 2011-2016) directors of research at CRIR-affiliated rehabilitation centres.

In 2018, the PUR awarded my supervisor (Dr. Thomas), and co-supervisor (Dr. Ahmed) funding to implement an evidence-based practice in outpatient stroke rehabilitation and evaluate the success of the implementation. This funding was integrated with that from the Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies in Community Mobility Rehabilitation (BRILLIANT-Rehab) program, led by Dr. Ahmed. BRILLIANT is funded by a Canadian Foundation of Innovation (CFI) Infrastructure grant to support the development and maintenance of a data monitoring system for dual clinical and research use. Ultimately, the goal of the BRILLIANT program is to optimize the use of data so that clinicians deliver the right intervention, to the right person, at the right time, such that patients receiving rehabilitation services can benefit from optimal function and meaningful participation in the community.

Across the participating sites in three health regions (Centre intégrés de santé et de services sociaux (CISSS) du Laval and the Centres intégrés universitaires de santé et de services sociaux (CIUSSS) du Centre-Sud-de-l'Île-de-Montréal and du Centre-Ouest-de-l'Île-de-Montréal), there are approximately 80 clinicians who deliver care to nearly 1000 stroke outpatients annually. Key administrators, managers and clinicians met at each of the participating sites and independently selected the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) as the evidence-based practice to be implemented as part of the PUR-funded project. This

unanimous decision was driven by a 2018 mandate from the Ministère de la Santé et des Services sociaux (MSSS) of Québec to integrate the participation index of the MPAI-4 into stroke rehabilitation programs (1).

2.2. Mayo-Portland Adaptability Inventory – version 4

The MPAI-4 is a measure of stroke outcomes that can be used to inform the selection of rehabilitation interventions and evaluate rehabilitation outcomes and programs (2). The MPAI-4 includes items used to assess patients' physical, cognitive, emotional, behavioural, and social well-being, including participation. The items are arranged in three subscales: the abilities index, the adjustment index, and the participation index (2,3). See Appendix A for the full English version of the measure.

Clinicians, patients, or caregivers can complete the MPAI-4 in English or French (2,4). The MPAI-4 is scored by consensus – at least two people need to score the MPAI-4 to generate an interpretable MPAI-4 score (2). Depending on familiarity with the measure, it takes 15-30 minutes to complete the MPAI-4. There are no costs or certifications needed to use the MPAI-4.

Findings from a systematic review of measurement properties indicate that the MPAI-4 or the just the participation index by itself can be used to evaluate and provide a descriptive portrait of a patient at a single time point. While there is some available evidence on responsiveness, more research is needed to support the use of the MPAI-4 for monitoring the progress of stroke outpatients over time or for predicting outcomes (e.g., return to work). In contrast, there is stronger evidence that the participation index can evaluate the progress of stroke outpatients over time (5). Finally, there is a lack of published evidence of the MPAI-4's content validity and little on its interpretability (e.g., one article concerning the minimal important change (5,6). However, several institutions around the world have been using the MPAI-4 for over a decade (7). Due to this anecdotal evidence, it is generally recommended that clinical sites consider both participation index and MPAI-4 change scores, however they should be more cautious in their interpretations. For example, this can be done by considering whether the MPAI-4 score reflects meaningful change by comparing it to clinician or patient reports of change, or other outcome measures (5).

2.3. MPAI-4 Implementation

From 2019-2023, a team led by Drs. Ahmed and Thomas implemented the MPAI-4 as a clinician-reported outcome measure in three sites. The team used an integrated knowledge translation (IKT) approach with researchers, managers, and clinicians to facilitate the success of the MPAI-4 implementation project. The Institut national d'excellence en santé et services sociaux (INESSS) MPAI-4 implementation toolkit was used to inform the implementation at all three sites (8).

As suggested in the toolkit, we began by forming the implementation team at each site. The implementation team included administrators, managers, rehabilitation clinicians and researchers affiliated with the rehabilitation centre or its embedded research centre, and the MPAI-4 implementation research project. The role of the implementation team was to tailor the MPAI-4 and the selected implementation strategies to their local context, and to be involved in the research projects associated with MPAI-4 implementation and sustainability. Involvement of these stakeholders also included determining the study topics, objectives, and settings; facilitating recruitment and access to data; assisting on data interpretation; and formulating implications for the organization.

Early on and throughout the implementation process, all three MPAI-4 implementation teams expressed concern regarding the sustained use of the MPAI-4 post-implementation. The MPAI-4 needs to be sustained over the long-term for patients to receive the expected benefits associated with using the MPAI-4 (i.e., targeted intervention selection, standardized outcome evaluation) and for evaluation to inform program improvements. Thus, the implementation teams indicated that focused attention on the sustainability and sustainment of the MPAI-4 would be highly relevant to them.

2.4. Implementation Timeline

My doctoral thesis work on the sustainability and sustainment of the MPAI-4 was embedded within the MPAI-4 implementation project (9). This project underwent major

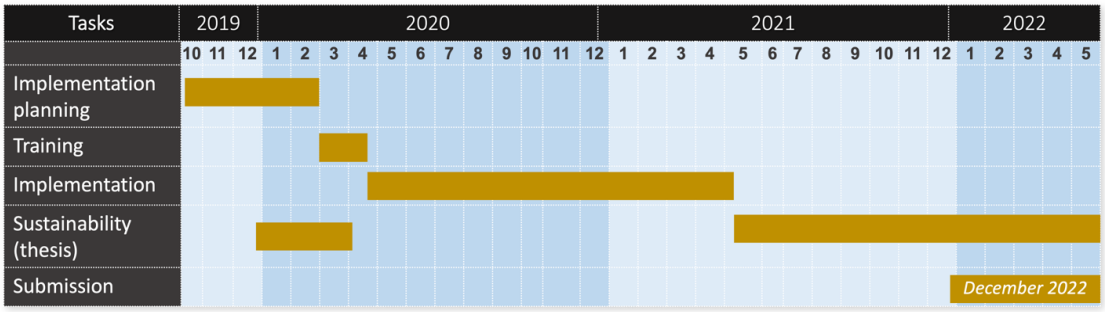

Figure 2-1: Pre-pandemic Implementation Timeline

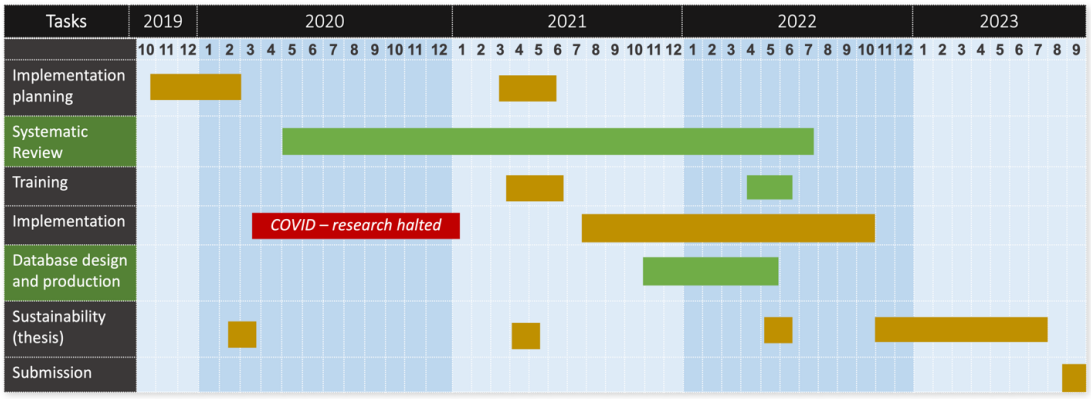

Figure 2-2: Post-pandemic MPAI-4 Implementation Timeline

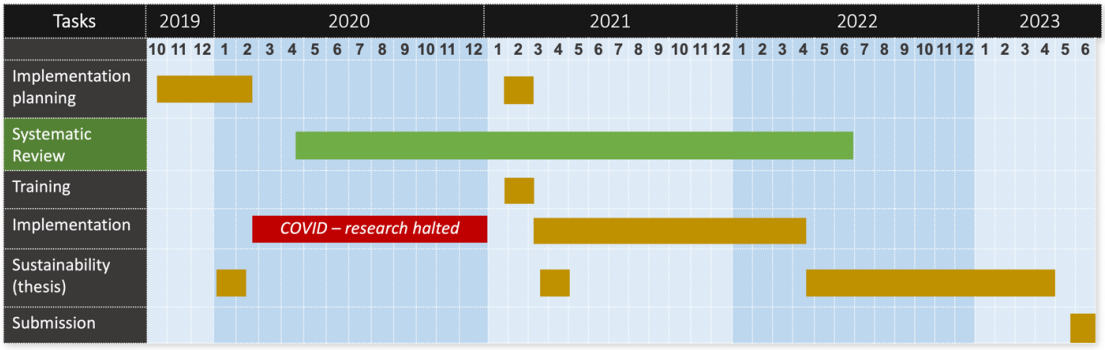

Figure 2-3: Post-new MPAI-4 platform Implementation Timeline

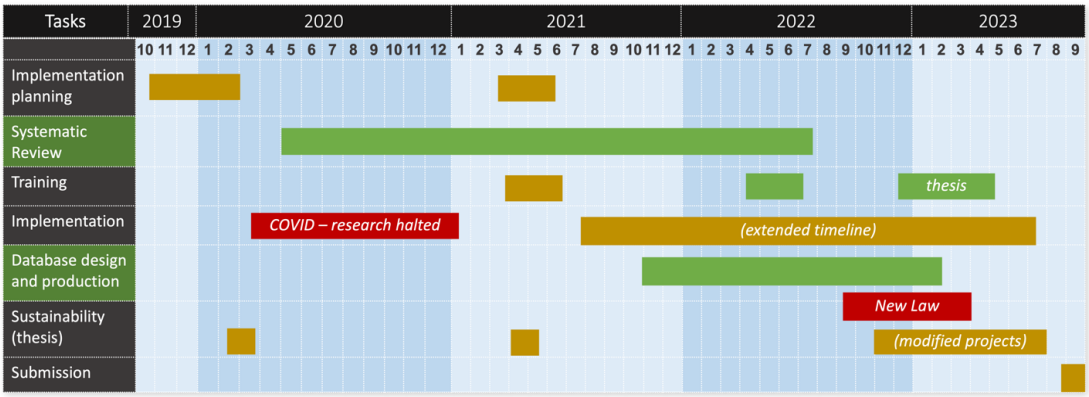

Figure 2-4: Post-new Data Privacy Law Implementation Timeline

changes in its prospective timeline, most notably from pre-pandemic (**Figure 2-1**) to post-pandemic (**Figure 2-2**), then again following the requirement from clinical teams that a new digital platform the MPAI-4 be created (**Figure 2-3**) and a new privacy law governing patient data-sharing and use for research purposes going into effect in Québec in September 2022 (10) (**Figure 2-4**). Both the pandemic and the new privacy law had a direct and substantive impact on the implementation of the MPAI-4 and the data collection for the associated research projects, including my own doctoral work.

2.4.1. Modifications due to the COVID-19 pandemic

Modifications due to the pandemic can be viewed in **Figure 2-1** and **Figure 2-2**. Given that one year had passed since the original implementation planning had taken place in Winter 2020, planning was restarted post-pandemic in the Winter of 2021. This was done only after we verified that the team decisions were still relevant and revising those that were not. We found that there were large changes in healthcare policies, and a reduction in individual, team, and organizational capacity for change. For example, all sites noted that they were understaffed with large wait lists following the pandemic (restrictions were placed on access to rehabilitation as clinicians were re-assigned to pandemic priority areas). We adjusted the implementation plan accordingly. For example, the implementation team at each site planned the implementation process to streamline clinicians' return to regular rehabilitation work post-pandemic and orientation for new hires regarding the MPAI-4 training and implementation. Moreover, the preliminary results from a systematic review of the measurement properties of the MPAI-4 that we had started at the beginning of the pandemic lockdowns in March 2020 helped us with our post-pandemic planning. In particular, the results from the systematic review deepened our understanding of the current evidence to inform evidence-based practice for the MPAI-4. Furthermore, collecting all published evidence for the MPAI-4 helped us identify researchers with whom we could build relationships and share MPAI-4 knowledge, particularly concerning successful MPAI-4 implementation. Otherwise, we planned for the MPAI-4 implementation and sustainability projects to go ahead as envisioned pre-pandemic, albeit shifted to one year later.

2.4.2. Modifications due to the request for a new MPAI-4 digital health platform

Implementation tasks and the associated timeline were adjusted following feedback from the teams that, for the MPAI-4 to be acceptable, a new digital platform was required (**Figure 2-3**). Specifically, we developed a new, mixed-use clinical and research digital platform. This digital platform included key features such as a more user-friendly interface, the automatic calculation, and interpretation of standardized T scores against a normative sample, graphs of item and subscale level results for individual patients, and calculations and graphs for program and site level comparisons. To create this digital platform, we undertook a phase of digital platform design and production, and server architecture development, design and production that we had not originally planned for. While two of the three participating sites continued to use the MPAI-4 with patients during the creation of the digital platform, one site declined to adopt the MPAI-4 until the digital platform was launched. In all cases, without the automatic MPAI-4 interpretations within the new digital platform, the clinical teams could score patients on the MPAI-4. However, they did not interpret the results and thus, did not integrate them within their clinical decision-making.

A consequence of launching a new digital platform with access to new MPAI-4 interpretations is that new training was required. Clinical teams requested an in-person synchronous training session on the advanced interpretations of the MPAI-4 facilitated by the new digital platform. This request aligns with the process models (INESSS MPAI-4 implementation toolkit), determinant frameworks (Consolidated Framework for Implementation Research version 2 (CFIR 2.0)) and theories (sustainability realist review (project 1)) underpinning the implementation and sustainability projects of the MPAI-4. As part of the MPAI-4 implementation project (9), we identified CFIR-informed barriers including access to knowledge and information, and innovation evidence that we thought could be addressed by the advanced training session (11). The results of the sustainability realist review suggested that continued expertise, especially via ongoing training, would likely influence the continued use of a given rehabilitation practice (12). Thus, the training session was delivered as soon as possible after the new digital platform was made available in each health site (i.e., November 2022 (Site 1) April 2023 (Site 2), May 2023 (Site 3)).

As we planned to deliver the advanced interpretation training session, we made the knowledge from the original and advanced interpretation training sessions available online as

well as in on-demand formats. The development of these ongoing training strategies was informed by clinical needs and the findings from the sustainability realist review (i.e., project 1 of this thesis) conducted as a first step of my doctoral work which suggests that ongoing, especially on-demand orientation and booster training is essential to sustain newly implemented rehabilitation practices (12). The on-demand resources included video modules on the basics of the MPAI-4, a walk-through case scenario on how to score a patient as well as navigating and applying the automatic interpretations on the new digital platform. Other online materials included a FAQ page, infographics, and several written case scenarios with MPAI-4 scores (13).

2.4.3. Modifications due to a new provincial privacy law

About the same time as the new digital platform was being developed, a new provincial privacy law "*An Act to modernize legislative provisions as regards the protection of personal information*" was passed in September 2021. The first phase of the law went into effect on September 22nd, 2022, (10) (**Figure 2-4**). This law governs both the use of patient data for clinical purposes such as program comparisons across sites, and the use of patient data without their consent for research purposes. Both uses exist within the MPAI-4 implementation project. Unfortunately, the work that we had nearly completed for the digital platform to be compliant with the previous privacy legislation was not grandfathered in and we had to restart the process in September 2022. Thus, the launch of the new digital platform was delayed until data-sharing governance and approvals from all health regions and McGill University were obtained in July 2023. Furthermore, the approvals for the collection of data from patient charts without their consent which was needed for the sustainability realist evaluation (i.e., project 3) was delayed at all sites. The original submission for approvals to access patient charts was submitted in July 2022, with approvals granted in August 2023 (site 1), September 2023 (site 2), and December 2022 (site 3).

2.5. Implementation Differences Between Sites

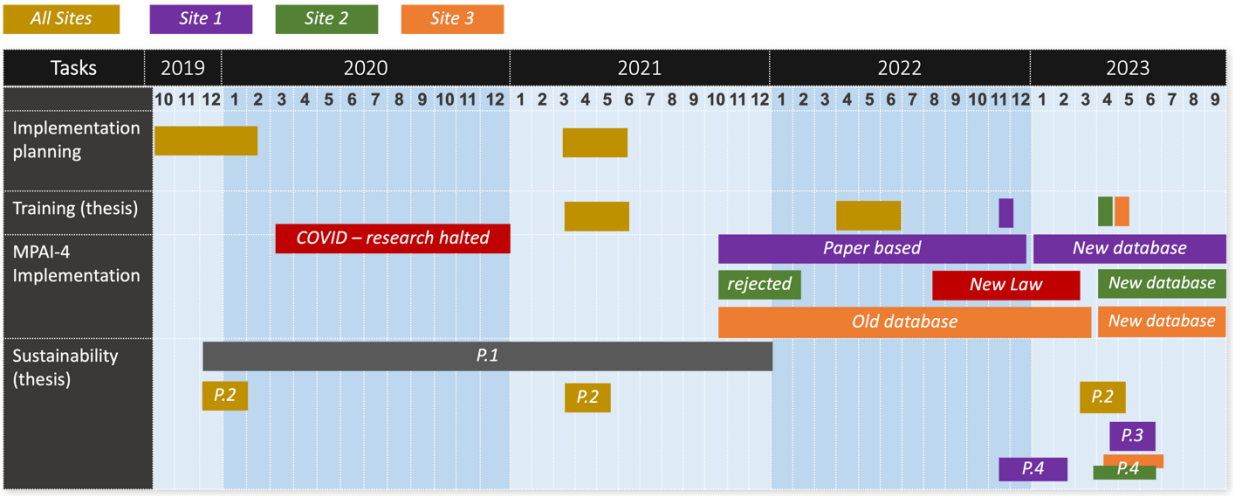

Figure 2-5: MPAI-4 implementation timeline between sites

The MPAI-4 implementation timelines in **Figures 2-1, 2-2, 2-3** and **2-4** simplify the implementation process across the three sites by showing them as going through each phase at the same time. However, this was not the case. There are important differences in the implementation timelines and how the MPAI-4 was implemented across the three sites.

As shown in **Figure 2-5,** all three sites started scoring patients on the MPAI-4 in October 2021. Site 1 decided to keep collecting MPAI-4 in a paper-based format and input the data into the new digital platform at a later date. Site 2 declined to adopt the MPAI-4 and stopped using it until the new digital platform was ready for use. Site 3 accepted the use of the old digital platform for MPAI-4 scoring. Sites 1 and 2 did not use the old digital platform due to incompatibility of the digital platform with the local server and/or poor user acceptance of the digital platform.

The new digital platform underwent an iterative and collaborative development process which was completed in Summer 2022; however, with the new privacy law, the digital platform could not be used by the sites until November 2022 in Site 1, and June 2023 in Site 2 and April 2023 in Site 3. Its full use as a multiregional platform was not possible until July 2023 when all approvals were signed. Advanced interpretation training via the new digital platform was scheduled to correspond with the new digital platform being ready for use in each health site. In all cases, once the digital platform was ready for use and the advanced interpretation training for

the MPAI-4 was delivered in the health site, the MPAI-4 started to be used within the new digital platform.

There are also differences across sites in how the MPAI-4 itself was implemented and sustained. Most notably, Site 1 decided in November 2022 that they would start using the participation index of the MPAI-4 only. They found that the MPAI-4's other two subscales were redundant within the battery of measures they already used and noted that the provincial mandate is for the use of the participation index only. When the clinical team consulted with the research team on this decision, we shared that the results from the MPAI-4 systematic review indicating that the evidence is strongest for the participation index in a stroke outpatient population as opposed to the global measure. Of note, the clinical team at Site 1 has found that for a small minority of clients using the full measure might have been preferred in retrospect. However, they have continued using the participation index whereas the other sites have chosen to continue to use the entire MPAI-4. All sites are aware that they can choose to only use the participation index.

Other differences between the sites include the way in which the MPAI-4 or the participation index scores are applied to clinical decision-making. Prior to the implementation of the new digital platform and delivery of the advanced training session in November 2022 (Site 1), April 2023 (Site 3) and May 2023 (Site 2), the sites completing the MPAI-4 (Sites 1 and 3) reported that 1-2 clinical care coordinators were primarily responsible for scoring patients on the MPAI-4. Furthermore, the sites reported that the MPAI-4 was treated as an exercise in data collection and that there was little to no interpretation of the scores. Thus, in effect, the MPAI-4 was not being used for clinical decision-making during this time.

Following the implementation of the new digital platform and delivery of the advanced training session, clinical teams reported using the MPAI-4 beyond simply scoring it. Full details are presented in *manuscripts 3* and *4*.

2.6. Modifications to this Thesis due to Changes in the MPAI-4 Implementation Timeline and Differences between Sites

There have been challenges to the implementation and sustainability of the MPAI-4 which have greatly affected the timeline for my doctoral work on the sustainability of the MPAI-

4. There are differences between the thesis protocol that I defended in October 2021 and that which I present in this written dissertation. Compared to the accepted protocol, *manuscripts 1* and *2* presented in this dissertation are as originally envisioned. I modified *manuscript 3* from the originally proposed multiple case study evaluation of MPAI-4 sustainment of all three sites to a single case study of site 1 only. I changed *manuscript 4* completely from estimating the psychometric properties of a sustainability planning and evaluation tool (i.e., the Clinical Sustainability Assessment Tool (CSAT)). Instead, the aim of the new project is to develop the advanced interpretation training session for the MPAI-4 and evaluate clinician reactions to the training session, and its impact on clinician learning and intent to start or continue to use the MPAI-4. Justifications for the changes to *manuscripts 3* and *4* are described next.

2.6.1. Justification of Thesis Manuscript 3 Modification

The inclusion of *manuscript 3* in this thesis as a longitudinal multiple-case study design was no longer feasible in all three sites due to the timing of the sustainability evaluation. Although the exact timing was determined in consultation with clinical teams, we estimated that the sustainability evaluation would take place at least 18 months following the continuous implementation of the MPAI-4 starting in October 2021, and 6 months following the advanced training session and the launch of the new digital platform. We chose these general criteria to align with the literature that sustainment should be measured a minimum of 12 months post-implementation (14) while recognizing that the MPAI-4 was not implemented all at once but in phases. Thus, the sustainment of different components of the MPAI-4 may be achieved at different timelines (e.g., scoring versus use in clinical decision-making). Site 1 met the criteria in June 2023, Site 2 would meet these criteria in September 2024 and Site 3 met these criteria in October 2023. In the interest of thesis feasibility, Site 1 was selected as a single case study.

The longitudinal nature of the originally designed case study, with repeated data collection at 12-, 16- and 20 months, was also eliminated in favour of data collection at a single time point for feasibility reasons. In this case, concerns with feasibility were driven by two factors. The first was a concern about the timely completion of my doctoral thesis. According to the original multiple case study design, I would be collecting data for 8 months starting in June 2023, September 2024, and October 2023 in sites 1, 2, and 3 respectively. This delay combined with those already experienced, was not deemed acceptable by the committee, and confirmed by

the graduate program in rehabilitation sciences. Second, during our consultation with clinical managers involved in this project, they asked whether three repeated data collection time points were necessary. This was a prohibitively large time commitment for participating clinicians. Instead, they welcomed changes to the study that would reduce the participation time required by clinicians.

Despite not having been able to collect survey and interview data at repeated timepoints, I conducted interviews with key informants about in which I asked about key events in the past (e.g., the use of certain strategies) and their expectations for the future. I also collected data from patient charts about the use of the MPAI-4 from 1 month pre-implementation to 18 months post-implementation. In this way, I still collected some longitudinal data where possible.

2.6.2. Justification of Thesis Manuscript 4 Modification

The CSAT data collection for this psychometric project was originally embedded within *manuscript 3*. However, altering *manuscript 3* to a single case study design meant that I could not estimate the psychometric properties of the CSAT due to an inadequate sample size for the proposed analyses. Thus, *manuscript 4* was completely changed.

As presented in this dissertation, in *manuscript 4* I aimed to develop a tailored, theory-informed advanced training session for the MPAI-4, and evaluate its impacts on clinician's reactions, learning, and intent to start or continue to use the MPAI-4. As previously explained, the need for this advanced training was informed by clinical needs, the INESSS MPAI-4 implementation toolkit, the barriers identified by the coding of implementation planning to the CFIR 2.0 as part of a complementary study of the implementation of the MPAI-4 (9,11), and the results of the sustainability realist review (project 1). In consultation with the clinical teams concerning relevance and feasibility, we selected an explanatory sequential mixed-method design for this project. Survey data was collected at 1 week pre-training session, 1-week post-training session, and 8 weeks post-training session followed by key informant interviews with 1-3 training session attendees at each site.

2.7. Summary

Many unforeseen factors contributed to making these necessary modifications such that this thesis could be completed in a timely manner while meeting the standards for doctoral research. Without these modifications the timeline would have been greatly extended (data collection as late as mid 2025 in Site 2). Although *manuscripts 3* and *4* were altered, the global objective of this thesis largely remained the same: to understand and optimize the sustainability and sustainment of the MPAI-4 in three health regions in Québec.

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Appendix A.
MPAI measurement tool

Mayo-Portland Adaptability Inventory-4

Muriel D. Lezak, PhD, ABPP & James F. Malec, PhD, ABPP

Name: _____ Clinic # _____ Date _____

Person reporting (circle one): Single Professional Professional Consensus Person with brain injury Significant other: _____

Below each item, circle the number that best describes the level at which the person being evaluated experiences problems. Mark the greatest level of problem that is appropriate. Problems that interfere rarely with daily or valued activities, that is, less than 5% of the time, should be considered not to interfere. Write comments about specific items at the end of the rating scale.

For Items 1-20, please use the rating scale below.

0 None	1 Mild problem but does not interfere with activities; may use assistive device or medication	2 Mild problem; interferes with activities 5-24% of the time	3 Moderate problem; interferes with activities 25-75% of the time	4 Severe problem; interferes with activities more than 75% of the time

Part A. Abilities	0	1	2	3	4
1. **Mobility**: Problems walking or moving; balance problems that interfere with moving about					
2. **Use of hands**: Impaired strength or coordination in one or both hands					
3. **Vision**: Problems seeing; double vision; eye, brain, or nerve injuries that interfere with seeing					
4. ***Audition**: Problems hearing; ringing in the ears					
5. **Dizziness**: Feeling unsteady, dizzy, light-headed					
6. **Motor speech**: Abnormal clearness or rate of speech; stuttering					
7A. **Verbal communication**: Problems expressing or understanding language					
7B. **Nonverbal communication**: Restricted or unusual gestures or facial expressions; talking too much or not enough; missing nonverbal cues from others					
8. **Attention/Concentration**: Problems ignoring distractions, shifting attention, keeping more than one thing in mind at a time					
9. **Memory**: Problems learning and recalling new information					
10. **Fund of Information**: Problems remembering information learned in school or on the job; difficulty remembering information about self and family from years ago					
11. **Novel problem-solving**: Problems thinking up solutions or picking the best solution to new problems					
12. **Visuospatial abilities**: Problems drawing, assembling things, route-finding, being visually aware on both the left and right sides					

Part B. Adiustment	0	1	2	3	4
13. **Anxiety:** Tense, nervous, fearful, phobias, nightmares, flashbacks of stressful events					
14. **Depression:** Sad, blue, hopeless, poor appetite, poor sleep, worry, self-criticism					
15. **Irritability, anger, aggression:** Verbal or physical expressions of anger					
16. ***Pain and headache:** Verbal and nonverbal expressions of pain; activities limited by pain					
17. **Fatigue:** Feeling tired; lack of energy; tiring easily					
18. **Sensitivity to mild symptoms:** Focusing on thinking, physical or emotional problems attributed to brain injury; rate only how concern or worry about these symptoms affects current functioning over and above the effects of the symptoms themselves					
19. **Inappropriate social interaction:** Acting childish, silly, rude, behavior not fitting for time and place					
20. **Impaired self-awareness:** Lack of recognition of personal limitations and disabilities and how they interfere with everyday activities and work or school					

Use scale at the bottom of the page to rate item #21

21. Family/significant relationships: Interactions with close others; describe stress within the family or those closest to the person with brain injury; "family functioning" means cooperating to accomplish those tasks that need to be done to keep the household running

0 Normal stress within family or other close network of relationships	1 Mild stress that does not interfere with family functioning	2 Mild stress that interferes with family functioning 5-24% of the time	3 Moderate stress that interferes with family functioning 25-75% of the time	4 Severe stress that interferes with family functioning more than 75% of the time

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Part C. Participation

22. Initiation: Problems getting started on activities without prompting

0 None	1 Mild problem but does not interfere with activities; may use assistive device or medication	2 Mild problem; interferes with activities 5-24% of the time	3 Moderate problem; interferes with activities 25-75% of the time	4 Severe problem; interferes with activities more than 75% of the time

23. Social contact with friends, work associates, and other people who are not family, significant others, or professionals

0 Normal involvement with others	1 Mild difficulty in social situations but maintains normal involvement with others	2 Mildly limited involvement with others (75-95% of normal interaction for age)	3 Moderately limited involvement with others (25-74% of normal interaction for age)	4 No or rare involvement with others (less than 25% of normal interaction for age)

24. Leisure and recreational activities

0 Normal participation in leisure activities for age	1 Mild difficulty in these activities but maintains normal participation	2 Mildly limited participation (75-95% of normal participation for age)	3 Moderately limited participation (25-74% of normal participation for age)	4 No or rare participation (less than 25% of normal participation for age)

25. Self-care: Eating, dressing, bathing, hygiene

0 Independent completion of self-care activities	1 Mild difficulty, occasional omissions or mildly slowed completion of self-care; may use assistive device or require occasional prompting	2 Requires a little assistance or supervision from others (5-24% of the time) including frequent prompting	3 Requires moderate assistance or supervision from others (25-75% of the time)	4 Requires extensive assistance or supervision from others (more than 75% of the time)

26. Residence: Responsibilities of independent living and homemaking (such as, meal preparation, home repairs and maintenance, personal health maintenance beyond basic hygiene including medication management) but not including managing money (see #29)

0 Independent; living without supervision or concern from others	1 Living without supervision but others have concerns about safety or managing responsibilities	2 Requires a little assistance or supervision from others (5-24% of the time)	3 Requires moderate assistance or supervision from others (25-75% of the time)	4 Requires extensive assistance or supervision from others (more than 75% of the time)

27. *Transportation

0 Independent in all modes of transportation including independent ability to operate a personal motor vehicle	1 Independent in all modes of transportation, but others have concerns about safety	2 Requires a little assistance or supervision from others (5-24% of the time); cannot drive	3 Requires moderate assistance or supervision from others (25-75% of the time); cannot drive	4 Requires extensive assistance or supervision from others (more than 75% of the time); cannot drive

28A. *Paid Employment: Rate either item 28A or 28B to reflect the primary desired social role. Do not rate both. Rate 28A if the primary social role is paid employment. If another social role is primary, rate only 28B. For both 28A and 28B, "support" means special help from another person with responsibilities (such as, a job coach or shadow, tutor, helper) or reduced responsibilities. Modifications to the physical environment that facilitate employment are not considered as support.

0 Full-time (more than 30 hrs/wk) without support	1 Part-time (3 to 30 hrs/ wk) without support	2 Full-time or part-time with support	3 Sheltered work	4 Unemployed; employed less than 3 hours per week

28B. *Other employment: Involved in constructive, role-appropriate activity other than paid employment.
Check only one to indicate primary desired social role: Childrearing/care-giving Homemaker, no childrearing or care-giving Student Volunteer Retired (Check retired only if over age 60; if unemployed, retired as disabled and under age 60, indicate "Unemployed" for item 28A.

0 Full-time (more than 30 hrs/wk) without support; full-time course load for students	1 Part-time (3 to 30 hrs/ wk) without support	2 Full-time or part-time with support	3 Activities in a supervised environment other than a sheltered workshop	4 Inactive; involved in role-appropriate activities less than 3 hours per week

29. Managing money and finances: Shopping, keeping a check book or other bank account, managing personal income and investments; if independent with small purchases but not able to manage larger personal finances or investments, rate 3 or 4.

0 Independent, manages small purchases and personal finances without supervision or concern from others	1 Manages money independently but others have concerns about larger financial decisions	2 Requires a little help or supervision (5-24% of the time) with large finances; independent with small purchases	3 Requires moderate help or supervision (25-75% of the time) with large finances; some help with small purchases	4 Requires extensive help or supervision (more than 75% of the time) with large finances; frequent help with small purchases

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Part D: Pre-existing and associated conditions. The items below do not contribute to the total score but are used to identify special needs and circumstances. For each rate, pre-injury and post-injury status.

30. Alcohol use: Use of alcoholic beverages.

Pre-injury _____ Post-injury _____

0	No or socially acceptable use	**1**	Occasionally exceeds socially acceptable use but does not interfere with everyday functioning; current problem under treatment or in remission	**2**	Frequent excessive use that occasionally interferes with everyday functioning; possible dependence	**3**	Use or dependence interferes with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

31. Drug use: Use of illegal drugs or abuse of prescription drugs.

Pre-injury _____ Post-injury _____

0	No or occasional use	**1**	Occasional use does not interfere with everyday functioning; current problem under treatment or in remission	**2**	Frequent use that occasionally interferes with everyday functioning; possible dependence	**3**	Use or dependence interferes with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

32. Psychotic Symptoms: Hallucinations, delusions, other persistent severely distorted perceptions of reality.

Pre-injury _____ Post-injury _____

0	None	**1**	Current problem under treatment or in remission; symptoms do not interfere with everyday functioning	**2**	Symptoms occasionally interfere with everyday functioning but no additional evaluation or treatment recommended	**3**	Symptoms interfere with everyday functioning; additional treatment recommended	**4**	Inpatient or residential treatment required

33. Law violations: History before and after injury.

Pre-injury _____ Post-injury _____

0	None or minor traffic violations only	**1**	Conviction on one or two misdemeanors other than minor traffic violations	**2**	History of more than two misdeameanors other than minor traffic violations	**3**	Single felony conviction	**4**	Repeat felony convictions

34. Other condition causing physical impairment: Physical disability due to medical conditions other than brain injury, such as, spinal cord injury, amputation. Use scale below #35.

Pre-injury _____ Post-injury _____

35. Other condition causing cognitive impairment: Cognitive disability due to nonpsychiatric medical conditions other than brain injury, such as, dementia, stroke, developmental disability.

Pre-injury _____ Post-injury _____

0	None	**1**	Mild problem but does not interfere with activities; may use assistive device or medication	**2**	Mild problem; interferes with activities 5-24% of the time	**3**	Moderate problem; interferes with activities 25-75% of the time	**4**	Severe problem; interferes with activities more than 75% of the time

Comments:

Item #

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Scoring Worksheet

Items with an asterisk (4, 16, 27, 28/28A) require rescoring as specified below before Raw Scores are summed and referred to Reference Tables to obtain Standard Scores. Because items 22-24 contribute to both the Adjustment Subscale and the Participation Subscale, the Total Score will be less than the sum of the three subscales.

Abilities Subscale

Rescore item 4. Original score = _____
If original score = 0, new score = 0
If original score = 1, 2, or 3, new score = 1
If original score = 4, new score = 3

A. New score for item 4 = _____
B. Sum of scores for items 1-3 and 5-12 = _____
(use highest score for 7A or 7B)

Sum of A and B = Raw Score for Abilities subscale = _____ (place in Table below)

Adjustment Subscale

Rescore item 16. Original score = _____
If original score = 0, new score = 0
If original score = 1 or 2, new score = 1.
If original score = 3 or 4, new score = 2

C. New score for item 16 = _____
D. Sum of scores for items 13-15 and 17-24 _____

Sum of C and D = Raw Score for Adjustment Subscale _____ (place in Table below)

Participation Subscale

Rescore item 27. Original score = _____
If original score = 0 or 1, new score = 0
If original score = 2 or 3, new score = 1
If original score = 4, new score = 3

Rescore item 28A or 28B. Original score = _____
If original score = 0, new score = 0
If original score = 1 or 2, new score = 1
If original score = 3 or 4, new score = 3

E. New score for item 27 = _____
F. New score for item 28Aor 28B = _____
G. Sum of scores for items 22-24 = _____ (place in Table below)
H. Sum of scores for items 25, 26, 29 = _____

Sum of E through H = Raw Score for Participation Subscale = _____ (place in Table below)

Use Reference Tables to Convert Raw Scores to Standard Scores

	Raw Scores (from worksheet above)	**Standard** (Obtain from appropriate reference Table)
I. Ability Subscale (Items 1-12)	_____	_____
II. Adjustment Subscale (Items 13-24)	_____	_____
III. Participation Subscale (Items 22-29)	_____	_____
IV. Subtotal of Subscale Raw Scores (I-III)	_____	
V. Sum of scores for items 22-24	_____	
VI. Subtract from V. from IV = Total Score	_____	_____

Chapter 3.
Reflexive Statement

My positionality, professional experience, as well as my values and beliefs have influenced my interest in the sustainability of evidence-based practices and my approach to my doctoral work. I discuss these below.

3.1. Positionality

I am a Registered Kinesiologist and doctoral student in the rehabilitation science program at McGill University. I grew up in an English-speaking, middle-class suburb of Toronto. Although I did not speak French when I moved to Montréal in 2019, I recognized that learning the language was essential to the success of my research and in collaborating with stakeholders such as clinicians, managers, and patients. I have since gained enough fluency in French to facilitate meetings, conduct interviews and deliver training sessions. Although I have experienced mild discrimination as an Anglophone both with and without the ability to communicate in French, overall I have benefitted from the privilege of my position as a doctoral student at a prestigious, English-speaking institution.

3.1.1. Professional Experience

Throughout my professional life, I have worked as an educator, including as a teaching assistant and a lecturer, and have volunteered in science outreach. While completing my master's degree, I drew on both my educational and clinical experience as well as on my networks to develop a research agenda for the profession of kinesiology (1). A key finding from the development of this research agenda was that many of the research gaps generated in this study were instead research to practice gaps. In other words, although participants requested research to answer certain questions, this research already exists, unbeknownst to them. Thus, I was exposed to the concept of research to practice gaps in healthcare for the first time.

Following the completion of my master's degree, I noticed research to practice gaps once again while working as a lecturer at the University of Waterloo. I was delivering continuing development workshops to kinesiologists, physiotherapists, occupational therapists and other

healthcare professionals. While exploring how I could sustain the impact of the workshops, I learned about the field of implementation science. As I delved deeper into the implementation science literature, I learned about the many factors beyond both entry-level education and continuing professional development that influence both the uptake and sustainment of evidence-based practices. Recognizing the gap in our understanding of sustainability in particular, I was inspired to gain expertise in this area by pursuing doctoral studies.

3.1.2. Personal Values, Beliefs and Motivations

As a clinician and educator, I have first-hand experience of the challenges of remaining up to date on best practices. I have an interest in supporting healthcare professionals and their organizations in narrowing the research to practice gap and delivering the best quality care to patients. I value doing this work in a way that allows for research evidence, clinician experience and patient values to be considered when decisions are made about patient care. I recognize the important role that context plays in evidence-based practice – a clinical decision made in one healthcare environment may not be the same as in another. Furthermore, I believe that evidence-based practice should be sustainable.

While I do believe sustainability is important in an environmental sense (e.g., decarbonization, waste reduction in healthcare (2)), the focus of my thesis is on another interpretation of sustainability – the embeddedness, durability or maintenance of optimized care delivery and patient outcomes. Over at least the past 20 years, researchers have argued that sustained, optimized care delivery is hard to achieve in healthcare (3–5). At the core of their argument is that evidence-based practice is a highly individualized mode of care delivery, making it difficult to predict the service a patient will ultimately receive. Prediction via modeling and forecasting are often used in other sectors for decision-making (6). In healthcare, optimization is not often based on models or forecasts. Instead, continuous quality improvement and professional development are considered vital to the optimization of patient care (7). My interest in undertaking work on sustainability is to gain the knowledge and skills to contribute to evidence-based practice in healthcare.

3.1.3. Alignment of my own positionality and that of the implementation team

I believe that my positionality, professional experiences, and values and beliefs are aligned with those of the MPAI-4 implementation teams. For example, prompted by my co-supervisor Dr. Ahmed, the research team proposed to undertake a systematic review of the psychometric properties of the MPAI-4 (8). This aligned with the value I put on using best evidence in decision-making. Furthermore, it addressed the needs expressed by the clinical teams at the sites where the MPAI-4 was implemented. Specifically, the clinical teams recognized that the work done implementing the MPAI-4 into traumatic brain injury programs in the same rehabilitation centres (9) would have to be adapted to the stroke programs. The results of the MPAI-4 systematic review helped the implementation team make evidence-based decisions regarding these adaptations.

In another instance, the implementation team emphasized the need to evaluate not just MPAI-4 implementation as planned in the study led by my supervisors (10) but also its sustainability. My research interests aligned with the need expressed by the implementation team. As I began to design my doctoral work, it was important that my research questions be aligned with my values and beliefs, in addition to being relevant to the stakeholders and settings I am working within. When my research questions pointed towards the use of realist methodologies, I needed to select the branch of realism that would underpin my thesis. On reflection, the values of the implementation team, including my own, more closely align with the values in Pawson and Tilley's realism than critical realism.

Pawson and Tilley's realism employs a critical lens of cross-validation and iterative empirical testing to evidence (11,12). In contrast, critical realism has a critical/normative lens, often with an emancipatory focus (13–15). I felt more confident working an iterative mode of evidence generation and testing rather than a mode of evidence generation that has a central focus on probing and challenging norms. I believe that this is because Pawson and Tilley's realism aligns closely with the process I was taught in my undergraduate degree in kinesiology and undertook in my work as a healthcare professional. Specifically, to gather information about a patient then conduct testing to confirm or provide further insight before finally working with the patient to select and proceed with a treatment plan. The treatment plan in turn can be updated as new information comes to light, including information from other healthcare professionals. Although I had never worked in any of the centres in which I collected data for my doctoral

research, in speaking extensively with clinicians I noted that they approached their work according to a similar iterative and collaborative method. Since Pawson and Tilley's realism has these same core tenants, I believe this paradigm aligns well with the values and expectations of the clinical members of the implementation team.

3.2. Reflexivity throughout the research process

As I complete my thesis work, I have a much clearer view of my positionality and the effects it has had on both the research design and how my research has been conducted. At the time that decisions about research design and their conduct were being made, I worked to be reflexive, but I did not always fully understand how my values or experiences were influencing my thesis project. I put measures in place to mitigate the risk that my values or experiences would result in reduced relevance, trustworthiness or quality of research. These included consulting with my committee members, other researchers and clinical stakeholders (full details discussed in each manuscript). Although there are decisions that I would make differently with the benefit of hindsight (e.g., include patient partners on the implementation team and consult with them on research projects), I believe that the reflexive process I undertook throughout my thesis was appropriate.

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Chapter 4.
Understanding How Newly Implemented Rehabilitation Best Practices Are Sustained: A Realist Review

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Abstract

Objective: We conducted a realist review to understand how (mechanism) and in what circumstances (context) evidence-based practices are sustained in rehabilitation (outcome).

Data Sources: MEDLINE, Embase, reference lists, and targeted websites.

Study Selection: Two independent reviewers calibrated study selection; then 1 reviewer screened all titles and abstracts, while the second reviewer screened a random 20%. We repeated this process for full texts. We included 115 documents representing 61 implementation projects (8.9% of identified documents). Included documents described implementation projects in which physical therapists, occupational therapists, and/ or speech-language pathologists were the target users of an evidence-based practice.

Data Extraction: Two reviewers repeated the independent process described in study selection to extract basic study and sustainability characteristics as well as context, mechanism, outcome, and strategy text.

Data Synthesis: Using basic numerical analyses, we found that only 54% of evidence-based practices in rehabilitation are sustained. Furthermore, while authors who reported sustainability planning sustained the practice 94% of the time, sustainability planning in rehabilitation is rare (only reported 26% of the time). Extracted text was synthesized using the realist technique of inductive and deductive retroduction in which context, mechanism, outcome, and strategy text are combined into narrative explanations of how sustainability works. To inform these explanations, we applied normalization process theory and the theory of planned behavior. Collectively, the 52 identified narratives provide evidence for 3 patterns: (1) implementation and sustainability phases are interconnected, (2) continued use of the evidence-based practice can be interpreted as the ultimate sustainability outcome, and (3) intermediate sustainability outcomes (ie, fit/alignment, financial support, benefits, expertise) can become contextual features influencing other sustainability outcomes.

Conclusions: Implementation teams can use the narrative explanations generated in this review to optimize sustainability planning. This can sustain practice changes and improve quality of care

and patient outcomes. Future research should seek to iteratively refine the proposed narrative explanations.

Introduction

Rehabilitation clinicians (physiotherapists (PTs), occupational therapists (OTs) and speech-language pathologists (SL-Ps)) help enable individuals to function independently in their daily lives, reintegrate into the community and fully participate in meaningful activities.(1,2) To optimize these outcomes, rehabilitation clinicians are expected to use evidence-based practices (EBPs) which have demonstrated effectiveness. Unfortunately, there are many existing gaps between EBPs and actual practices in rehabilitation (3,4). Furthermore, systematically implemented EBPs to address this gap are often poorly sustained post-implementation (5). According to large-scale empirical investigations (6,7) and systematic reviews (8,9) in the wider healthcare literature, only 40-70% of EBPs continue to be used post-implementation. Poor sustainment of EBPs can have negative consequences, including wasted human and financial investments (10–13), and reduced quality of care and suboptimal patient outcomes (11,12,14). Thus, EBP sustainability needs to be urgently and systematically addressed.

In recognition of the need to optimize the sustainability of EBPs, multiple research agendas have been developed (10,13,15) spurring interest in this rapidly maturing field (16,17). Across the wider healthcare literature, a proliferation of sustainability knowledge syntheses (i.e. scoping reviews (18,19), systematic reviews (8,9,20–30) and narrative reviews (11,16,31,32)) provide a comprehensive description of sustainability strategies (9,11,20,23,31,33), influential contextual factors (11,16,20–22,24–26,29,31), outcomes (8,9,11,16,18,20,21,24,26,31,33), and theories, models and frameworks (21,22). These syntheses have exposed three main gaps: first, a need for context-specific sustainability guidance for implementation teams; second, a lack of clarity concerning how an EBP is sustained across different contexts; and third, certain healthcare fields such as rehabilitation have not consolidated basic study and EBP sustainability data.

Context-specific guidance

Currently, implementation teams are supported in optimizing sustainability via descriptive frameworks that identify potentially useful strategies (e.g. audit and feedback) (34) possible sustainability outcomes (13,14,32) and influential contextual factors (e.g. staff turnover) (32,35–37). These frameworks are limited because they do not provide guidance as to which sustainability strategies work in which contexts to achieve specific outcomes. Without context-

specific guidance, implementation teams may develop sustainability approaches that exclude necessary strategies or include unnecessary ones. In the former, major sustainability barriers may not be addressed which could lower the likelihood of EBP sustainment. Conversely, using unnecessary strategies may inflate costs (38), or result in an over-resourced environment that is unfavourable to EBP sustainment (11,39). There is a need to develop practical, context-specific sustainability guidance.

How an EBP is sustained (or not)

Sustainability is influenced by the practice environment, and as such, mechanisms are context-sensitive (i.e. the context facilitates or inhibits the mechanism which then gives rise to an outcome) (40,41). Given the paucity of research on the mechanisms that underlie EBP (i.e., human decision-making and the opportunities individuals are afforded to make decisions), there is a need to examine the nature of these mechanisms in various contexts. Understanding the mechanisms underlying sustainability across various contexts can optimize sustainability outcomes in future implementation projects.

Synthesis of basic sustainability information in rehabilitation

Recent knowledge syntheses have consolidated sustainability literature in varied healthcare fields such as public health (13), chronic care (19), and acute care (22). Other than a recent citation analysis of the Knowledge-to-Action Framework in which the authors identified general sustainability activities (e.g., seven included studies measured sustainability outcomes (42)), there has been no synthesis of the sustainability literature in rehabilitation. As in other healthcare fields, a synthesis of sustainability characteristics in rehabilitation research can shed light on: (1) the current state of the literature in implementation studies; (2) promising patterns in results which future research could explore further; and (3) help researchers avoid duplication of efforts.

This paper reports on the results of a realist review we conducted to understand how (mechanism), in what circumstances (context) and for what duration EBPs are sustained in rehabilitation (outcome).

METHODS

We conducted a realist review within Pawson and Tilley's realist paradigm. We situated this work within a stratified, objective reality in which explanations of how an intervention works were privileged (43–45). According to Pawson's and Tilley's realism, these explanations must each contain context, mechanism and outcome concepts. Context refers to any condition or circumstance that facilitates or hinders mechanisms. A mechanism refers to human reasoning and decisions that cause an outcome to occur, and an outcome is the desired or observed products of an intervention (46). Following recommendations from realist experts in the field of implementation, we explicitly identified strategies (S) as part of the causal explanation (47). Strategies refer to the actions, methods or activities that are used to (1) encourage individuals to reason or make decisions to achieve a certain outcome or (2) alter the context to trigger a mechanism (47,48).

Context, mechanism, outcome and strategy concepts are combined into causal explanations called context-mechanism-outcome configurations (CMOCs) that are informed by existing theory in the domain under study (implementation theory in this review) (49,50). Then, explanatory patterns are sought across all CMOCs to compile them into a program theory which highlights these explanatory patterns. The program theory is specific enough to provide explicit guidance when applied in rehabilitation but sufficiently abstract to be relevant to similar contexts (49–52). A realist review begins with an initial program theory, which is developed to achieve the final output – the refined program theory (46,49). For a full list of definitions for key terms used in this study, see **Table 4-1**.

This realist review was designed based on Pawson's foundational work (49,50). Realist reviews follow steps that are comparable to systematic reviews; however, these steps are enacted in an iterative, non-linear fashion with the ultimate goal to develop a refined program theory that is relevant to stakeholders. To this end, we conducted this review according to the Realist and Meta-Review Evidence Synthesis: Evolving Standards (RAMESES) guidelines on quality and reporting of realist reviews (46) and PRISMA guidelines (53). The protocol was registered in PROSPERO (CRD42020212625).

Table 4-1: Definitions of key terms used in this study (from RAMESES training manual unless otherwise stated)

Term	Definition
Sustainability	"(1) after a defined period of time, (2) a program, clinical intervention, and/or implementation strategies continue to be delivered and/or (3) individual behavior change (i.e., clinician, patient) is maintained; (4) the program and individual behavior change may evolve or adapt while (5) continuing to produce benefits for individuals/systems." (Moore et al 2017) "(1) continued capacity to deliver the innovation, (2) continued delivery of the innovation, and (3) continued receipt of benefits. The key conditions related to (2) and (3), and included: (2a) innovations must continue in the absence of the champion or person/team who introduced it and (3a) adaptation is critical to ensuring relevancy and fit, and thus to delivering the intended benefits." (Urquhart et al 2020) "(1) continued program activities, (2) continued health benefits, (3) capacity built, (4) further development (adaptation) and (5) cost recovery." (Lennox et al 2018)
Context	The conditions and circumstances that trigger mechanisms.
Mechanism	The implementation resources, and resulting human reasoning and decisions that cause an outcome to occur.
Outcome	The desired products and/or observed products of an intervention.
Strategy	The actions, methods or activities that are used to either 1) provide resources and/or encourage individuals to reason or make decisions to achieve a certain outcome or 2) alter the context to trigger a mechanism to achieve a certain outcome
CMOC	Context-mechanism-outcome configuration. In realist reviews, causation is described in form of CMOCs where particular features of context (C) activate specific mechanisms (M) that generate certain outcomes (O). In this review, strategies (S) are made explicit as part of the CMOC.
Program Theory	A plausible and sensible explanation of how an intervention is supposed to work according to the patterns seen across individual CMOCs.
Domain Theory	A formal theory that has previous been applied in the field of research in which the review is being carried out (i.e. implementation science).
Middle Range Theory	A theory at a level of abstraction in which it is detailed enough and 'close enough to the data' that testable hypotheses can be derived from it, but abstracted enough to apply to other, similar situations as well.
Theory of Planned Behaviour	A middle range theory developed by Ajzen that states that behavioural intention leads to that behaviour or action. Three mechanisms are proposed to influence behavioural intention: attitudes, subjective norms and perceived behavioural control. The latter also acts on behaviour directly (Ajzen 1991).
Normalization Process Theory	A middle range theory developed by May and Finch which proposes different types of work that people do explain the implementation and sustainability of processes in social contexts. These types of work include coherence or sense making, cognitive participation or engagement, collective action and reflexive monitoring (May and Finch 2009).

Stakeholder Involvement

We purposively sampled stakeholders with previous experience in EBP implementation and sustainability including researchers, rehabilitation managers and clinicians throughout our professional networks. We invited stakeholders to participate in discussions with the research team at different points throughout the research process (see steps below). We consulted stakeholders via one-on-one interviews in which we adopted the realist teacher-learner interviewing approach (54). In this approach, the interviewer and stakeholder switch between teacher and learner roles to confirm, falsify and modify the research question, CMOCs and/or the program theory, or suggest new lines of inquiry. To accomplish these objectives, before and during the interviews, we shared the current results with stakeholders, then took on a learner role when we asked them to share and explain their opinion, and how they might modify the results.

Step 1: Clarify the Scope

To develop the research question and the initial program theory we defined sustainability by combining three recent comprehensive definitions (21,55,56): after a defined period of time, the clinical practice and/or sustainability strategies continue to be delivered, and individual behavior change (i.e., clinician, patient) and the capacity for the clinical practice is maintained; the clinical practice and individual behavior change may evolve or adapt while continuing to produce benefits for individuals/systems and remaining financially viable. We then developed and piloted the search strategy (step 2) and selection criteria (step 3). After extracting (step 4) and synthesizing the data (step 5) from all included pilot articles, stakeholders provided feedback on the resulting research question and initial program theory. We identified and confirmed Normalization Process Theory (NPT) and the Theory of Planned Behaviour (TPB) as our chosen theories to inform the initial program theory. NPT (57,58) is concerned with the "social organization of the work (implementation), of making practices routine elements of everyday life (embedding), and of sustaining embedded practices in their social contexts (integration)" (59). The TPB proposes that behavioural intention leads to (sustained) behaviour or action (60).

Combined, NPT and the TPB may offer a more holistic explanation of sustainability since NPT was developed to specifically focus on different constructs from TPB. However, the NPT developers recognize that individual behavioural intention is necessary to explain the work that individuals do to implement and sustain a practice (59,61). The combination of NPT and TPB has been used to understand the implementation of surgical safety checklists where

sustainment was considered a single outcome (62). A detailed description of the iterative approach of step 1 and the initial program theory can be found in Appendix A and Appendix B, respectively.

Step 2: Search for Evidence

We developed the main (MEDLINE) search strategy (sustainability AND implementation science AND rehabilitation) using an article test set and the Yale MeSH analyzer (63) to confirm relevant articles were being captured. The research team revised the search strategy before it was peer-reviewed by an academic medical librarian (Appendix C). The search was iteratively updated, including adding a search in EMBASE, using reference list and reverse citation searching, searching relevant websites and databases (64) and conducting targeted searches for additional academic or grey literature related to already included implementation projects. All searches were conducted up to April 13th 2021.

Step 3: Document Selection

To be included, documents had to be concerned with the sustainability of an EBP used by rehabilitation professionals (OT, PT, S-LP). There were no restrictions regarding the document type (i.e. all academic and grey literature), the nature of the EBP, type of measurement or sustainability outcome (e.g. standardized measurement instrument or self-report, any outcome as defined by authors), the use of certain sustainability strategies or the rehabilitation setting. Documents were excluded if they were not in English or French (Appendix D).

The first author (RA) pilot-tested the selection criteria on 100 articles from MEDLINE to develop the initial program theory. For the electronic database document selection, two independent reviewers performed title and abstract screening on a 5% calibration set with a goal of 90% agreement. When the agreement threshold was reached, RA screened the titles and abstracts of the remaining documents while a second team member (AZ) independently screened a random 5%. We repeated the calibration process for the full text screen. For all other search strategies, RA screened all the documents then AZ screened all those included. The two reviewers discussed and resolved conflicts in consultation with the review team.

Step 4: Data Extraction

RA extracted data from all documents and AZ performed a 5% pilot then an additional 15% for consistency. First, we extracted data on document and intervention characteristics, and

basic information regarding strategies, context, mechanisms and outcomes using an extraction table. Second, we uploaded included documents to NVivo 12 and coded the extracted text according to strategy, context, mechanism and outcome. Strategies, mechanisms and outcomes were primarily coded deductively, informed by the ERIC taxonomy (65), NPT (57) and the TPB (60), and the comprehensive sustainability definition informing this study, respectively. However, new codes were developed inductively when necessary. In contrast, context was primarily coded inductively because during the pilot phase we found that the realist conceptualization of context as defined by its function in the causal explanation is broader than that in common determinant frameworks (e.g. Consolidated Framework for Implementation Research (66)) or models (e.g., structure in Donabedian's model (67)).

Two reviewers (RA and AZ) independently rated rigour of extracted information on context, mechanisms, outcomes and strategies (46). A subjective rating of rigour is used because a realist review draws data from any type and any part of a document. Since data in different documents and sections of an article are generated through different means and methods, using standardized checklists to judge rigour in realist reviews is not appropriate (68). A consensus was reached for each extracted component of the CMOC based on the plausibility and coherence of the methods through which the data were generated (49,68).

Step 5: Data Synthesis

We conducted a descriptive analysis of the data in the extraction table to expose patterns that may inform CMOC and program theory development and refinement. For example, relationships between EBP sustainment and sustainability planning were analyzed numerically and led to specific lines of inquiry in CMOC and program theory refinement. We then engaged in a combination of deductive and inductive retroduction – inferences were made based on interpretations of the data to refine CMOCs grounded in the initial program theory or develop CMOCs emerging from the data, respectively (45). We used cross-case comparison supported by NVivo case analysis functions (69,70) since the entirety of a CMOC was often not articulated in one document or implementation project.

We kept an audit trail and held regular research team meetings to discuss ongoing analytic judgements and findings. The CMOCs and the program theory were further refined via the stakeholder consultations. Stakeholders (1) exposed analytic gaps, (2) highlighted which CMOCs and aspects of the program theory were relevant and easily interpretable, and which

were not, and (3) suggested ways to enhance how the findings could support sustainability practice and advance sustainability research (70,71).

RESULTS

Document Characteristics

The electronic database search resulted in 1168 articles following deduplication. 122 were included following title and abstract screening, and 36 following full-text screening. All other search strategies identified an additional 123 documents. 121 were retrieved for full text screening and 79 were included in the final review. In total, 115 documents representing 61 unique implementation projects were included in this review (**Figure 4-1**).

Included documents comprised qualitative (n=18, 16%), quantitative (n=25, 22%) and mixed-method studies (n=22, 19%), and webpages (n=34, 30%). Excluding webpages, 40% of included documents were published since 2015 (n=32). Implementation projects targeted rehabilitation clinicians (n=36, 59%) and multidisciplinary teams including non-rehabilitation clinicians (n=25, 41%) across a wide variety of practice settings (Appendix E, Appendix F).

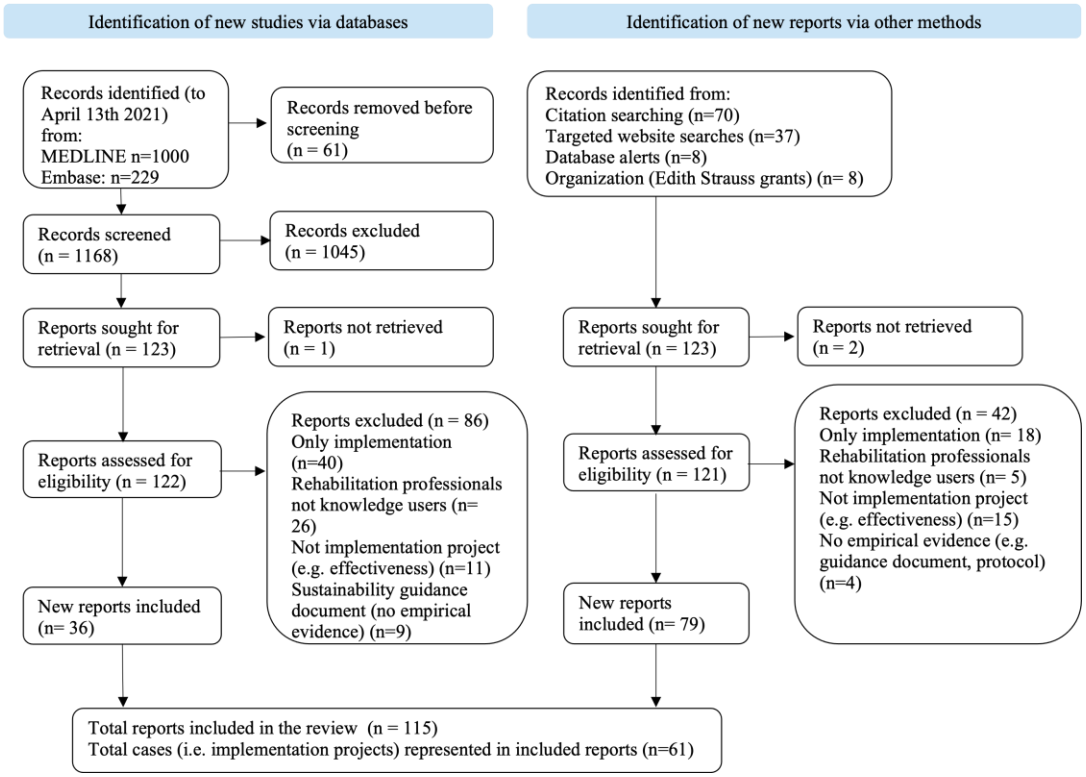

Figure 4-1: PRISMA flowchart

Sustainability Characteristics

Authors reported EBP sustainment in 54% of included implementation projects (n=33), while 8% were completely unsustained (n=5) and 33% were mixed (some sites sustained and some unsustained) or sustained but at a significantly reduced level (e.g. 80% use during implementation phase, 50% use during sustainability phase). Sustainment was evaluated less than a year (n=13, 21%) or 1-2 years (n=22, 36%) post-implementation, most often via self-report by clinicians and/or managers (Appendix E, Appendix F).

84% of implementation teams stated that they used theories, models and/or frameworks to guide implementation and/or sustainability (n=51). In contrast, sustainability planning was rarely conducted, with only 26% of implementation projects including a description of sustainability specific planning (n=16). Of those who did report sustainability planning, 10% reported planning post-implementation (n=6) and 11% reported sustainability planning concurrent with implementation planning (n=7) (Appendix E, Appendix F).

When authors reported sustainability specific planning, they reported sustainment 94% of the time (n=15/16); if no planning was reported, they reported sustainment 49% of the time (n=22/45). When authors used a theory, model and/or framework, they reported sustainment 71% of the time (n= 36/51); if none was used, sustainment was reported 20% of the time (n= 2/10) (Appendix E, Appendix F).

Refined Program Theory

Context, mechanism, outcome, and strategy concepts were combined to form the 52 explanatory CMOCs identified in this review. The CMOCs were combined to form the refined program theory that explains how EBPs in rehabilitation are sustained (38 CMOCs), unsustained (12 CMOCs) or sustained at a reduced level (2 CMOCs). We found three major explanatory patterns which we highlight in the program theory in **Figure 4-2**. We present a brief narrative overview of these three explanatory patterns via exemplifying CMOCs, along with illustrative quotes that informed the development of that CMOC. A full list of all 52 CMOCs can be found in **Table 4-2** and **Table 4-3**, and a complete table with all supporting documentation and text excerpts can be found in Appendix G.

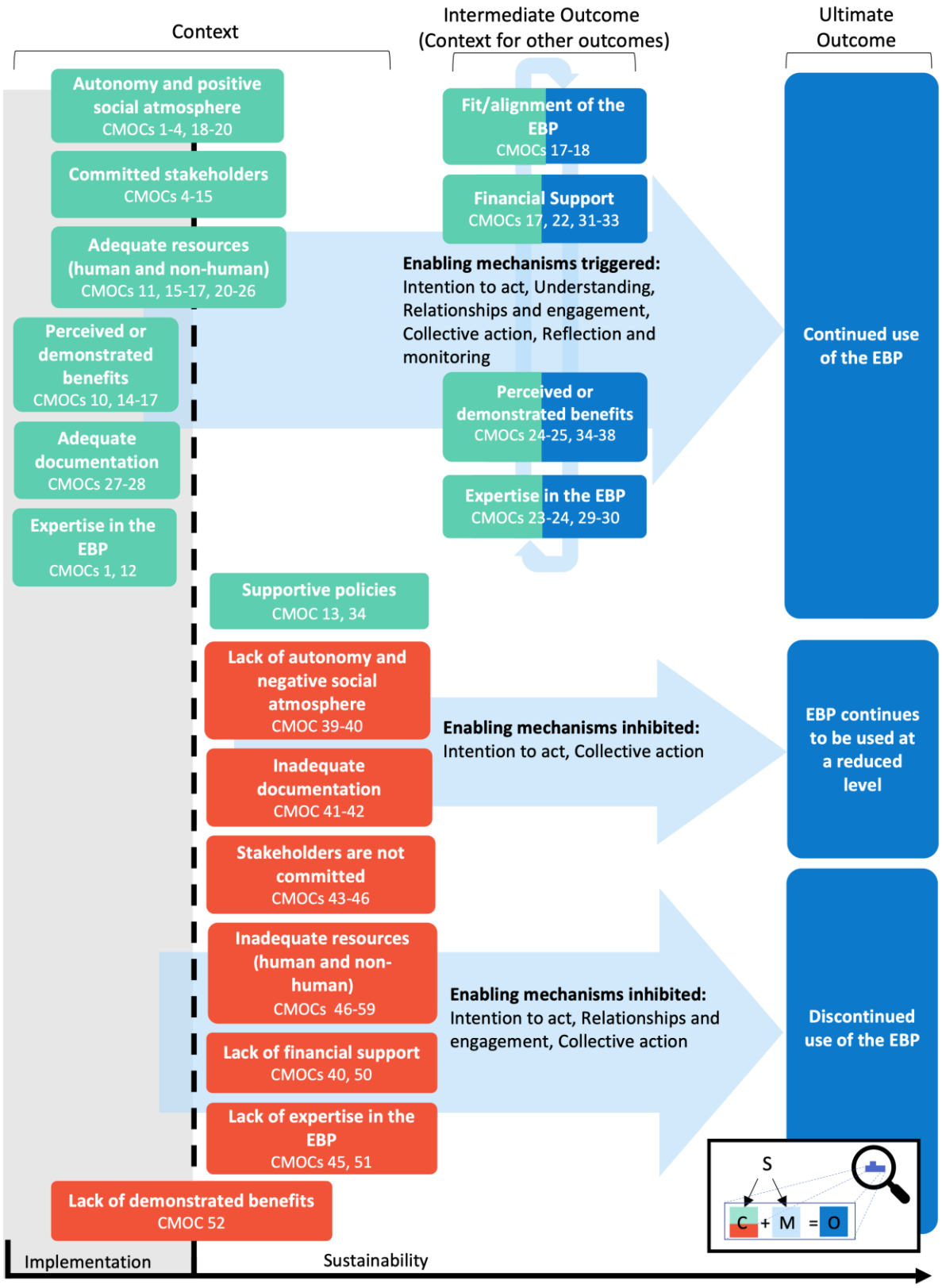

Figure 4-2: Refined program theory

Table 4-2: Context-mechanism-outcome configurations (CMOCs) explaining how and in what contexts rehabilitation practices are sustained

#	CMOC narrative (sustained)	articles	passages
1	If clinicians or clinician-managers have autonomy over their own work and retain knowledge of the evidence-based practice (C) through ongoing training (S), then they will value the evidence-based practice (M) which results in its continued use (O).	1	4
2	If clinicians have autonomy over their use of the evidence-based practice (C), then the practice will be relevant to them and fit their workflow (O) because of the work clinicians do together to evaluate and modify the evidence-based practice (M) when its adaptability is promoted (S).	1	3
3	If there is a positive workplace atmosphere concerning research (C), then the evidence-based practice will be continued by clinicians and the organization (O) because the clinicians perceive positive social pressure and/or expectation from influential colleagues to perform the practice (M) when clinical champions are identified and prepared (S).	5	8
4	If key stakeholders in the organization are committed and the social atmosphere is positive (C), then clinicians will continue to use the evidence-based practice (O) because they will be able to effectively divide the labour for the practice amongst themselves (M) when communication is optimized using interprofessional education strategies and collaborative approaches to implementation or sustainability (S).	7	10
5	If the clinical champion is dedicated to the evidence-based practice (C), then the evidence-based practice will continue to be used by clinicians (O) because clinicians (and the clinical champions) feel confident in their ability to perform the practice (M) when ongoing training and consultation are provided to them (S).	2	2
6	When clinical champions and new leaders are identified (S) then there is a leader or their trained successor in the organization who is dedicated to the evidence-based practice (C) resulting in the continued use of the evidence-based practice (O) because someone is working to drive the practice forward by continuing to define the necessary actions and procedures (M).	1	1
7	When sustainability specific planning is conducted to address the needs of clinicians (S) then there are committed stakeholders in the organization (C) which results in the evidence-based practice continuing to be used by clinicians (O) because clinicians will believe it is right for them to be involved and take ownership of the practice (M).	3	3
8	If the evidence-based practice is complex and/or requires extra time to use but there is management support for it (C) then the practice will continue to be used by clinicians (O) because they have a positive attitude and continue to be confident in their ability to perform the clinical practice (M) when academic partnerships or coalitions are developed (S).	8	12
9	If there is sufficient demand for the evidence-based practice from patients or from other healthcare providers via referrals, and there are committed stakeholders who support the practice in the organization (C), then it will continue to be delivered by clinicians (O) because they regularly evaluate the worth of the clinical practice (M) as part of developing a formal implementation blueprint, assessing for readiness, identifying barriers and facilitators to sustainability and other sustainability specific planning (S).	3	5
10	When the evidence-based practice is adapted and strategies are tailored to the local context (S) then key stakeholders are retained and remain committed, clinicians and/or managers perceive clear benefits of the evidence-based practice over others, and there is sufficient demand from patients for the practice (C), which results in the evidence-based practice continuing to be delivered by the organization (O) because both the clinicians and managers recognize the advantage and alignment of the practice (M).	4	8

11	When building a coalition has facilitated resource sharing (S) then there is management support and adequate resources (C) resulting in the evidence-based practice remaining financially viable (O) because the available resources have been allocated appropriately and the key clinical practice processes are defined by the key stakeholders (M).	4	5
12	When building a coalition has facilitated resource sharing (S) then there is management support and sufficient non-financial resources for the evidence-based practice (C), resulting in the continued use of the practice by clinicians (O) because the human resource needs of the clinical practice can be divided between stakeholders who are working together to operationalize the practice (M).	2	3
13	If new healthcare policies increase the complexity of the evidence-based practice (e.g. as a result of healthcare crises such as a pandemic) but there remains a sufficient patient demand (C), then organizations will continue to deliver the practice (O) because clinicians and managers still perceive the value, importance and benefits of the adapted practice (M) when adaptations to conform to new regulations are made (S).	2	3
14	If there are committed managers and other key stakeholders within and external to the organization (C), advisory boards, workgroups and/or a coalition can be enacted (S) to incorporate and provide access to key individuals so clinicians will believe it is right for them to be involved and take ownership of the evidence-based practice (M), resulting in organizations continuing to deliver the practice (O).	5	11
15	When a formal implementation blueprint is collaboratively developed based on a readiness assessment, and ongoing audit and feedback are used (S) to create an environment where clinicians and senior management are committed to the evidence-based practice and are exposed to demonstrated evidence of its benefits (C), then the practice will continue to be used by clinicians (O) because senior management will provide the necessary resources and make procedural decisions for the clinical practice that ensures its integration into the normal clinical workflow so clinicians have confidence in their ability to perform the evidence-based practice (M).	4	5
16	If the evidence-based practice is an expected part of duties due to the benefits it has for the organization (C), then the organization will continue to deliver the practice (O) because the labour has been adequately divided to fit the workflow of clinical teams (M) when the practice is adapted and strategies are tailored to the local context (S).	3	3
17	If patients and clinicians perceive a receipt of benefits, and there are adequate financial resources and/or a viable business model for the evidence-based practice, then even if the practice is considered complex (C), it will be continued by the organization (O) because clinicians recognize the value and importance of the clinical practice (M) when positive patient or family feedback is obtained (S).	8	13
18	If the evidence-based practice aligns with organizational priorities (C), then the evidence-based practice will continue to be delivered by the organization (O) because clinicians understand the value, benefits and importance of the clinical practice (M) when quality monitoring is used to facilitate the relay of clinical data to clinicians (S).	10	13
19	If the evidence-based practice aligns with organizational priorities and has become an expected part of clinical duties (C), then it will continue to be delivered by the organization (O) because key participants bought into and took ownership of the practice and are continuously working to drive it forward (M) when clinical champions and other leaders are recruited (S).	3	6
20	Especially if there is turnover, ongoing training is needed (S) to signal that the evidence-based practice is an expected part of duties (C) so that clinicians continue to feel confident in their ability to perform the practice (M), resulting in continued expertise amongst clinicians (O).	5	6
21	If clinicians have adequate time to reflect on the evidence-based practice (C) then the practice will continue to be used by clinicians (O) because they are able to gain confidence in their ability to perform the clinical practice (M) when audit and feedback is used (S).	1	2
22	If an organization prioritizes the evidence-based practice such that clinicians have adequate time and there are adequate financial resources (C) when strategies such as accessing new funding are used (S), then clinicians perceive social pressure to understand and perform the practice (M) resulting in continued expertise (O).	2	2

23	If there is organizational turnover but the necessary expertise is still present on the clinical team (C) when ongoing training in conducted (S), then clinicians will continue to use the evidence-based practice (O) because there is social pressure or expectation for them to perform it (M).	5	5
24	If clinicians have adequate time and expertise, and perceive benefits of using the evidence-based practice for themselves (e.g. faster) (C) then they will continue to use it (O) because they are confident in their ability to perform the practice (M) when licensure standards are updated to encompass and/or clarify the competencies required by the evidence-based practice (S)	2	2
25	If clinicians perceive that an evidence-based practice has meaningful benefits for patients and they have the time to perform it (C), then they will continue to use the practice (O) because they have a positive attitude about it when the required resources have been allocated in the workplace (M) following adaptations to fit the practice to their clinical workflow (S).	2	2
26	If clinicians have adequate time and financial resources (C), then there will be continued capacity for the evidence-based practice (O) because clinicians will continue to feel confident about being able to perform the practice and understand their specific tasks and responsibilities (M) when ongoing training is conducted (S).	1	1
27	If adequate documentation systems are in place (C), then the organization will continue to deliver the evidence-based practice (O) because clinicians believe that it is right for them to be involved and that they can make a valid contribution when the practice stays visible (M) through the relay of clinical data to clinicians (S).	1	1
28	If adequate documentation systems are in place (C), quality monitoring can be used (S) to provide evidence for clinicians to understand the value and importance of the evidence-based practice (M) resulting in clinicians continuing to see benefits in the practice for themselves (O)	3	5
29	If there is adequate expertise on the clinical team for the evidence-based practice (C), then it will continue to be delivered by the organization (O) because clinicians will have worked together to periodically appraise the worth of the practice (M) when they use tools to assess sustainability readiness, barriers and facilitators, and use the assessment information to tailor strategies and promote adaptability (S).	2	2
30	When ongoing training is conducted (S) then clinicians will continue to have adequate knowledge of the evidence-based practice (C), resulting in its continued use (O) because clinicians maintain confidence in their ability to perform the practice (M).	4	7
31	If there are adequate financial resources for the evidence-based practice (C) then it will continue to be delivered by organizations (O) because the practice is valued by individuals in charge of funding decisions (M) when quality monitoring systems are used by the organization (S).	4	6
32	When a dissemination organization is started to collect money related to either program training or certification (S) so there are adequate financial resources for the evidence-based practice (C) then it will be continued at the program level (O) because the available financial resources are allocated appropriately by the individuals in charge of the program (M).	4	5
33	If there are adequate financial resources (C), then clinicians and organizations will continue to deliver the evidence-based practice (O) because clinicians believe it is right for them to be involved and take ownership of it (M) when there is an implementation advisor or a data expert to relieve clinicians of the research or implementation burden (S).	3	3
34	If there are external best practice guidelines supporting the evidence-based practice and the practice produces benefits for patients, clinicians and organizations (C), then it will continue to be used by clinicians (O) because clinicians and other relevant stakeholders (e.g. managers) appraise and modify the practice as the guidelines are updated (M) when small cyclical tests of change are conducted (S).	3	5
35	If the evidence-based practice is perceived to be beneficial by clinicians (C), then they will continue to use it (O) because the clinicians have worked together to evaluate its worth (M) during local consensus discussions (S).	3	4
36	If there is a demonstrated receipt of benefits for clinicians or patients (C), then the evidence-based practice will continue to be delivered by organizations (O) because clinicians have a positive attitude about the practice (M) when favourable clinical information is relayed (S).	6	6

37	If the use of the evidence-based practice results in demonstrated benefits for the organization (C) via robust quality monitoring (S) executives will understand the novelty, and the added value, benefits and importance of the practice (M) such that they provide access to a new, steady funding stream (O).	8	10
38	If there are demonstrated benefits for patients and clinicians perceive benefits of using the evidence-based practice for themselves (e.g. faster) (C), then clinicians will maintain their expertise for the practice (O) because clinicians have determined how effective and useful the practice is for them and patients (M) when quality monitoring is used (S).	2	2

Table 4-3: Context-mechanism-outcome configurations (CMOCs) explaining how and in what contexts rehabilitation practices are unsustained or sustained at a reduced level

#	CMOC narrative (unsustained or sustained at a reduced level)	articles	passages
39	If stakeholders do not have authority over the decisions related evidence-based practice, then deprioritization of the practice by the organization (C), will result in its discontinuation (O) because individuals making prioritization decisions do not value the practice over others (M). Building a coalition and developing a quality monitoring system could help develop the necessary support with individuals who do have the authority to prioritize the evidence-based practice within the organization (e.g. management and/or executives) (S).	4	4
40	If there is a lack of financial resources and the evidence-based practice is not part of expected duties (C), then there is no social expectation to perform it (M) and therefore the practice will not continue to be delivered by clinicians (O). Strategies such as leadership mandating change could be used to signal the high priority of the practice and expectation of its use (S).	3	3
41	If record systems have not been updated or data warehousing has not been used (S) such that there are not adequate documentation procedures in place (C) then informed decisions surrounding the policies and procedures for the evidence-based practice cannot be made (M), resulting in a reduced level of sustained use by clinicians (O).	1	1
42	When new documentation procedures are in place but data is not relayed to clinicians (C) such that they do not perceive that the new evidence-based practice is superior to existing practice pathways (M) then they will not continue to use the evidence-based practice (O). Using educational strategies, and audit and feedback to provide the opportunity for clinicians to perceive the difference and superiority of the new evidence-based practice has been suggested (S).	2	3
43	If none or inappropriate clinical champions or leaders were recruited (S) such that the right people did not lead the intervention project or were not identified as clinical champions (C), then the evidence-based practice will not be continued by the organization (O) because clinicians and/or managers do not believe it is right for them to be involved (M).	4	5
44	If patients and caregivers have not been educated such that they have adequate knowledge of the evidence-based practice (S), they may complain or not buy in (C), then clinicians will not continue to use the evidence-based practice (O) because they are not confident in their ability to perform it at a level which is appropriate and/or acceptable to the patient (M).	1	4
45	When key members of the clinical team are not involved in advisory boards and workgroups or collaboratively developing a formal implementation blueprint (S), there may be a lack of expertise, communication and commitment within the team for the evidence-based practice	2	3

	(C), leading to clinicians not continuing to use the practice (O) because no one or not enough people are working to drive the practice forward (M).		
46	If clinicians do not have the time, and there is a lack key stakeholder support for the evidence-based practice (C) since strategies such as building a coalition have not been used to engage these individuals (S), then clinicians will use the practice at a reduced level (O) because there is a lack of social pressure or expectation f if adequate documentation systems are in place or them to perform it (M).	1	4
47	If clinicians do not have the time (C), then they will not continue to perform the evidence-based practice (O) because the necessary resources have not been provided, and decisions surrounding the policies and procedures for the practice have not been made to ensure its integration into the normal clinical workflow (M) when the practice has not been adapted (S).	3	4
48	If there is inadequate time or opportunity for the clinicians to gain and/or share their knowledge of the evidence-based practice (C) since ongoing training or train-the-trainer strategies have not been used (S), then not enough clinicians will be confident in their ability to perform the practice (M) resulting in clinicians no longer having the expertise for the practice (O).	2	2
49	If there is turnover in key stakeholders (especially the leader or clinical champion) (C) and new leaders or champions are not recruited (S), then the evidence-based practice will not be continued by the organization (O) because there is no one or not enough people working to drive the clinical practice forward by continuing to define the necessary actions and procedures for the clinical practice (M).	3	4
50	If there are inadequate financial resources or no business case for the evidence-based practice (C), then it will not continue to be delivered by clinicians or the organization (O) because it was not valued enough by individuals in charge of funding decisions (M). Accessing new funding via another source or adapting the practice to create a business case for it have been suggested (S).	2	4
51	If knowledge of the evidence-based practice declines (C) due to a lack of patient recruitment and/or ongoing training (S), the use of the practice will not be continued (O) because clinicians are no longer confident in their ability to perform the clinical practice (M).	5	5
52	When data is relayed to clinicians (S) showing there are no benefits to the evidence-based practice for clinicians or patients (C), then the practice will not continue to be used by organizations (O) because clinicians have a negative attitude about the practice (M).	1	1

Implementation and Sustainability Phases are Interconnected

The first major explanatory pattern in the program theory is that a number of influential contextual factors that are developed during implementation are carried through into the sustainability phase to generate sustainability outcomes, thus linking the two phases. For example, context in CMOC 2 refers to autonomy developed during implementation; if clinicians have autonomy over their own use of the EBP (C), then the practice will be relevant to them and fit their workflow (O) because of the work clinicians do together to evaluate and modify the EBP (M) when its adaptability is promoted (S):

> *"Over time, [the Model of Human Occupation (MOHO)] came to be viewed as an indispensable resource, but the process of knowledge assimilation was complex…The therapists needed to exercise autonomy to use MOHO knowledge as they deemed appropriate: to modify and adapt it in order to meet both their human and practice needs." Authors' discussion* (72)

CMOCs concerning unsustained or reduced level of sustainment of the EBPs only contain contextual features that develop during both phases or entirely within the sustainability phase. For example, CMOC 49 contains the context of turnover during the sustainability phase; if there is key stakeholder turnover (especially when the stakeholder is the leader or clinical champion) (C) and new leaders or champions are not recruited (S), then the use of the EBP will not be continued by the organization (O). This is because there is no one or not enough individuals working to drive the EBP forward by continuing to define necessary actions and procedures (M):

> *"[The lead geriatrician] moved [away] and pretty soon you and I (interventionists) weren't there anymore…there were a series of geriatricians that came and went and came and went; and didn't have his – I can't say level of expertise, but his personality, and drive for it." Participant interview* (73)

Finally, contextual factors can be developed during both phases. CMOC 9 illustrates that patient referrals were increased during implementation and sustainability phases (C), contributing to the improved use of the EBP by clinicians in the sustainability phase compared to the implementation phase (O):

> *"There was increased adoption by outpatient clinics, physical therapists, and referrers. Furthermore, the four initial referrers increased their overall PT referrals…from 115 referrals in the 2016 fiscal year to 167 in the 2019 fiscal year, a 45% increase." Authors' discussion* (74)

Continued Use of the EBP Interpreted as the Ultimate Sustainability Outcome

Continued use of the EBP is the most common sustainability outcome. It comprises multiple levels, including clinician (as in the aforementioned CMOC 9), organizational (as in the aforementioned CMOC 49) and program (i.e., extra-organizational). CMOC 32 is the only example at the program level; when an organization that is responsible for disseminating the EBP collects money for program training or certification (S) to attain adequate financial resources (C) then the EBP will be continued at the program level (O) because the available financial resources are allocated appropriately by the individuals in charge (M):

> *"A paid membership on the [Rehabilitation, Sports and Exercise] program in which institutions have to pay the program owners became a successful solution not only to continue the "Physical Activity Counseling Centers," but also to continue this nationwide collaboration between rehabilitation institutions." Authors' discussion* (75)

In the program theory, multi-level continued use is considered the ultimate outcome because all other (i.e. intermediate) outcomes can contribute to the continued, discontinued or reduced use within refined CMOCs. For example, CMOC 32 contains financial support (an intermediate outcome) as a contextual factor that generates continuation of the EBP at the program level. Similarly, in one study used to develop CMOCs 36 and 52, the authors used multilevel regression analysis to estimate the predictive role of demonstrated improvements in quality of care (C) on the continued delivery of disease management programs (O) (5):

> *"The ability of professionals to effectively improve quality of chronic care delivery as a result of the disease management approach is expected to have positively influenced professionals' views on this approach making them more motivated to change their old ways and making the new working method part of their daily routine practice. Unsuccessfully improving quality of care delivery may have resulted in preference for old working habits, with the danger of discontinuation of the new working method within the disease-management approach by professionals." Authors' discussion* (5)

In this example, continued use is interpreted as being influenced by demonstrated benefits. This relationship (as opposed to the inverse) is how continued use is always conceptualized within the refined CMOCs.

Intermediate Outcomes become Enabling Contextual Factors for subsequent Sustainability Outcomes

Intermediate outcomes identified in the program theory concerning sustained EBPs act as outcomes in some CMOCs and context in others. This creates temporal relationships amongst outcomes, where outcomes generated earlier (i.e., intermediate outcomes) can act as context for other, later outcomes (i.e., other intermediate or ultimate outcomes). For example, CMOC 28 links adequate documentation systems (C) to clinicians continuing to see benefits in the EBP for themselves (O):

> *"The feeling of being relieved emerged gradually when the participants saw how the implementation of the [Occupational Therapy Intervention Process Model] generated improvements in their daily practice." Authors' discussion* (76)

In contrast, CMOC 37 demonstrates benefits as a contextual factor; if the use of the EBP results in demonstrated benefits for the organization (C) via robust quality monitoring (S) executives will understand the added value, benefits and importance of the practice (M) such that they provide access to a new, steady funding stream (O):

> *"To date, 10 out of the 13 [Advanced Musculoskeletal Physiotherapy (AMP)] models have had business cases for continuation of service with ongoing funding approved at a health service level. This…is reflective of the positive outcomes achieved by the AMP Program" Authors' discussion* (77)

Collectively, CMOCs 28 and 37 demonstrate how an intermediate outcome (i.e. benefits) can be a contextual factor or an outcome. CMOC 37 also shows that demonstrated benefits can help generate another intermediate outcome (financial support). Any intermediate outcome can be a contextual factor for another intermediate outcome or the ultimate outcome of continued use of an EBP.

By their nature as sustainability outcomes, the constructs labelled as intermediate outcomes are contained in the sustainability phase. However, the constructs of benefits and expertise are also found in implementation as contextual factors. For example, CMOC 23 illustrates expertise for the EBP being developed in both implementation and sustainability phases (C) via initial and ongoing training (S):

> *"[The high sustainability site] reported training [part-time coverage] therapists – outside of research oversight and on their own time – to ensure*

> *conformity of rehabilitation approaches by all therapists treating any appropriate patients in the facility." Authors' discussion* (78)

Intermediate outcomes were only identified in refined CMOCs explaining sustained EBPs. However, the intermediate outcome constructs are found in unsustained or reduced level CMOCs as context only, except for fit and alignment. For example, CMOC 51 contains expertise as a contextual factor; if knowledge of the EBP declines (C) due to a lack of patient recruitment and/or ongoing training (S), the use of the practice will not be continued (O) because clinicians are no longer confident in their ability to perform the clinical practice (M):

> *"The small number of patients enrolled onto [Enhanced Recovery After Surgery (ERAS)] in this speciality was found to affect some staff's ability to differentiate who was an 'ERAS patient' and thus enact the relevant care pathway." Authors' discussion* (79)

DISCUSSISON

In this realist review we aimed to understand how (mechanism), in what circumstances (context) and for what duration EBPs are sustained in rehabilitation (outcome). From the 115 included documents representing 61 unique implementation projects, we identified 52 unique explanatory statements containing context, mechanism, outcome, and strategy concepts (i.e., CMOCs). Combining these CMOCs, we developed an overall explanation as to how EBPs are sustained in rehabilitation (i.e., a refined program theory).

We identified three major explanatory patterns in the refined program theory that have implications for the understanding of EBP sustainability. First, although often conceived as two distinct phases in implementation theories, models, or frameworks (80), we found that implementation and sustainability phases are highly interconnected. This aligns with recent literature in which the authors theorize that sustainability overlaps with the implementation phase (14,15,81,82). This overlap has given rise to recommendations for concurrent implementation and sustainability planning as an important predictor of positive sustainability outcomes (35,36,83). Our findings support this recommendation; when authors reported sustainability specific planning, EBPs were sustained 94% of the time versus 49% of the time when no planning was reported. Future research could test the relationship between sustainability planning and EBP sustainment according to the testable hypotheses proposed by the CMOCs in this review.

Second, the continued use of the EBP was identified as the ultimate outcome that implementation teams strive for, or that ultimately determines whether the EBP is perceived as sustained or unsustained. Continued use is the most common way to conceptualize and operationalize sustainability outcomes in both rehabilitation (5,75,84) and the wider healthcare literature (13,14,85). For example, authors of a recently developed measure used to assess sustainment in all healthcare contexts referred to continued use as the core component of sustainment (86). Similarly, findings from this realist review suggest that the ultimate outcome, that is, continued use of an EBP, may have a larger importance or relevance than other sustainability outcomes. Thus, continued use may need to be weighted more heavily than other sustainability outcomes as it may make up a greater proportion of what it means to sustain an EBP. Implementation teams should always carefully consider measurement of continued use using robust methods such as audit data or validated measures (86). In accordance with other authors (28,30,32), we suggest that work on pragmatic (e.g. easy, compatible, brief (87)) measurement tools to support multidimensional sustainability outcome measurement is needed.

Finally, we found that intermediate outcomes (i.e., fit/alignment, financial support, benefits, expertise) become enabling contextual factors for subsequent sustainability outcomes (i.e., all other intermediate outcomes as well as continued use of the EBP). This creates temporal relationships between CMOCs; (49,88) that is, outcomes achieved at an earlier timepoint become contextual factors for outcomes achieved at a later timepoint. Though relationships between outcomes are not recognized in Moore and colleagues' comprehensive sustainability definition (55) or recent frameworks containing sustainability outcomes (13,21), limited relationships were reported in a study by Urquhart in which healthcare managers defined sustainability (56). The findings of this review suggest that there are extensive interactions between sustainability outcomes, signifying that they are not simply combined to form the multidimensional construct of sustainability. Future research should empirically test the relationships between sustainability outcomes that are hypothesized by the refined CMOCs.

Via the refined program theory, context-specific sustainability guidance is available to implementation teams which goes beyond that currently available in existing sustainability planning guides (34,89) and tools (35,37,90). However, teams could benefit from using the program theory in combination with other sustainability tools (e.g. to assess context), either prospectively during sustainability planning to guide the selection of sustainability strategies or

retrospectively during sustainability evaluation to explain how and why the EBP was sustained (or not).

Sustainability planning guidance (prospective)

I. Assess or identify sustainability constructs (i.e., contextual features, probable mechanisms or outcomes to be achieved)
II. Match constructs to those described in the program theory to find relevant CMOCs
III. Use identified CMOCs to select strategies which are linked to assessed or identified constructs

Sustainability evaluation guidance (retrospective)

I. Assess or identify sustainability constructs (i.e., contextual features, mechanisms, strategies, outcomes)
II. Match constructs to those described in the program theory to find relevant CMOCs
III. Use identified CMOCs to explain results and plan next steps

All identified CMOCs in the program theory are unlikely to be applicable within a single project; indeed, some CMOCs may only apply to certain types of EBPs. For example, 'patient demand' can be an influential contextual factor for EBPs such as falls prevention training, where patients often need to be actively recruited (91). In such cases the program theory does not need to be used in its totality. Implementation teams should use the CMOCs applicable to the EBP and their local context.

This review synthesized basic study and EBP sustainability information in rehabilitation for the first time. As in healthcare more broadly (16,17), sustainability literature in rehabilitation is rapidly maturing (i.e., 40% of included documents published in the last 5 years), however, sustainment rates remain poor (54% sustained in this review versus 40-70% reported in other healthcare fields (6–9)). Sustainment may be overestimated as many authors evaluated sustainability as early as 6 months post-implementation and longer term EBP sustainability has not been reported (78,92–94). The 2020 update of the RE-AIM framework recommends that sustainability be evaluated at least 1-year post-implementation (14), while other experts have recommended at least 2 years (55). Extended post-implementation follow-up studies are necessary.

Strengths and Limitations

The refined program theory is based on a rigourous analysis and synthesis (44,46,47,49) of a large number of documents representing a wide variety of contexts, mechanisms, outcomes and strategies. Thus, there is a warrant for the transferability of the program theory to similar circumstances. For example, sustainability in clinical settings where there are multidisciplinary teams without a rehabilitation clinician could be informed by findings in this review.

We needed to interpret included documents representing non-realist data into realist terms to develop our program theory. While the relatively consistent occurrence of certain patterns speaks for the robustness of most of our CMOCs, more work is needed to test and further refine these. Furthermore, although we have identified many CMOCs, we do not claim to have developed an exhaustive and definitive explanation of sustainability. As with any complex intervention in an open social system, there are most likely additional explanations for the observed outcomes.

We were unable to include information concerning the duration of EBP sustainment in refined CMOCs since the limited longitudinal data (n=13, 21%) often only represented snapshots in time. Similarly, we attempted to extract data on sex and gender per international guidelines (95–97); however, this data was never reported. Finally, realist questions such as 'for whom' were not investigated in this review as they were not prioritized by stakeholders, but these may be worthy of future exploration. Future research should use methods which can follow sustainability trends over time, such as in longitudinal case study designs (98), report and analyze sex and gender data appropriately (99). and consider EBP sustainability differences between rehabilitation professions.

CONCLUSION

The results of this realist review indicate that the sustainability of EBPs in rehabilitation is a pressing challenge, as noted in other healthcare fields (10,13,15). Extending what is known regarding sustainability, we explained how, why and in what circumstances an EBP in rehabilitation is sustained. By so doing, this review provides context-specific sustainability guidance to implementation teams in rehabilitation that may be transferable to other healthcare fields. There are plans to further refine the program theory developed in this review by

empirically testing it as part of an evaluation of the sustainability of an EBP in rehabilitation. We encourage other researchers and implementation teams to use and further refine the program theory as part of a cycle of iterative theorizing (52,100,101).

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Appendix A.
Development of the Research Question and Initial Program Theory

Step 1: Clarify the Scope (continued)

The initial research question was broad (i.e. how, for whom and in what circumstances are evidence-based practices sustained in healthcare?). In discussions with the research team and stakeholders, the population was narrowed from healthcare to rehabilitation, and the type of evidence-based practice was narrowed to one that is used by clinicians, excluding evidence-based practice s targeted to patients (e.g. self-management), policy-makers (e.g. health systems level) or other stakeholders. Finally, the concept of duration (i.e. the time during which an evidence-based practice is sustained) was determined to be an important factor (1). Thus, the component 'for what duration?' was added to the research question. The final question (matching the previously stated objective) is: How (mechanism), in what circumstances (context) and for what duration are evidence-based practices sustained in rehabilitation (outcome)?

We developed the initial program theory using the approach recommended by the RAMESES training guide; we created individual CMOCs by identifying outcomes then determined links to mechanisms and context (and in the case of this review, strategies) (2). We used the comprehensive definition of sustainability discussed in the introduction to capture all sustainability outcomes for the initial program theory. Then, we linked mechanisms, context and strategies to outcomes by referring to the National Health Service (NHS) Sustainability Model (3), sustainability tools (Clinical Sustainability Assessment Tool (CSAT) (4), Long Term Success Tool (5)) and the Expert Recommendations for Implementing Change (ERIC) taxonomy (6). Following the development of these basic CMOCs, we tested them using articles identified in a pilot search of MEDLINE. Testing them consists of extracting (step 4) and synthesizing the data (step 5) from the articles to find empirical support for the initial CMOCs.

Once CMOCs had preliminary empirical support, we reviewed knowledge syntheses (7,8) to identify implementation theories previously applied to sustainability that can explain the patterns of mechanisms seen across multiple CMOCs. Matching identified implementation theories to initial CMOCs, we first identified Normalization Process Theory (NPT) (9), followed by the Theory of Planned Behaviour (TPB).

Normalization Process Theory

NPT (10) is the most common middle range theory applied to sustainability (7) and received one of the highest sustainability theory scores in the review of reviews which rated sustainability theories using the T-CaST (8). NPT is concerned with the "social organization of the work (implementation), of making practices routine elements of everyday life (embedding), and of sustaining embedded practices in their social contexts (integration)" (11). Four mechanisms explain these processes: coherence or sense making, cognitive participation or engagement, collective action and reflexive monitoring (12) (See below for full NPT). It should be noted that there is some conflict in the literature as to whether normalization is synonymous with sustainability (8) or is fundamentally different from it (13).

Authors of a recent systematic review of NPT found evidence that implementation outcomes (including sustainability) could be explained by reference to the mechanisms specified by NPT in all but one of 130 studies included in the review (14). NPT has previously been used to explain sustainability in rehabilitation (15,16), and in realist reviews of the implementation of safety checklists in surgery in which sustainability was one outcome (17) and of Lean quality improvement sustainability in pediatric healthcare (18). Mirroring the safety checklist review, after applying NPT we determined the need for a behaviour change theory to explain CMOCs containing behavioural mechanisms and outcomes. Thus, we added the TPB to the program theory (19).

The Theory of Planned Behaviour

The TPB has been applied to sustainability and received the same score as NPT in the review of reviews in which authors applied the T-CaST rating system (8). The TPB proposes that behavioural intention leads to behaviour or action. Three mechanisms are proposed to influence behavioural intention: attitudes, subjective norms and perceived behavioural control. The latter also acts on behaviour directly (See below for full TPB) (19).

Results of a meta-analyses suggest that TPB can explain up to 25 per cent of variance in outcomes in prospective studies of behaviour change (20,21). Similar to NPT, some researchers have suggested that behaviour is related but is conceptually distinct from sustainability (8) while others state that the maintenance of behaviour change is a core construct of sustainability (22).

Use of NPT and TPB in combination

Combined, NPT and TPB may offer a more holistic explanation of sustainability since NPT was explicitly developed to exclude constructs of TPB. However, NPT developers have recognized that individual behavioural intention is a necessary component of explaining the work that people do to implement and sustain a practice (11,23). The combination of NPT and TPB has not previously been applied to explain sustainability directly, but has been applied to understand the implementation of surgical safety checklists where sustainment was considered a single outcome (17).

Stakeholder feedback was solicited to finalize the initial program theory. Stakeholders suggested additional contextual factors (especially concerning societal and systems features), helped clarify the definitions of sustainability outcomes, confirmed the plausibility of applying the NPT and TPB, and identified a feedback loop between benefits, which is perceived as an earlier sustainability outcome, and later sustainability outcomes (e.g. continued use of the evidence-based practice).

Normalization Process Theory

NPT is composed of four mechanisms which can explain sustainability (10,11,24):

- Coherence refers to how everyone individually and collectively understands the intervention, its purpose, and potential value. It also includes how individuals and the team see the intervention as differing from usual care delivery. Common synonyms include sense-making
- Cognitive participation refers to individual and leadership of the intervention and agreement to work with it. Common synonyms include engagement or relationships.
- Collective action refers to the operational work that people do such that everyone knows who is doing what. Common synonyms include action or operational work.
- Reflexive monitoring includes feedback gathered on outcomes and impacts of the intervention, which can reinforce its continued application and adaptation. Common synonyms include reflection and monitoring, reflection or appraisal work.

Table A.1: Table 2 from (11):

Table 2 Framework for operationalizing normalization process theory

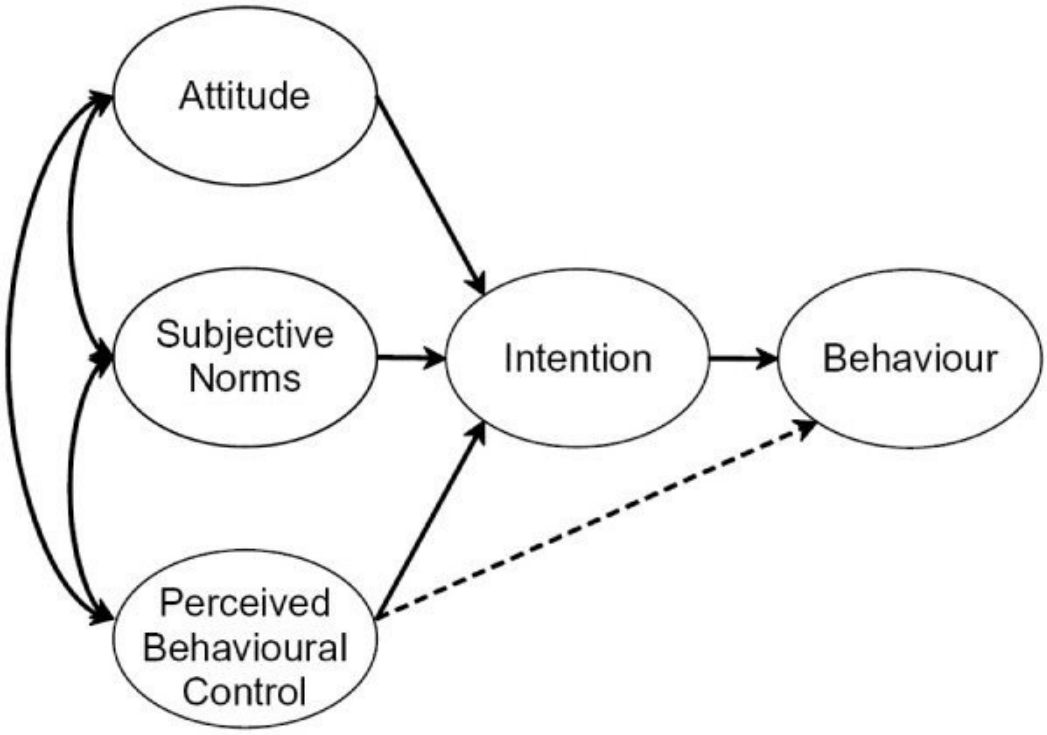
	Coherence *What is the work?*	*Cognitive Participation* *Who does the work?*	*Collective Action* *How does the work get done?*	*Reflexive Monitoring* *How is the work understood?*
Systematic explanation of mechanisms and components at work	Factors that promote or inhibit the mobilization of a practice	Factors that promote or inhibit participation in a practice	Factors that promote or inhibit enacting a practice	Factors that promote or inhibit the appraisal of a practice
Knowledge about the sources and operation of investments at work	Beliefs and behaviours that define and organize objects	Beliefs and behaviours that define and organize actors	Beliefs and behaviours that define and organize work	Beliefs and behaviours that define and organize understanding
Investigation of core questions that could include…	*How is a practice conceptualized by participants? How does it hold together in action?*	*How do participants come to engage with a practice? How do they decide on engagement and the purposes that it serves?*	*How do participants enact a practice? How are their activities structured and constrained?*	*How do participants appraise a practice What are its effects of appraisal? How are they mediated?*

Theory of Planned Behaviour (TPB)

The theory states that an individual's intention to perform a behaviour is the proximal predictor of behaviour. In turn, intention is predicted by

- Attitude (a person's overall evaluation of the behaviour)
- Subjective norms (a person's own estimate of the social pressure to perform or not perform the target behaviour)
- Perceived behavioural control (the extent to which a person feels able to enact the behaviour; it has two aspects: how much a person has control over the behaviour and how confident a person feels about being able to perform or not perform the behaviour).

Figure A.1: Model of the components of the Theory of Planned Behaviour, from (19)



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Appendix B.
Initial Program Theory

Figure B.1: Simplified model

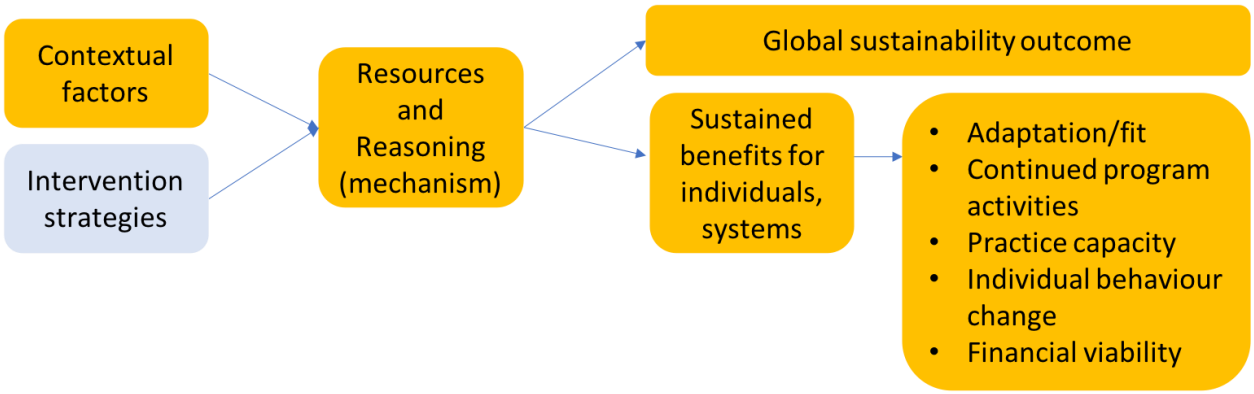
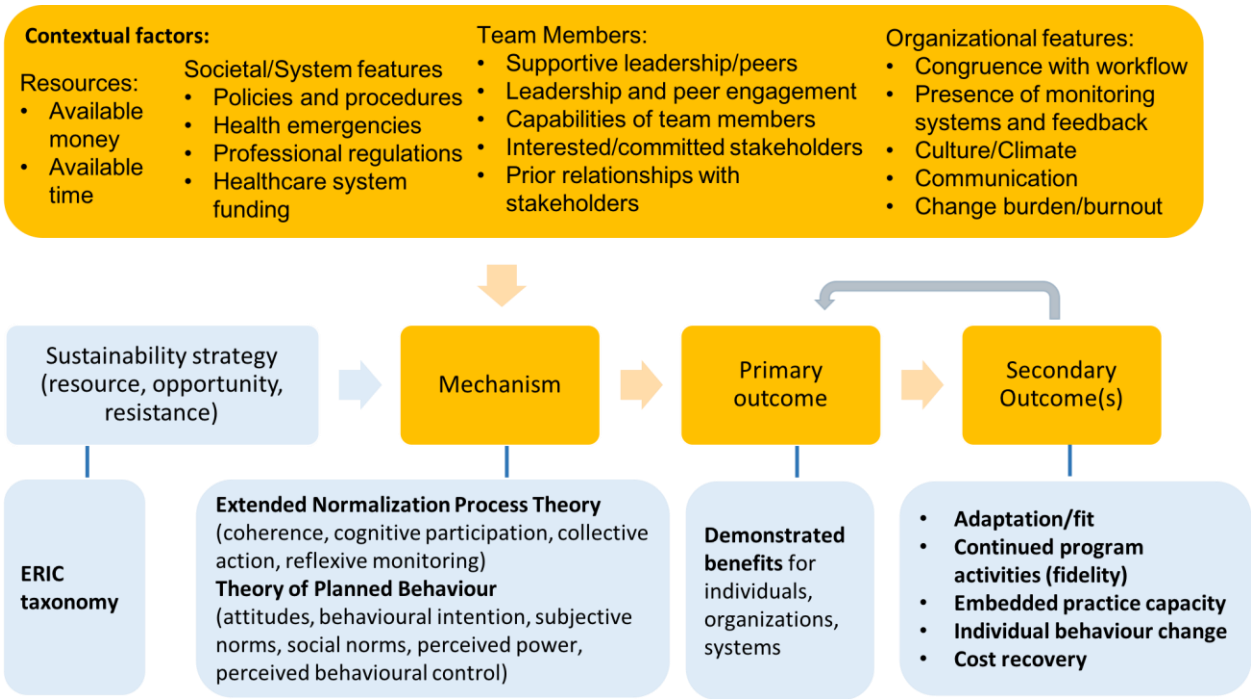


Figure B.2: Full model



Appendix C
PRESS Guideline 2015— Search Submission & Peer Review Assessment

Reference: McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. J Clin Epidemiol. 2016 Mar 18. pii: S0895-4356(16)00058-5.

Search submission: This section to be filled in by the searcher

Searcher: Rebecca Ataman Email: Rebecca.ataman@mail.mcgill.ca

Date submitted: **May 21, 2020** Date requested by: **June 4 2020**

Realist Review Title

A realist review of strategies enhancing the sustainability of knowledge translation interventions in rehabilitation

This search strategy is …

X	My PRIMARY (core) database strategy — First time submitting a strategy for search question and database
	My PRIMARY (core) strategy — Follow-up review NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions
	SECONDARY search strategy— First time submitting a strategy for search question and
	SECONDARY search strategy — NOT the first time submitting a strategy for search question and database. If this is a response to peer review, itemize the changes made to the review suggestions

Database (i.e., MEDLINE, CINAHL)

MEDLINE, followed by Grey Literature. If necessary (theoretical saturation not reached) then search CINAHL, followed by EMBASE. If necessary, the search strategy or the databases may be added to/expanded as needed.

Interface (i.e., Ovid, EbscoHost…)

Ovid, EbscoHost

Research Question (Describe the purpose of the search) *[mandatory]*

What strategies enable the sustainability of knowledge translation interventions in rehabilitation, when, for whom, under what circumstances and for what duration?

Objective 1. To identify strategies which enhance sustainability of knowledge translation interventions in rehabilitation in certain contexts

Objective 2. To produce a middle-range (program) theory explaining our findings

This review will follow the Realist and Meta-Review Evidence Synthesis: Evolving Standards (RAMESES) guidelines on quality and reporting (Available from: https://www.ramesesproject.org/).

PICO Format Outline the PICOs for your question — i.e., Patient, Intervention, Comparison, Outcome, and and Study Design — as applicable) and Study Design — as applicable) Study Design — as applicable)

N/A

Inclusion Criteria (List criteria such as age groups, study designs, etc., to be included) *[optional]*

We will use the following inclusion criteria to determine if the document is likely to contain relevant data:

- Document type: all study designs and documents that indicate they may contain relevant data (i.e. relevant to the research question/program theory)
- Types of participants: directed to clinicians as knowledge users
- Types of intervention: knowledge translation interventions directed to rehabilitation professionals (occupational therapy, physical therapy, audiology and speech-language pathology)
- Sustainability Outcomes: (1) Continues to produce benefits for individuals/organizations/systems, (2) maintain relevancy and fit, (3) the clinical intervention and/or implementation strategies continue to be delivered (fidelity), (4) Continued capacity to deliver the intervention (continues in absence of champion/person who introduced it), (5) Individual behavior change (i.e., clinician, patient) is maintained, (6) Cost recovery

Exclusion Criteria (List criteria such as study designs, date limits, etc., to be excluded) **[optional]**

Studies will be excluded if: 1) they are published in any other language than English or French.

Was a search filter applied?

Components of the comprehensive KT search filter on Ovid.

Notes or comments you feel would be useful for the peer reviewer *[optional]*

Realist reviews are iterative and the search strategy is built around the so called 'program theory', essentially a series of hypotheses which align with the research question. Thus, the

search strategy does align with the research question as normal, but the search only needs to retrieve enough articles such that the hypotheses can be confidently answered. This is reflected in the databases chosen to search within.

Please copy and paste your search strategy here, exactly as run, including the number of hits per line. [mandatory]

Database(s): **Ovid MEDLINE(R) ALL** 1946 to May 2020
Search Strategy:

#	Searches	Results
1	Clinical Competence/ or exp "Diffusion of Innovation"/ or exp Evidence-based practice/ or organizational innovation/ or knowledge management/ or translational medical research/ or Quality improvement.tw,kf. or Quality Improvement/ or ((organi*ational adj3 innovation*) or (facilitator* or barrier*)).tw,kf. or ((evidence-informed or evidence based) adj (healthcare or health care or decision making or practice)).tw,kf. or ((program or intervention) adj2 (uptake or diffusion or disseminat* or implement* or adoption)).tw,kf. or ((research or knowledge or evidence) adj2 (mobilization or exchange or uptake or "use" or diffusion or disseminat* or utili*ation or transfer* or translat* or implement* or adoption)).tw,kf.	626186
2	exp Rehabilitation/ or exp Physical Therapy Modalities/ or exp Physical Therapy Specialty/ or exp Occupational Therapy/ or occupational therapists/ or audiology/ or speech-language pathology/ or (rehabilitation therap* or rehabilitation or physiotherap* or physical therap* or occupational therap* or speech language patholog* or speech language therap* or speech patholog* or speech therap* or "speech and language patholog" or "speech and language therap*" or audiolog*).tw,kf.	459944
3	sustainable or sustainability or sustainment or "implementation outcome*" or "outcome* of implementation" or maintenance or routini*ation or institutionali*ation or normali*ation or re-invention or "continued use" or durability or assimilation or "long term use" or "use long term" or "program continuation" or "intervention continuation" or "implementation continuation").tw,kf.	448987
4	1 and 2 and 3	872
5	(health services research or implementation science).jn.	5538
6	2 and 3 and 5	20
7	4 and 6	879

Peer review assessment: this section to be filled in by the reviewer

Reviewer: **Jill Boruff**	Email: jill.boruff@mcgill.ca	Date completed: June 4 2020

Do you wish to be acknowledged? (If yes, the review team will be advised to add an acknowledgement to any publications related to this work). Yes

The suggested acknowledgement is "We thank Jill Boruff, MLIS for peer review of the MEDLINE search strategy."

1. TRANSLATION

A ---No revisions	
B --- Revision(s) suggested	
C --- Revision(s) required	

If "B" or "C," please provide an explanation or example:

2. BOOLEAN AND PROXIMITY OPERATORS

A ---No revisions	
B --- Revision(s) suggested	
C --- Revision(s) required	

If "B" or "C," please provide an explanation or example:

3. SUBJECT HEADINGS

A ---No revisions	
B --- Revision(s) suggested	
C --- Revision(s) required	

If "B" or "C," please provide an explanation or example:

4. TEXT WORD SEARCHING

A ---No revisions	
B --- Revision(s)suggested	
C --- Revision(s) required	

5. SPELLING, SYNTAX, AND LINE NUMBERS

A ---No revisions	
B --- Revision(s)suggested	
C --- Revision(s) required	

If “B” or “C,” please provide an explanation or example:

6. LIMITS AND FILTERS

A ---No revisions	
B --- Revision(s) suggested	
C --- Revision(s) required	

If “B” or “C,” please provide an explanation or example:

OVERALL EVALUATION (Note: If one or more “revision required” is noted above, the response below must be “revisions required”.)

A ---No revisions	
B --- Revision(s) suggested	
C --- Revision(s) required	

Additional comments:

Appendix D
Inclusion and Exclusion Criteria

Table D.1: Inclusion and Exclusion Criteria

1. Does the document concern a KT intervention or the implementation of an intervention?	If no, exclude with exclusion reason based on what the document does concern. E.g. 'healthcare services', 'clinician wellbeing' If it's a very random article, you can put 'Not KT' or 'Not healthcare' 'rehabiliation care' 'primary care' 'specialized care' (including mental health, HIV, other specialists)
2. Does the document concern the sustainability of the intervention?	If no, exclude based on what the document does concern. E.g. knowledge gap, implementation planning, implementation
3. Does the document concern an intervention directed to clinicians?	If no, exclude with exclusion reason of other population. E.g. 'policy-makers', 'patients'
4. Does the document concern an intervention directed to rehabilitation clinicians (PT, OT, SLP?	If no, exclude with exclusion reason of other field. 'mental health' 'surgery'

Appendix E
Additional Tables

Table E.1: Relationships between Sustainment and key characteristics within included implementation projects

	n (%)
Sustainability Planning and Sustained	15 (94)
No planning and Sustained	22 (49)
Theory, Model, Framework use and Sustained	36 (71)
No Theory, Model, Framework use and Sustained	2 (20)

Table E.2: Basic characteristics of included documents (n=81), excluding webpages (n=34)

	n (%)
Year published	
2004-2010	10 (9)
2011-2015	31 (27)
2016-2020	40 (35)
2021	6 (5)
Study Design	
Quantitative	25 (22)
Mixed method	22 (19)
Qualitative	18 (16)
Quality sssImprovement	12 (10)
Commentary s or guideline	4 (3)
Study Duration	
< 1 year	10 (12)
1- > 2 years	21 (26)
2- >3 years	22 (27)
3+ years	13 (16)
not reported s ss or applicable	15 (19)

Table E.3: Basic Characteristics of included implementation projects (n=61)

	n (%)
Field	
Multidisciplinary	25 (41)
Rehabilitation	36 (59)
Targeted clinicians	
1-20	22 (36)
21-50	8 (13)
51-100	12 (20)
101+	9 (15)
Not reported	10 (16)
Number of sites	
1	20 (33)
2-5	12 (20)
6-10	8 (13)
11-20	8 (13)
21+	8 (13)
Not reported	5 (8)
Setting	
Acute hospital (may be s academic affiliated)	19 (31)
Rehabilitation hospital s s or clinic (may be s s s s academic affiliated)	18 (30)
Community or home-ss s based	13 (21)
Acute hospital and s s ss community centre	3 (5)
Acute hospital and ss s s s rehabilitation centre	3 (5)
Telerehab/online	2 (3)
Non-governmental ss s s s organization	2 (3)
University	1 (2)
Any location	1 (2)
Geographical Location	
North America	31 (51)
Europe	16 (26)
Australia	10 (16)
Africa	2 (3)
International	2 (3)
Received Funding	45 (74)

Table E.4: Sustainability Characteristics of included implementation projects (n=61)

	n (%)
Sustainability Planning	
None reported	45 (74)
Done, but unclear when	3 (5)
Concurrent planning	7 (11)
Post-implementation planning	6 (10)
Timing of Sustainability Evaluation	
< 1 year	13 (21)
1- > 2 years	22 (36)
2- >3 years	4 (7)
3+ years	11 (18)
Not reported or no ss s s s evaluation	11 (18)
Timing of sustainability Evaluation	
< 1 year	13 (21)
1- > 2 years	22 (36)
2- >3 years	4 (7)
3+ years	11 (18)
Not reported	11 (18)
Sustainment	
Mixed	14 (23)
Reduced level	6 (10)
Completely unsustained	5 (8)
Sustained	33 (54)
Not reported	3 (5)
Rehabilitation clinician targets	
PT	25 (41)
OT	9 (15)
SL-P	2 (3)
PT + OT	16 (26)
PT + SL-P	1 (2)
OT + SL-P	1 (2)
All	3 (5)
Not reported or unclear	4 (7)
Longitudinal sustainability data	13 (21)
Theory, Model, Framework use	51 (84)

Appendix F
Extraction Tables

Table F.1: First half (columns A-M)

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
1	Active Physical Therapy Intervention in Patients with Acute Lung Injury	Dinglas, V.D., Parker, A.M., Reddy, D.R.S., Colantuoni, E., Zanni, J.M., Turnbull, A.E., Nelliot, A., Ciesla, N. and Needham, D.M.	2014	A Quality Improvement Project Sustainably Decreased Time to Onset of Active Physical Therapy Intervention in Patients with Acute Lung Injury	To evaluate the sustainability of an early rehabilitation QI project in a single medical ICU (MICU) and to evaluate how the QI project and other patient- and ICU-related factors are associated with the timing of initiation of active physical therapy intervention in the MICU	High, majority of population seems to be PTs, provides detailed information on O, some information on strategies and context	S - moderate, non-specific description although reported by implementation team C - low, non-specific description by implementation team O - high, used clinical indicators in pre-post- design to evaluate benefits S - moderate, reported by implementation team, difficult to understand when they did what	Multidisciplinary, ICU mobility	Quantitative (pre–, post-survey, clinicl data)	20	1	Acute hospital (ICU)	United States
2	Active Physical Therapy Intervention in Patients with Acute Lung Injury	Hopkins, RO, Spuhler, VJ, and Thomsen, GE	2007	Transforming ICU culture to facilitate early mobility	To describe how they transformed an ICU Culture to Facilitate Early Mobility	Moderate, a fair amount of information on context but limited other info	C - high, reported by implementation team, used measure for climate M - low, anecdotal/opinion based from authors O - high, chart audit, patient data	Multidisciplinary, ICU mobility	Quality Improvement report (longitudinal survey data)	not reported	1	Acute hospital (RICU)	United States
3	AHRQ Fall Prevention	Agency for Healthcare and Research Quality	2013	How do you sustain an effective fall prevention program?	To present a case study of successful sustainment	Low, From trustworthy source, but all anecdotal. Very	C - low, opinon/inference no data O - low, opinon/inference no	multidisciplinary, ICU mobility	Quality Improvement report (anecdotal	N/A	N/A	Acute hospital	United States

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
						small amount of information in this document, no indication of time	data S - low, opinon/inference no data		case study)				
4	AHRQ Fall Prevention	Agency for Healthcare and Research Quality	2018	AHRQ Toolkit Helped Madonna Rehabilitation Hospital Reduce Patient Falls by 21 Percent	To present a case study of successful sustainment	Low, From trustworthy source, but all anecdotal. Very small amount of information in this document, only implicit indication of time	S - moderate, reported by implementation team members in press release style interview	Multidisciplinary, ICU mobility	Quality Improvement report (anecdotal case study)	not reported	not reported	Rehabilitation hospital	United States
5	AMP	Harding, P., Burge, A., Walter, K., Shaw, B., Page, C., Phan, U., Terrill, D. and Liew, S.	2018	Advanced musculoskeletal physiotherapists in post arthroplasty review clinics: a state wide implementation program evaluation	To evaluate outcomes following a state-wide implementation of post arthroplasty review (PAR) clinics for patients following total hip and knee arthroplasty, led by advanced musculoskeletal physiotherapists in collaboration with orthopaedic specialists.	High, PT population, not a practice but an entire role. detailed information on outcomes especially	S - low, non-specific description C - low, authors conducted interviews, which likely contributed this info, but its unclear, and not very detailed across sites O - high, chart audits, cost analyses S - moderate, detailed at program not site level	Rehabilitation, orthopedics	Mixed methods (prospective observational study, longitudinal)	not reported	10 (5 urban, 5 rural)	not reported	Australia
6	AMP	Pricewaterhouse eCoopers Australia (PwC) for the Department of Health and Human Services Victoria	2015	Evaluation of the Advanced Musculoskeletal Physiotherapy Program: Final Report	To detail key results and findings from an evaluation of the AMP Program, examining the impacts of workforce redesign following implementation of AMP clinics across Victoria.	High, gives considerable detail on program level outcomes with policy level focus	C - high, provides good overview of site level factors from interviews and program/policy level factors of program M - low, anecdotal/opinion by author O - high, provides detailed breakdown of	Rehabilitation, orthopedics	Quality Improvement report (outcome evaluation for policy stakeholders (interviews, administrative data))	not reported	13	clinic	Australia

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
							costs, clinical chart review of practices, evidence for benefits (e.g. time to appointment) and notes continued funding secured						
7	AMP	State of Victoria, Department of Health	2014	Advanced Musculoskeletal Physiotherapy Clinical Education Framework: The manual	The manual provides details of the development of the competency standard, and the process to achieve competency, mentoring and ongoing competency requirements across all the areas of AMP practice.	Moderate, provides evidence for specific strategies for the AMP program	S - high, provides detailed overview of strategies for clinicians and organizations for AMP	Rehabilitation, orthopedics	Training manual				Australia
8	CAN-RESTORE	Janaudis-Ferreira, T., Mathur, S., Tansey, C. M., Blydt-Hansen, T., & Hartell, D.	2020	Disseminating Knowledge to Providers on Exercise Training After Solid Organ Transplantation	(1) to disseminate the evidence supporting exercise training at all stages of the solid organ transplantation recovery trajectory to exercise professionals, health-care professionals, physicians, and directors of transplant programs in order to enhance their ability to apply evidence to practice and (2) to build a community of exercise professionals and researchers across Canada	Low, non specific information compiled from a literature review and focus groups with experts	S - low, not a lot of detail, reported by authors/implementers for project broadly as opposed to specific sites. O - low, provided access to website over a period of 3 years as an indicator of continued capacity and/or use, thus outcome unclear	Rehabilitation, exercise progam (post-transplant)	Quality Improvement report (case report)	N/A	N/A	online	Canada
9	CAN-RESTORE	webpage; healthcare professionals	accessed march 9 2021	https://canrestore.wordpress.com/		Moderate, detailed information available through website on strategies and indirectly indicate sustainment	S - high, detailed information as everything is freely available online O - low, indirect implication of continued use/related activities (continued activities, including online conference (June 2020) and new material posted online as of August 2020. New posts on the facebook page as of February 2021)						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
10	CAN-RESTORE	webpage; transplant patients and caregivers	accessed march 9 2021	https://canrestore.wordpress.com/for-transplant-patients-caregivers/		Moderate, detailed information available through website on strategies and indirectly indicate sustainment	S - high, detailed information as everything is freely available online						
11	CanWell	Cheifetz, O., Park Dorsay, J., Hladysh, G., MacDermid, J., Serediuk, F., & Woodhouse, L. J.	2014	CanWell: meeting the psychosocial and exercise needs of cancer survivors by translating evidence into practice	To describe the development, implementation, and effectiveness of the CanWell program, an evidence-based, community and partnership-based, exercise, and education program for all people with cancer.	Low, very little information, mostly on implementation. Only reason this article is useful is due to known sustainment (website)	S - moderate, reported by implementation team in reasonable detail M - moderate, theory-informed, but opinion based by authors	Multidisciplinary, exercise program (cancer)	Quantitative (pre-post-prospective cohort)	not reported	1	community centre (YMCA)	Canada
12	CanWell	webpage; current contact information for program	accessed march 10 2021	https://www.ymcahbb.ca/Programs/LiveWell/CanWell-LiveWell-(1)?location=5f8d05a1-6a9e-4f60-b826-9930d667435d		Low, indication that the program is still running at the YMCA site	O - moderate, reports program is still present at organization, but no report of potential changes (indicates a 12 week program); indicates continuation since 2009 pilot						
13	CanWell	webpage; general info on 2009 pilot	accessed march 10 2021	https://www.hamiltonhealthsciences.ca/wp-content/uploads/2019/02/CanWell-Seasons-article-Summer-2009.pdf		Low, minimal information about the program, overlaps with the pilot described in the article	S - low, brief, non-specific information about strategies used for the program						
14	Cerebral Palsy Knowledge Brokers	Rivard LM, Russell DJ, Roxborough L, Ketelaar M, Bartlett D, and Rosenbaum P.	2010	Promoting the Use of Measurement Tools in Practice: A Mixed-Methods Study of the Activities and Experiences of	(1) To describe the brokering activities of 24 pediatric physical therapist KBs (2) To report KBs' perceptions of the utility of their role and their experiences with the brokering process	Moderate, a fair amount of information on strategy and context but limited other info	S - high, very detailed from research team and interviews with KBs at each site C - high, information from research team and KBs at each site (interviews)	Rehabilitation, pediatric (measures for cerebral palsy)	Mixed methods (weekly logs, interviews)	24 knowledge brokers; 95 PTs	28 children's rehabilitation organa	community organizations	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				Physical Therapist Knowledge Brokers			M - low, opinion from authors S - high, research team reported overall/overarching strategy, not at site level but broad program level C - moderate, used questionnaire made for this study, used 'factor analysis' (unclear) to determine subscales and interpret them				nizations		
15	Cerebral Palsy Knowledge Brokers Enhanced	Russell, D. J., Rivard, L. M., Walter, S. D., Rosenbaum, P. L., Roxborough, L., Cameron, D., ... & Avery, L. M.	2010	Using knowledge brokers to facilitate the uptake of pediatric measurement tools into clinical practice: a before-after intervention study.	(1) To evaluate the short-term (six-month) and long-term (12-month) impact of a multi-faceted KT intervention using KBs to facilitate the use of four evidence-based measurement tools by PTs in children's rehabilitation facilities in Ontario (the 'East'), and Alberta and British Columbia (the 'West'). (2) To explore factors such as organizational support that might modify or mediate the intervention.	High, PTs are target group, detailed information about most CMOC data	M - low, opinion/anecdotal from authors O - moderate, self-reported use from fairly large sample	Rehabilitation, pediatric (measures for cerebral palsy)	Mixed method (longitudinal evaluation)	24 knowledge brokers; 95 PTs	28 children's rehabilitation organizations	community organizations	Canada
16	Pulmonary Rehabilitation Program	Van der Braak, K., Janaudis-Ferreira, T., Bourbeau, J. and Sedeno, M.	2018	Sustainability of the canadian pulmonary rehab program 18 months after its implementation	To assess the sustainability of the implementation of the Canadian Pulmonary Rehabilitation (PR) program 18 months after implementation in a single site.	Low, not rehabilitation specific target audience, very little information	C - low, brief mention of some relevant contextual information	Rehabilitation, COPD	Quantitative (pre-, post-, follow-up survey and clinical data design)				
17	Enhanced Pulmonary Rehabilitation Program	van der Braak, K., Wald, J., Tansey, C., Paes, T., Sedeno, M., Selzler, A.M., Stickland, M., Bourbeau, J. and Janaudis-Ferreira, T.	2020	Implementation and Sustainability of an Enhanced Pulmonary Rehabilitation Program in a single centre	to assess the implementation of this program into a single site; determine the sustainability 18 months after implementation; and to identify the satisfaction with, facilitators of and barriers to implementation and sustainability of the program	Moderate, rehabilitation not the primary target, but the information is detailed	S - high, detailed information reported by implementation team C - moderate, close ended survey and anecdotal from authors M - anecdotal by authors	Rehabilitation, COPD	Quantitative (pre-, post-, follow-up survey and clinical data design)	8	1	Acute hospital	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
					as perceived by patients with COPD and HCPs		O - high, clinical chart review and evidence of continued educational workshops for patients, but less than recommended						
18	Enhanced Pulmonary Rehabilitation Program	webpage; Living Well with COPD for Pulmonary Rehabilitation	accessed march 16 2021	https://www.livingwellwithcopd.com/living-well-and-pulmonary-rehabilitation.html		Low, not rehabilitation specific target audience, very little information	S - high, evidence for continuation of some strategies C - moderate, indication of some key policy level contextual factors						
19	ERAS	Herbert, G., Sutton, E., Burden, S., Lewis, S., Thomas, S., Ness, A., & Atkinson, C.	2017	Healthcare professionals' views of the enhanced recovery after surgery programme: a qualitative investigation	To gain an understanding of the facilitating factors and challenges of implementing the programme with a view to providing additional contextual information to aid implementation	Moderate, detailed information but PT/SL-P not the primary population in this study	S - high, reported from theory-guided interview data C - high, reported from theory-guided interview data M - high, reported from theory guided interview data O - low, non-specific self-report in interviews	Multidisciplinary, Enhanced Recovery After Surgery (ERAS)	Qualitative (theory guided semi-structured interviews)	26	1 (4 departments)	Acute hospital	United Kingdom
20	ERAS	Sutton E, Herbert G, Burden S, Lewis S, Thomas S, et al	2018	Using the Normalization Process Theory to qualitatively explore sense-making in implementation of the Enhanced Recovery After Surgery programme: "It's not rocket science"	To explore the utility of Normalization Process Theory (NPT) as a methodological framework to aid exploration of ERAS implementation, with a focus on the core NPT construct coherence.	Moderate, rehabilitation not the main target, but very detailed information regarding mechanisms in particular	S - low, some key strategies mentioned but details not given C - moderate, main factors as reported in non-framework informed participant interviews M - high, theory informed participant interviews	Multidisciplinary, enhanced recovery after surgery (nutrition)	Qualitative (interviews)	26	1 (4 departments)	Acute hospital	United Kingdom

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
21	ERAS	webpage; international homepage	accessed March 25th 2021	https://erassociety.org/		Low, not primarily a rehabilitation target audience, provides overview of information available for ERAS through the umbrella international organization	S - moderate, basic overview of available events and information offered						
22	ERAS	webpage; UK homepage	accessed March 25th 2021	https://www.erasuk.net/		Low, not primarily a rehabilitation target audience, provides overview of information available for ERAS in the UK specifically	S - moderate, basic overview of available educational materials and information C - moderate, indicates some policy level contextual factors in the UK O - low, indirect evidence via most recent webinar February 2021						
23	ERAS Alberta (Colorectal)	Gramlich, L., Nelson, G., Nelson, A., Lagendyk, L., Gilmour, L. E., & Wasylak, T.	2020	Moving enhanced recovery after surgery from implementation to sustainability across a health system: a qualitative assessment of leadership perspectives	To systematically synthesize feedback from health care leaders to inform further spread, scale and sustainability of ERAS care across a health system.	Moderate, detailed information presented but not targetted primarily to rehabilitation clinicians	S - high, from interviews with site key informants C - high, from interviews with site key informants M - moderate, applied TDF to interviews, but did not clearly tie it to results O - low, anecdotal by authors and self-report by participants	Mutidisciplinary, enhanced recovery after surgery (ERAS)	Qualitative (interviews)	44	6	Acute hospital	Canada
24	ERAS Alberta (Colorectal)	website	accessed March 26th 2021	https://www.albertahealthservices.ca/scns/page10959.aspx		Moderate, overview of all ERAS information available, but not rehabilitation specific target	S - moderate, overview of all strategies available with some with full links C - moderate, basic information on Alberta healthcare policy context O - high, cost data presented regarding cost savings in original sites; noted as continued at original sites and spread						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
25	ESCAPE pain	Walker, A., Boaz, A., & Hurley, M. V.	2021 accessed March	Influence of commissioning arrangements on implementing and sustaining a complex healthcare intervention (ESCAPE-pain) for osteoarthritis: a qualitative case study	To explore the perspectives of physiotherapists on the influence of commissioning arrangements on the implementation and sustainability of a group rehabilitation programme for osteoarthritis (ESCAPE-pain).	High, focus on rehabilitation professionals, high level of detail provided	S - high, detailed information as reported by implementation team and from interviews C - moderate, detailed information as reported by implementation team and from non-framework informed interviews M - moderate, detailed information as reported by implementation team and non-theory informed interviews O - moderate, self-report from participants, as well as informal follow-up with sites to determine if program discontinued or continued	Rehabilitation, exercise program (arthritis)	Qualitative (multiple case study)	30	11	Rehabilitation hospital outpatient clinics	United Kingdom
26	ESCAPE pain	webpage; covid-19 support	25th 2021 accessed March	https://escape-pain.org/providers-overview/covidsupport		Moderate, detailed information for educational materials hosted online	S - high, full information about how to adapt intervention to the COVID-19 context and resources that fit that context are available O - low, sustained program activities on website						
27	ESCAPE pain	webpage; e-learning	25th 2021	https://escape-pain.org/providers-overview/elearning		Moderate, detailed information for educational materials hosted online	S - high, full educational materials available O - low, sustained delivery of training						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
28	ESCAPE pain	webpage; facilitator training	accessed March 25th 2021	https://escape-pain.org/providers-overview/facilitator-training		Moderate, detailed information for educational materials hosted online	S - high, full educational materials available O - low, sustained delivery of training						
29	ESCAPE pain	website; commissioners	accessed March 25th 2021	https://escape-pain.org/commissioners		Moderate, detailed information for educational materials hosted online	S - high, information directed to health service commissioners (funders), especially information about cost-effectiveness						
30	ESCAPE pain	website; home	accessed March 25th 2021	https://escape-pain.org/		Moderate, detailed information for educational materials hosted online	S - moderate, overview of full scope of the program and stategies on website O - moderate, program level sustainment evident through program activities as published on website						
31	ExerGames	Perez, C., Kaizer, F., Archambault, P., & Fung, J.	2017	A novel approach to integrate vr exer-games for stroke rehabilitation: Evaluating the implementation of a 'games room'	To evaluate the integration of virtual reality (VR) exer-games for people post-stroke through the implementation of a "exer-games room" in an inpatient rehabilitation hospital	High, this article is fairly detailed. Although difficult to distinguish between implementation and sustainability, it contains S, C, M and O	S - high, detailed from implementation team and interviews C - high, from participant interviews M - moderate, reported as information from clinician interviews, but not clearly linked to outcome O - moderate, perceptions based on patient and clinician interviews, not clinical data for benefits.	Rehabilitation, stroke (virtual reality)	Mixed methods (evaluation)	not reported	1	rehabilitation hospital	Canada
32	ExerGames	Perez, C., Kaizer, F., Archambault,	2016	The Implementation of an Exergames Program for Stroke	To evaluate exergames as an adjunctive therapy in stroke	Low, minimal information (conference abstract),	M - moderate, reported as information from	Rehabilitation, stroke	Mixed methods	not reported	1	rehabilitation hospital	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		P., Lamontagne, A., Levin, M., & Fung, J.		Rehabilitation: Evaluation One Year Later	rehabilitation, one year after implementation	with only one mechanism and outcome reported	clinician interviews, but not clearly linked to outcomeO - moderate, perceptions based on patient and clinician interviews, not clinical data for benefits.	(virtual reality)	(evaluation)				
33	Falls prevention australia	Hill, K., Vrantsidis, F., Clemson, L., Lovarini, M. & Russell, M.	2011	Community falls prevention program sustainability guidelines: training materials	To develop program sustainability guidelines and an accompanying training program to: (1) facilitate the incorporation of falls prevention activities into agency work (2) maximise the likelihood of longer term sustainability of effective (critical) components of programs (3) assist agencies plan sustainability from the outset	Low, non specific information compiled from a literature review and focus groups with experts	S - moderate, fairly detailed, as part of guideline. Compiled from literature and focus groups C - low, non specific information, not detailed	Multidisciplinary, falls prevention	Guidelines (literature review and stakeholder feedback)	N/A	N/A	N/A	Australia
34	Falls prevention australia	Hill, K., Vrantsidis, F., Clemson, L., Lovarini, M. & Russell, M.	2011	Community falls prevention program sustainability guidelines: supporting document	To assist agencies to plan program sustainability from the outset, thereby improving the likelihood of maintaining effective falls prevention programs longer term.	Low, non specific information compiled from a literature review and focus groups with experts	S - moderate, fairly detailed, as part of guideline. Compiled from literature and focus groups C - low, non specific information, not detailed	Multidisciplinary, falls prevention	Guidelines (literature review and stakeholder feedback)	N/A	N/A	N/A	Australia
35	Falls prevention australia: Stepping On	Lovarini, M.	2012	Sustainability of a community-based falls prevention program: A grounded theory (chapters 7-11)	To explore the factors affecting the sustainability of Stepping On to develop an understanding and explanation for how such programs can be sustained over time.	High, very detailed information, although not PT/OT only, the amount of info is incredible	S - high, detailed from participant interviews C - high, from participant interviews M - high, from participant interviews O - low, self-reported	Multidisciplinary, falls prevention	Qualitative (grounded theory, interviews)	34	15	not-for-profit organisations (n=7), government health	Australia

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
							from participant interviews (7/13 sustained during study period, 5/13 indicated that they intended to sustain post-study period)					organisations (n=3), non-government health organisations (n=2) local council (n=1) 11 organizations recieved public funding	
3 6	GRASP	webpage; homepage	accessed April 18th 2021	https://neurorehab.med.ubc.ca/grasp/		Moderate, detailed information for educational materials, patient educational materials, evidence for GRASP and recruitment materials	S - high, detailed information available/freely accessible O - low, indirect evidence for continuation of program as a whole						
3 7	GRASP	Yang, C. L., Bird, M. L., & Eng, J. J.	2021	Implementation and evaluation of the Graded Repetitive Arm Supplementary Program (GRASP) for people with stroke in a real world community setting: Case Report.	To describe a process evaluation of the implementation of an evidence-based upper extremity rehabilitation intervention for stroke, the Graded Repetitive Arm Supplementary Program, in a community setting.	Low, Only delivered to one OT, mostly focused on effectiveness of GRASP program	S - high, detailed information from implementation team C - moderate, non-detailed information from implementation team or reported by patients O - low, reported	Rehabilitation, stroke (upper limb)	Mixed methods (evaluation)	2	1	community centre	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
							anecdotally by authors						
38	GRASP	Yang, C. L., Bird, M. L., & Eng, J. J.	2021	Implementation and evaluation of the virtual Graded Repetitive Arm Supplementary Program (GRASP) for individuals with stroke during the COVID-19 pandemic and beyond	To study the implementation and the effectiveness of the virtual GRASP program delivered and evaluated via videoconferencing in individuals with stroke	Low, unclear if OT, PT or SL-P present in this study but included based on in-person implementation having an OT, mostly focused on effectiveness of virtual GRASP program	S - high, detailed information from implementation team C - moderate, non-detailed information from implementation team or reported by patients O - low, reported anecdotally by authors	Rehabilitation, stroke (upper limb)	Mixed methods (evaluation)	4	1	community centre	Canada
39	iBEST	Richmond, H., Hall, A.M., Hansen, Z., Williamson, E., Davies, D. and Lamb, S.E.	2018	Exploring physiotherapists' experiences of implementing a cognitive behavioural approach for managing low back pain and identifying barriers to long-term implementation	(1) to describe physiotherapists' experiences of implementing a cognitive behavioural approach (CBA) for managing low back pain (LBP) after completing an extensive online training course (iBeST) (2) to identify how iBeST could be enhanced to support long-term implementation before scale up for widespread use.	Moderate, directed to PTs, but not very detailed information on sustainability, most of paper evaluates the online training and gets info on adoption. Sustainbility is speculative.	S - moderate, reported by team who developed iBEST training materials, did not report implementation at sites after training C - moderate, theory informed from interviews but speculative, all participants in implementation M - moderate, theory informed from interviews, but speculative, all participants in implementation	Rehabilitation, Low back pain (cognitive behavioural approach)	Qualitative (constructivist interviews)	11	6		United Kingdom
40	iBEST	webpage; Back Skills Training Implementation (iBeST)	accessed march 16 2021	https://www.ndorms.ox.ac.uk/rrio/ibest		Moderate, basic overview of program and links to training	S - moderate, detailed information on online course, but not implementation at specific sites						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
4		webpage; CLAHRC The BeST treatment for low back	accessed march 16			Moderate, good information up until funding ended (~2018?) but nothing posted since MOOC							
1	iBEST	pain	2021	https://clahrcprojects.co.uk/resources/projects/best-treatment-low-back-pain%C2%A0;		closed (~2019)	C - information about the general context of the implementation of iBEST						
4		webpage;	accessed march 16	https://www.futurelearn.com/courses/back-skills-training-programme;		Moderate, good information up until funding ended (~2018?) but nothing posted since MOOC	S - moderate, detailed information on online course, but not implementation at specific sites O - low, no info on website to indicate sustained other than the website being maintained.						
2	iBEST	MOOC	2021			closed (~2019)	MOOC not currently running						
4		webpage; The BeST treatment for low back	accessed march 16			Moderate, good information up until funding ended (~2018?) but nothing posted since MOOC							
3	iBEST	pain	2021	https://www.clahrc-oxford.nihr.ac.uk/impact/the-best-treatment-for-low-back-pain#the-solution;		closed (~2019)	S - moderate, detailed information on online course, but not implementation at specific sites						
4	Lead Research Occupational Therapist	Hitch, D., Lhuede, K., Vernon, L., Pepin, G. and Stagnitti, K.	2019	Longitudinal evaluation of a knowledge translation role in occupational therapy	To evaluate the impact, in the first 2.5 years, of this role across a range of variables (1) changes in the workforces' participation in quality assurance, research and knowledge translation activities (such as changes to practice, revisions of documentation, dissemination in multiple formats etc). (2) changes in the attitudes of the workforce towards evidence based practice (3) workforce perceptions of this knowledge translation role (4) changes in the social network in this service	High, OT only, detailed reporting of most of CMO	S - high, KB only, reported by KB as PI C - moderate, reported by KB as PI, some information from survey data M - high, from validated measures (EBPAS-15) and social network analysis O - high, used academic and clinical outputs as indicator,	Rehabilitation, mental health knowledge translation	Quantitative (longitudinal survey, social network analysis)	42 (2014), 44 (2016)	32	public mental health service sites (inpatient and community)	Australia

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
					around evidence based practice (5) outcomes achieved by this role against key performance indicators								
4 5	Lead Research Occupational Therapist	webpage; hospital careers page	accessed March 25th 2021	https://www.nwmh.org.au/careers/allied-health-careers/careers-occupational-therapy		Moderate, directly related to program in research article (i.e. same position) but not a lot of detail given	O - moderate, reports lead OT position still present at organization, but no report of potential changes to the role, etc. S - high, reported by central implementation team with information from site implementation team interviews C - high, reported by central implementation team with information from site implementation team interviews and NHS sustainability model/tool						
4 6	MOVE AB	Holroyd-Leduc, J., Harris, C., Hamid, J. S., Ewusie, J. E., Quirk, J., Osiowy, K., ... & Straus, S. E.	2019	Scaling-up implementation in community hospitals: a multisite interrupted time series design of the Mobilization of Vulnerable Elders (MOVE) program in Alberta	To scale-up the program and conduct a replication study evaluating the impact of the evidence-informed mobilization intervention on various units in community hospitals within a different Canadian provin	Moderate, detailed and varied information, but rehabilition professionals not primary target users	M - moderate, data from non-theory informed interviews, no quotes reported O - high, chart audits and clinical data, reduced level according to authors, but could be considered unsustained	Multidisciplinary, mobility in hospital	Quantitative (interrupted time series design with survey and clinical indicators)	not reported	7 units at four community hospitals	Acute hospital	Canada
4 7	MOVE ON	Liu, B., Almaawiy, U.,	2013	Evaluation of a multisite educational	To implement and evaluate the impact of an evidence-	Low,	S - moderate, reported at high level by	Multidisciplinary,	Quantitative	not reported	32 units	Acute hospital	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		Moore, J. E., Chan, W. H., & Straus, S. E.		intervention to improve mobilization of older patients in hospital: protocol for mobilization of vulnerable elders in Ontario (MOVE ON)	based strategy to promote early mobilization and prevent functional decline in older patients admitted to university-affiliated acute care hospitals in Ontario, Canada	not primarily directed to rehabilitation professionals, general detail at high level of intervention, not site specific	research team overseeing implementation as a whole as opposed to local implementation teams S - low, detail as reported at overall implementation level, not by site by research coordinator, not local implementation teams C - low detail as reported at overall implementation level, not by site by research coordinator, not local implementation teams	mobility in hospital	(interrupted time series design with survey and clinical indicators)		in 14 hospitals	(academic affiliated)	
48	MOVE ON	Liu, B., Moore, J. E., Almaawiy, U., Chan, W. H., Khan, S., Ewusie, J., ... & MOVE ON Collaboration	2018	Outcomes of Mobilisation of Vulnerable Elders in Ontario (MOVE ON): a multisite interrupted time series evaluation of an implementation intervention to increase patient mobilisation.	To evaluate the impact of the staff intervention on the primary outcome, patient mobilisation, over 3 time periods—pre-intervention (10 weeks), during intervention (8 weeks) and post-intervention (20 weeks	Moderate, rehabilitation clinicians are not primary targets, detailed information on outcomes	M - low, opinion by authors in discussion O - high, segmented regression analysis using data from observation and clinical charts	Multidisciplinary, mobility in hospital	Quantitative (interrupted time series design with survey and clinical indicators)	not reported	32 units in 14 hospitals	Acute hospital (academic affiliated)	Canada
49	MOVE ON	webpage; home page	accessed march 10 2021	https://www.movescanada.ca/mobilization/		Low, evidence for dissemination organization's range of activities	S - low, non-specific evidence for strategies						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
50	MOVE ON	webpage; hospital resources	accessed march 10 2021	https://www.movescanada.ca/resources-for-hospitals/		Low, overview of all materials offered to hospitals to help them implement and sustain MOVE ON	S - low, non-detailed information on strategies						
51	MOVE ON	webpage; patient resources	accessed march 10 2021	https://www.movescanada.ca/resources-patients-families/		Low, detailed information regarding strategies, but no information on specific sites or indications that the program is sustained beyond the website being maintained	S - moderate, strategies which manifest as documents (e.g. educational materials) have high level of detail. O - low, no info on website to indicate sustained other than the website being maintained						
52	MOVE ON	webpage; planning for sustainability	accessed march 10 2021	https://www.movescanada.ca/resources-for-hospitals/planning-for-sustainability/;		Moderate, detailed information regarding strategies	S - moderate, strategies which manifest as documents (e.g. educational materials) have high level of detail.						
53	MOVE ON	webpage; sustainability strategies recommended by MOVE ON participants	accessed march 10 2021	https://www.movescanada.ca/wp-content/uploads/MOVEing-Forward-A-Backgrounder-on-Sustainability-2019-09-06.pdf		Moderate, detailed information available from some sort of data collection with MOVE ON participants	S - moderate, basic information on strategies participants think will be useful to aid sustainability						
54	OT practice model	Sirkka, M., Larsson-Lund, M. and Zingmark, K.	2014	Occupational therapists' experiences of improvement work: a journey towards sustainable evidence-based practice	To explore occupational therapists' experiences of participating in long-term improvement work based on the Occupational Therapy Intervention Process Model.	Moderate, although there is a lot of information and most is quite detailed, and its directed to OTs, the focus of the paper	S - moderate, reported by implementation team but not very detailed C - high, focus group information. No framework but that fits with the research	Rehabilitation, care model	Qualitative (descriptive focus groups repeated 5 years apart)	19	1	Acute hospital OT unit	Sweden

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
						isn't so much on the sustainment of the OTIPM itself (it can't be, its theoretical) but on the benefits/impacts of this model in practice and if those are sustained; does break down the ten year period into adoption, implementation and sustainability phases, which is interesting Moderate,	design M - high, focus group information. No theory but that fits with the research design O - moderate, self-report by participants in focus groups and presumably backed up by implementation team who have knowledge of the unit/are members of the unit						
55	OT practice model	Sirkka, M., Zingmark, K. and Larsson-Lund, M.	2014	A process for developing sustainable evidence-based occupational therapy practice	To explore and describe how longterm improvement work based on the Occupational Therapy Intervention Process Model (OTIPM) evolved in an occupational therapy unit.	although there is a lot of information and most is quite detailed, and its directed to OTs, the focus of the paper isn't so much on the sustainment of the OTIPM itself (it can't be, its theoretical) but on the benefits/impacts of this model in practice and if those are sustained; does break down the ten year period into adoption, implementation and sustainability phases, which is interesting	S - moderate, reported by implementation team but not very detailed C - moderate from written documents. No framework but that fits with the research design M - moderate, written documents. No theory but that fits with the research design O - low, from written documents, not stated who wrote them/or any outcome data (performance data?) to support sustainment	Rehabilitation, care model	Qualitative (descriptive study of written documents (pattern matching))	21	1	Acute hospital OT unit	Sweden

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
56	PAPT	MacDonald, J., Doyle, L., Moore, J. L., & Rafferty, M. R.	2021	Sustainment of Proactive Physical Therapy for Individuals With Early-Stage Parkinson's Disease: A Quality Improvement Study Over 4 Years	To describe the process of sustaining a clinical program in practice for over four years	High, the initiative is directed at PTs and the information given is detailed	S - high, detailed information from implementation team and from data collected via documents and interviews C - high, used measures (NHS, CSAT) M - moderate, data informed opinions from authors, unclear data O - high, used measures (NHS, CSAT) and clinical chart review	Rehabilitation, exercise program (parkinson's disease)	Mixed method (evaluation using interviews, document review, clinical data)	6	3	Rehabilitation hospitals (outpatient)	United States
57	PAPT	Rafferty MR, MacDonald J, Byskosh A, Sloan L, Toledo S, Marciniak C, et al	2019	Using Implementation Frameworks to Provide Proactive Physical Therapy for People With Parkinson Disease: Case Report	To present the application of a proactive physical therapy (PAPT) approach at 1 rehabilitation center using implementation frameworks to support the (1) implementation process, (2) determinants of implementation success, and (3) implementation evaluation	Moderate, PTs were targets, but this study was not primarily about sustainability but implementation	S - high, detailed information from implementation team and from data collected via documents and interviews C - high, detailed information from implementation team and from data collected via documents and interviews O - high, used clinical chart review	Rehabilitation, exercise program (parkinson's disease)	Mixed method evaluation (interviews, document review, clinical data)	2	1	Rehabilitation hospitals (outpatient)	United States
58	Pulmonary rehab balance training	Harrison, S.L., Beauchamp, M.K., Sibley, K., Araujo, T.,	2015	Minimizing the evidence-practice gap - a prospective cohort study	To translate lessons learnt from efficacy studies of balance training into a sustainable clinical service.	High, PT main population, fairly detailed info	S - moderate, reported by implementation team but not a lot of detail	Rehabilitation, Falls prevention	Qualitative (interviews)	8	1	Rehabilitation hospital	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		Romano, J., Goldstein, R.S. and Brooks, D.		incorporating balance training into pulmonary rehabilitation for individuals with chronic obstructive pulmonary disease			C - moderate, from interviews, but not guided by framework M - moderate, reported from interview data but not guided by theory prospectively, only retrospectively (in discussion) O - low, self-report by coordinator stated as changes from recommended guidelines due to staffing/time constraints S - moderate, some information reported from implementation team but not very detailed					
59	Pulmonary rehab balance training	O'Hoski, Sachi, et al	2020	Clinician-Led Balance Training in Pulmonary Rehabilitation	(1) To explore whether the modified programme resulted in improved balance and balance confidence. (2) To provide information on the way in which balance training was operationalized as part of PR for clinicians wanting to incorporate it into an existing P	Moderate, focus of this article is primarily if the modified program produces the same benefits as the RCT version, as opposed to considering its sustainability.	C - moderate, some information reported from implementation team but not very detailed O - high, uses validated measures/clinical data to report benefits (patient improvements)	Rehabilitation, falls prevention	Quantitative (retrospective clinical data from consecutive admissions)	5	1	rehabilitation hospital	Canada
60	ReSpAct	Hoekstra, F., Alingh, R.A., van der Schans, C.P., Hettinga, F.J., Duijf, M.,	2014	Design of a process evaluation of the implementation of a physical activity and sports stimulation	To describe the design of the process evaluation of the implementation of the RSE programme within 18 Dutch rehabilitation centres and	High, by itself this wouldn't be included, but in combination with the other studies in this case, this	S - high, full detailed explanation	Rehabilitation, exercise program (persons with	Mixed method protocol, (longitudinal survey	not reported	18	Acute hospitals (6), Rehabilitation	Holland

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		Dekker, R. and van der Woude, L.H.		programme in Dutch rehabilitation setting: ReSpAct	hospitals in order to gain more insight into the implementation process itself and factors that facilitate or hamper the implementation process.	protocol provides important detail on strategies		disabilities and/or chronic disease)	and interviews)			hospitals (12)	
61	ReSpAct	Hoekstra, F., Hettinga, F. J., Alingh, R. A., Duijf, M., Dekker, R., van der Woude, L. H., & van der Schans, C. P.	2015	The current implementation status of the integration of sports and physical activity into Dutch rehabilitation care	To describe the current status of the nationwide implementation process of a sports and physical activity stimulation programme to gain insight into how sports and physical activity were integrated into Dutch rehabilitation care	High, In combination with the other studies in this case, this protocol provides important detail on context	C - moderate, provides contextual details at baseline as opposed to sustainability phase, however these seem to confirm findings reported elsewhere and extends them slightly	Rehabilitation, exercise program (persons with disabilities and/or chronic disease)	Quantitative (cross-sectional survey)	71	17	Acute hospitals (5), Rehabilitation hospitals (12)	Holland
62	ReSpAct	Hoekstra, F., Hettinga, F., Breejen, M., Duijf, M., Woude, L., Dekker, R., & Schans, C.	2017	Professionals' perceptions of factors affecting implementation and continuation of a physical activity promotion programme in rehabilitation: A qualitative study.	To describe professionals' perceptions of factors that facilitate or hamper the implementation and continuation of a physical activity promotion programme in rehabilitation	High, detailed information regarding context and strategies. In combination with other hoekstra studies, combines with outcomes	S - high, interview data C - high, interview data M - low, anecdotal/opinion based from authors in discussion, not reported in results	Rehabilitation, exercise program (persons with disabilities and/or chronic disease)	Qualitative (interviews)	28	18	12 rehab centres, 6 hospitals	Holland
63	ReSpAct	Hoekstra, F., Hoekstra, T., van der Schans, C. P., Hettinga, F. J., van der Woude, L. H., Dekker, R., & ReSpAct-group	2019	The implementation of a physical activity counseling program in rehabilitation care: findings from the ReSpAct study	(1) To evaluate the implementation of a physical activity counseling program (i.e., the RSE program) in rehabilitation over a three-year period, (2) To study heterogeneity in received counseling, (3) To investigate if and how distinct counseling profiles are associated with changes in patients' physical activity	High, Rehabilitation setting with highly detailed information, especially of outcomes	S - moderate, some detail available, but manuscript cited other studies C - moderate, some detail available, but manuscript cited other studies M - low, some detail available, but manuscript cited other studies	Rehabilitation, exercise program (persons with disabilities and/or chronic disease)	Quantitative (prospective cohort study using clinical data and surveys)	not reported	18	Acute hospitals (6), Rehabilitation hospitals (12)	Holland

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
					outcomes. While the first aim may contribute to a better understanding of how rehabilitation professionals implemented and executed a physical activity counseling program in their rehabilitation institution, the second and third aims illustrate an innovate method to assess heterogeneity in "real-world" implementation data by creating profiles of received counseling characteristics at the patient level.		O - moderate, self-reported fidelity (non-validated measure; counselling sessions not given with fidelity), patient outcomes (non-validated measure), # of centres as indicator						
64	ReSpAct	Hoekstra, F., van Offenbeek, M. A., Dekker, R., Hettinga, F. J., Hoekstra, T., van der Woude, L. H., & van der Schans, C. P.	2017	Implementation fidelity trajectories of a health promotion program in multidisciplinary settings: managing tensions in rehabilitation care	(1) To identify implementation fidelity trajectories of a health promotion program in a multidisciplinary setting, (2) To explore which organizational and professional characteristics are associated with these trajectories, (3) To test whether changes in patients' health behavior are different between these trajectories.	High, rehabilition setting with highly detailed information, especially of outcomes	S - low, anecdotal and non-detailed (see other studies) C - high, from framework guided survey and interviews M - moderate, from framework (not theory) guided interviews, low detail O - moderate, self-reported fidelity (non-validated measure), patient outcomes (validated measure)	Rehabilitation, exercise program (persons with disabilities and/or chronic disease)	Mixed method, (longitudinal survey and interviews)	T0: 69/73 (94%) T1: 59/69 (86%) T2: 66/75 (88%) (sustainability)	17	Acute hospitals (5), Rehabilitation hospitals (12)	Holland
65	SABC	Calo, W. A., Doerksen, S. E., Spanos, K., Pergolotti, M., & Schmitz, K. H.	2020	Implementing Strength after Breast Cancer (SABC) in outpatient rehabilitation clinics: mapping clinician survey data onto key	To assess implementation of the Strength after Breast Cancer (SABC) program in outpatient rehabilitation clinics	High, directed to PT and OT primarily, fairly high level of detail in results	S - moderate, detailed information from research team concerning the online course, but no information at the site levelC - moderate,	Rehabilitation, exercise program (cancer patients)	Quantitative (cross-sectional survey)	96 (24% response rate)	not reported	Rehabilitation clinics (outpatient)	United States

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				implementation outcomes			data collected via non-validated surveyM - low, opinion-based by authorsO - low, self-report by clinicians						
6 6	SABC	webpage; training course	accessed April 17 2021	https://klosetraining.com/course/online/strength-abc/		Moderate, fairly detailed information accessible	S - moderate, more information regarding online education O - low, website and educational registration works) C - high, information from surveys M - low, anecdotal/opinion only						
6 7	Stay on your Feet	Barnett, L., van Beurden, E., Eakin, E., Beard, J., Dietrich, U., & Newman, B.	2004	Program sustainability of a community-based intervention to prevent falls among older Australians	To investigate the program sustainability of Stay on Your Feet (SOYF), an Australian multi-strategy falls prevention program (1992–1996) that achieved a significant reduction in falls-related hospital admissions.	High, PT and OT are primary targets from a portion of the paper, a lot of info on outcomes and context. some information on strategies and mechanisms.	O - moderate, information from surveys with self-selecting convenience sample, could be over-reported sustainment S - moderate, not detailed reporting, if needed, all reduced or unsustained but some still percieved as sustained	Multidisciplinary, falls prevention	Mixed method (cross-sectional survey, focus groups)	57% were in nursing, 26% in physiotherapy, 12% in occupational therapy and 5% in health promotion.	N/A	N/A	Australia
6 8	Stay on your Feet	Hanson, H. M., & Salmoni, A. W.	2011	Stakeholders' perceptions of programme sustainability: Findings from a community-based fall prevention programme	To share the perceptions of programme sustainability held by key stakeholders involved in a community-based fall prevention programme in three Ontario demonstration communities in Canada.	Low, provides good information on barriers and strategies but essentially nothing on outcomes and mechanisms. Hard to	S - high, interview data C - high, interview data O - low, anecdotal/opinion based from authors in discussion, not reported in results	Multidisciplinary, falls prevention	Qualitative (multiple case study design)	45 stakeholders were involved in the study with 18, 15 and 12	3	private clinic, community centres	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
						link this info to anything				stakeholders participating from Sites 1, 2 and 3, respectively			
69	Stay on your Feet	webpage; homepage for Stay on your Feet	accessed March 25th 2021	https://www.stayonyourfeet.com.au/health-professionals/;		Moderate, detailed information available through website on strategies and indirectly indicate sustainment	S - high, homepage gives overview of all strategies offered through the dissemination organization O - low, last evidence of training session June 2019						
70	Stay on your Feet	webpage; homepage Queensland	accessed March 25th 2021	https://www.health.qld.gov.au/stayonyourfeet		Moderate, detailed information available through website on strategies and indirectly indicate sustainment	S - high, homepage gives overview of all strategies offered through the dissemination organization O - low, only in that website currently accessible						
71	Stay on your Feet	websites; Canadian portal	accessed March 25th 2021	https://cbpp-pcpe.phac-aspc.gc.ca/interventions/stay-on-your-feet-soyf/		Moderate, lists exact intervention, endorsement and links to dissemination organization	C - high, evidence for endorsement						
72	StrongWomen	Seguin, R.A., Economos, C.D., Nelson, M.E., Hyatt, R., Palombo, R. and Reed, P.N.	2008	Design and national dissemination of the StrongWomen Community Strength Training Program	To disseminate an easily sustainable, evidence-informed, community-based strength training program targeted to middle-aged and older women (StrongWomen).	Low, not rehab specific clinical population, about a dissemination organization	S - moderate, strategies provided by and encouraged by program reported. Site level not reported C - moderate, broader contextual factors	Multidisciplinary, exercise program (especially for middle aged and	Quality Improvement report (program report)	881 people have attended workshops (as of 2006)	not reported	program leaders must implement the Strong Women	United States

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
						implementing their program as opposed to implementation at the site level	reported, not site level O - moderate, presented evidence of continued and growing implementation of program as a whole, but not at the site level, did not note if there was turnover or sustainment of sites/program leaders	elderly women)				Program only in nonprofit organizations, such as senior centers, hospital outpatient centers, Extension Service locations, assisted living facilities, or faith-based organizations.	
73	StrongWomen	website; leader resources	accessed March 19th 2021	https://strongwomen.org/resources-for-strongwomen-leaders/		Moderate, detailed information available through website on strategies	S - moderate, strategies indicated but most information not freely accessible, need program leader login information						
74	StrongWomen	website; training dates	accessed March 19th 2021	https://strongwomen.org/		Moderate, detailed information indirectly indicates sustainment	S - moderate, info on ongoing training, indirect information concerning the continuation of the program (e.g. continued training dates offered) O - low, January 2021 training dates offered						

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
75	Survivorship Exercise Program	Santa Mina, D., Alibhai, S. M. H., Matthew, A. G., Guglietti, C. L., Steele, J., Trachtenberg, J., & Ritvo, P. G.	2012	Exercise in clinical cancer care: a call to action and program development description	(1) To describe the development of an exercise program for cancer patients in Toronto, Canada, (2) To offer experiential insights into the integration of exercise into oncologic care.	Moderate, OT not the focus but they are there, detailed information on strategies and context	S - high, detailed information from research team, no input from clinicians C - moderate, detailed information from research team, no input from clinicians O - low, anecdotal/opinion by authors	Multidisciplinary, exercise program (cancer patients)	Quality Improvement report	not reported	1	acute hospital and community clinic (program jointly run out of both locations)	Canada
76	Survivorship Exercise Program	webpage; program information	accessed March 18th 2021	https://www.uhn.ca/PrincessMargaret/Clinics/Cancer_Rehab_Survivorship/Pages/about_us.aspx#tab2		Low, minimal information about program and clinician team, implication that the program is sustained	C - moderate, provides some information on the current features of the facilities and clinical team for the program O - low, evidence for sustainment only through website being present						
77	Survivorship Exercise Program	website	accessed March 19th 2021	https://wellspring.ca/centre-of-innovation/cancer-exercise/		Moderate, detailed information available through website on strategies and indirectly indicate sustainment	S - high, strategies indicated through website, most strategies (e.g. educational materials) fully accessible through website O - low, evidence for ongoing training and outreach programs, greater than 20 sessions a week scheduled						
78	Tai Ji Quan: Moving for Better Balance	Li, F., Harmer, P., Stock, R., Fitzgerald, K., Stevens, J., Gladieux, M., Chou, L.S., Carp, K. and Voit, J.	2013	Implementing an evidence-based fall prevention program in an outpatient clinical setting	To investigate the dissemination potential of a Tai Ji Quan–based program, previously shown to be efficacious for reducing risk of falls in older adults, through outpatient clinical settings.	Low, rehabilitation clinicians not primary targets. Very little sustainability info (although the program is sustained, see website)	S - moderate, info from implementation team but not especially detailed C - moderate, info from implementation team but not especially detailed O - low, self-report from patients and implementation team O - (continued receipt	Multidisciplinary, fall prevention (referral to program)	Quantitative (pre-post-survey design)	Of the 252 providers invited to participate, 157 made referrals (100 medical doctors, 47	14	community centers (11), church (1), dance studio (1), rehabilitation	United states

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
							of benefits), high, attendance sheets of participants sustaining exercise post-intervention period			physical therapists, and 10 nurse practitioners)		center (1)	
79	Tai Ji Quan: Moving for Better Balance	webpage; highlights	accessed march 10 2021	https://tjqmbb.org/index.php/program/		Moderate, basic information for all the information hosted/dissemination by the organization	S - moderate, basic information available O - low, evidence for continued educational activities of the dissemination organization to January 2021						
80	Tai Ji Quan: Moving for Better Balance	webpage; home	accessed march 10 2021	https://tjqmbb.org/		Moderate, detailed information for workshops hosted online	S - moderate, basic information available						
81		Auld, M. L., and Johnston, L. M.	2019	Getting inTOUCH: outcomes of a knowledge translation intervention for tactile assessment knowledge, barriers, and practice in paediatric therapists working with children with cerebral palsy	To investigate a multi-faceted knowledge translation intervention to improve knowledge, remove barriers and enhance practice of tactile assessments by paediatric therapists	High, contains detailed information on S,C and O	S - high, reported in detail by implementation team C - moderate, not reported in detail, but information from interviews with clinicians. Described contextual factors at implementaotin versus sustainability O - low, self-reported outcomes from interviews and survey	Rehabilitation, pediatrics (cerebral palsy)	Mixed methods (pre-post-observational study)	12 (7 PT, 5 OT)	1	"state-wide service provider for individuals with CP "	Australia
82		Bailes, A.F. and Strenk, M.L., Quatman-Yates, C., and Hobart, J. and Furnier, A.	2019	Documenting Physical Therapy Dose for Individuals With Cerebral Palsy: A Quality	To describe the quality improvement (QI) activities used to improve treatment dose documentation for individuals with cerebral palsy (CP) and to discuss	High, Information on CMO, including strategies. Includes clear timeline	C - high, detailed reporting M - low, anecdotal/opinion only O - high, uses weekly	Rehabilitation, pediatrics (cerebral palsy)	Quality Improvement report	55	8	Pediatric academic medical center	United States

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				Improvement Initiative	insights gained from this project.		chart audits with clearly described method S - high, detailed reporting (especially of audit and feedback and PDSA cycles)					with 8 outpatient locations	
83		Bennett, S., Whitehead, M., Eames, S., Fleming, J., Low, S., & Caldwell, E.	2016	Building capacity for knowledge translation in occupational therapy: learning through participatory action research.	To describe a research project for developing a knowledge translation capacity building program for occupational therapy clinicians.	High, A lot of detailed information discussed for an OT specific intervention. Distinction between sustainability and implementation is clear.	S - high, detailed, reported by implementation team C - moderate, determined via survey and focus groups, but its very unclear in the text exactly where the claims about context came from (which method) M - low, opinion-based by authors in discussion O - low, opinion-based by authors.	rehabilitation, knowledge translation capacity	Mixed methods (focus group, survey)	52 total, 20 over the entire 18 month study period	1	Acute hospital	Australia
84		Bryant, L., Ferguson, A., Valentine, M., & Spencer, E.	2019	Implementation of discourse analysis in aphasia: investigating the feasibility of a Knowledge-to-Action intervention	To examine whether speech pathologists were able to translate knowledge and skills acquired during an implementation intervention to the assessment of a person with aphasia. To investigate the content of the intervention and the feasibility of the implementation strategy.	Low, the population is SL-P students at time of intervention (working SLPs at 6 months follow up)	S - high, detailed, reported by KT team M - high, self-report questionnaire O - low, self-report questionnaire	Rehabilitation, discourse analysis	Mixed method (pre-, post-, follow-up design with random assignment of intervention by site)	Participation in each condition: judgement-based (n=8) manual (n=5) computer-assisted (n=9),	4	University	Australia

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
										automated (n=7)			
85		Christie, L. J., McCluskey, A., & Lovarini, M.	2021	Implementation and sustainability of upper limb constraint-induced movement therapy programs for adults with neurological conditions: an international qualitative study	To identify individual, organisational and social factors enabling implementation and sustained delivery of CIMT programs internationally.	High, detailed information regarding context and strategies especially, very clear delineation between implementation and sustainability. Had some information of mechanisms via the TDF	S - moderate, reported retrospectively by interviewees. Some detail missing. C - high, based on interview data analyzed using the TDF M - high, based on interview data analyzed using the TDF O - low, based on self-reported survey results reported elsewhere (all participants reported sustaining CIMT with fidelity to core components)	Rehabilitation, stroke telerehabilitation	Qualitative (interpretive description, interviews)	11 total; 4 PT, 7 OT	11	Acute hospital Rehabilitation hospital Outpatient rehabilitation Community rehabilitation Public (n=6) and private health (n=5)	Australia 3 United Kingdom 4 United States of America 1 Norway 1 Canada 1 Denmark 1
86		Clemson, L., Donaldson, A., Hill, K. and Day, L.	2014	Implementing person-environment approaches to prevent falls: a qualitative inquiry in applying the Westmead approach to occupational therapy home visits	To explore issues underlying the implementation of an occupational therapist-led evidence-based home safety fall prevention intervention within community health services in Melbourne, Australia	Moderate, provides decent, although not incredibly detailed information on all aspects. Does not put them together into a clear CMO	S - low, non-specific description C - high, fairly detailed, reported in interviews by clinicians and coordinators (two levels), informed by theory M - high, interviews informed by theory O - opinion based only	Rehabilitation, fall prevention	Qualitative (interviews)	10	6	Community health centres	Australia
87		Cramm, J. M., Phaff, S., & Nieboer, A. P.	2013	The role of partnership functioning and	To explore associations between partnership functioning synergy and	Moderate, very few OTs in this	S - low, not detailed C - low, not detailed M - high, validated	Multidisciplinary, elderly	Quantitative (cross-sectional	106	21 programs	Community centres	Holland

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				synergy in achieving sustainability of innovative programmes in community care	sustainability of innovative programmes in community care.	cohort, however, there is very detailed information + CMO	measure/items O - high, validated measure/items	community programs	survey containing validated measures)	T0: 218 T1 (1 year): 300 T2 (2 years): 265			
88		Cramm, J.M. & Nieboer, A. P.	2014	Short and long term improvements in quality of chronic care delivery predict program sustainability	To identify the predictive role of short and long termimprovements in quality of chronic care delivery on disease-man-agement program sustainability.	High, CMOc configuration, lots of info on outcomes, but no strategies	C - high, uses standardized measure M - low, opinon/inference no data O - high, uses standardized measure	Multidisciplinary, disease management in chronic care	Quantitative (longitudinal survey)	# of people who reported at all timepoints: 106	22 programs	Acute hospital Primary care clinics Community care clinics	Holland
89		Finlayson, M,. Cattaneo, D,. Cameron, M,. Coote, S,. Matsuda, P.N., Peterson, E. and Sosnoff, J.J.	2014	Applying the RE-AIM Framework to Inform the Development of a Multiple Sclerosis Falls-Prevention Intervention	To summarize the recommendations from a multidisciplinary meeting that included patients to determine what was needed for successful translation of MS falls prevention evidence according to RE-AIM	Moderate, Very small amount of information in this document, about a non-specific intervention. Although developed from diverse stakeholder group, it is rough guidance only, as opposed to exact strategies	S - low, non-specific description O - low, opinion based only	Multidisciplinary, falls prevention (MS)	Commentary	N/A	N/A	N/A	Canada
90		Ford, J.H. 2nd, Wise, M., Krahn, D., Oliver, K.A.,	2014	Family care map: Sustaining family-centered care in Polytrauma	To assess sustainability of the Family Care Map in four Department of Veterans Affairs Polytrauma Rehabilitation Centers.	Moderate, unclear number of rehabilitation clinicians, but appear	S - low, noted limitation by authors is lack of detail here C - high, reported by several respondants at	Rehabilitation, polytrauma	Mixed-methods (sequential survey, then	35 (survey); 28 (interviews) of	4	Acute hospital	United States

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		Hall, C. and Sayer, N.		Rehabilitation Centers		to be small part of sample; large amount of configured CMOCs	each site M - high, used measurement tool and interviews O - low, self-report via survey and interviews		interviews)	possible 219 staff			
91		Fritz, J., Wallin, L., Soderlund, A., Almqvist, L. and Sandborgh, M.	2019	Implementation of a behavioral medicine approach in physiotherapy: impact and sustainability	To explore the effects on and sustainability of physiotherapists' clinical behavior when using facilitation to support the implementation of a behavioral medicine approach in primary health care for patients with persistent musculoskeletal pain.	Moderate, provides good information regarding a small number of S, C, M and O.	C - low, opinon-based M - moderate, used adapted questionnaire that they tested O - high, chart audits, observation with clearly described method S - high, detailed reporting	Rehabilitation, care model	Quantitative (pre-, post-test trial with experiemental and control groups))	15 (experimental group); 9 in control group	3	Country councils	Sweden
92		Gitlin, L.N., Jacobs, M. and Earland, Tracey Vause	2010	Translation of a dementia caregiver intervention for delivery in homecare as a reimbursable Medicare service: outcomes and lessons learned	To evalute whether a proven intervention, Environmental Skill-building Program (ESP), which reduces caregiver burden and enhances skills managing patient functioning, can be integrated into homecare practices of occupational therapists (OTs) and reimbursed through Medicare Part B.	Moderate, rehabilitation clinicians main target group, good information on strategies and context	S - moderate, reported by implementation team, but not especially detailed C - moderate, survey responses by clinicians, but not very detailed O - self-report by clinicians	Rehabilitation, dementia	Quantitative (post implementation survey)	22 (23 trained, of 30 potential/ who were asked)	1 company (unknown (home based locations),	Home or community based, private rehabilitation company reimbursed via medicare part B	United States
93		Gustavson, A. M., LeDoux, C. V., Stutzbach, J. A., Miller, M. J., Seidler, K. J., &	2021	Mixed-Methods Approach to Understanding Determinants of Practice Change in Skilled Nursing Facility	To explore what determinants impacted change in care delivery by occupational and physical therapists at 2 skill nursing facilities that implemented a	Moderate, PT/OT the main target group, timing of sustainability evaluation unclear	S - high, detailed information from implementation team C - high, focus group information within case study O - moderate, 1 site	Rehabilitation, exercise program (high intensity resistance training)	Mixed methods design (sequential explanatory	15	2	skilled nursing facility	

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
		Stevens-Lapsley, J. E.		Rehabilitation: Adapting to and Sustaining Value With Postacute Reform.	high-intensity resistance training intervention		sustained, 1 unsustained based on earlier quantitative data		quantitative explained using qualitative multiple case study)				
94		Gutierrez, D., & Kaplan, S. L.	2016	Aligning documentation with congenital muscular torticollis clinical practice guidelines: administrative case report.	To describe 2 cycles of implementation: (1) the facilitators and barriers to implementation and (2) selected quality improvement outcomes aligned with published clinical practice guidelines (CPGs).	High, PT and OT as main population. Detailed reporting	S - high, fairly detailed, reported by implementation team C - low, anecdotal information from implementation team, low detail M - low, anecdotal information from implementation team O - high, chart audit S - moderate, reported by implementation team, low detail C - high, reported by implementation team using interview data	Rehabilitation, pediatrics (congenital muscular torticollis)	Quality Improvement report	8	1	Rehabilitation hospital	United States
95		Ilott, I., Gerrish, K., Eltringham, S.A., Taylor, C. and Pownall, S	2016	Exploring factors that influence the spread and sustainability of a dysphagia innovation: an instrumental case study	To understand the processes, mechanism and outcomes associated with the spread and sustainability of this safety initiative	Low, rehabilitation not primary targets. Unclear between implementation and sustainability.	M - moderate, data from interviews, not theory-informed O - low, anecdotal from authors (although stated sustained, its unclear based on evidence)	Multidisciplinary, dysphagia	Qualitative (instrumental case study)	100+ exact number unclear; 30 clinicians were interviewed	1 healthcare system	Acute hospital wards (n unspecified) community unit (n=1)	United Kingdom
96		Kavanagh, A.Y., O'Brien, L.J., Maloney, S.R. and Osadnik, C.R.	2020	Barriers and facilitators to adopting functional maintenance initiatives for acutely	To describe clinician, research, and managerial staff perceptions regarding the barriers and facilitators to developing, implementing,	High, OT/PT not primary targets or members of implementation	S - moderate, interview data but not very detailed C - moderate, interview data but not	Multidisciplinary, Functional maintenance initiatives	Qualitative (qualitative descriptiv	unclear; 27 interviewees	9	Acute care hospitals (both public	Australia, internati onal

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				hospitalised older adults	and/or sustaining exemplar state-wide and international FMIs.	teams. Detailed information including full CMOC	especially detailed M - moderate, interview data, non-theory informed O - low, self-report from interview data (no mention if those that were sustained were reduced) S - moderate, fairly detailed reporting by implementation team, data collection only from their self-report		e interviews)			and private)	(unspecified)
97		Kelly, G., Moys, R., Burrough, M., Hyde, S., Randall, S., & Wales, L	2020	Rehabilitation in practice: improving delivery of upper limb rehabilitation for children and young people with acquired brain injuries through the development and implementation of a clinical pathway	To discuss barriers and facilitators to complex knowledge translation processes during three PDSA cycles.	High, Primary target users are PT/OT. Detailed reporting of implementation cycles	C - moderate, fairly detailed reporting by implementation team, data collection only from their self-report M - moderate, implementation team self-report, some from survey data of clinicians O - low, self report in survey by clinicians S - moderate, detailed information from implementersC - high, detailed info from implementation team and open ended question dataM - moderate, open-ended question dataO - low, indirect implication of continued use/related	Rehabilitation, Stroke (pediatric, upper limb)	Quality Improvement report (longitudinal)	14	1	Rehabilitation hospital (inpatient)	United Kingdom
98		Klingbeil, C. and Gibson, C.	2018	The Teach Back Project: A System-wide Evidence Based Practice Implementation	To examine the impact of a brief educational intervention for a multidisciplinary staff on knowledge of health literacy and the use of teach-back during patienteducation	Moderate, PT/OT not primary target users but fairly detailed dataa fair amount of information on context but limited other info		Multidisciplinary, communication strategy	Quantitative (pre-post-, follow up survey design)	>300	1 (multiple units)	Acute hospital (pediatric)	United states

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
							activities (limitation in covenience sample self-report) S - moderate, information from interviews, not particularly detailed beyond workshop given by research team						
99		Liddle, J., Lovarini, M., Clemson, L., Mackenzie, L., Tan, A., Pit, S.W., Poulos, R., Tiedemann, A., Sherrington, C., Roberts, C. and Willis, K.	2018	Making fall prevention routine in primary care practice: perspectives of allied health professionals	To explore how allied health professionals were making fall prevention practice routine in primary care and the factors that influenced their fall prevention practice, including the project workshops	Moderate, rehabilitation primary clinicians in this study, however there is som detail lacking	C - moderate, fairly detailed information from interviews that don't use a framework to inform them M - high, theory-informed interviews O - low, self-report from interviews S - high, reported by implementation team and one strategy (quality monitoring) being the methods used of the entire paper	Multidisciplinary, falls prevention	Qualitative (interviews)	15	not reported	private clinics, organizations or hospitals (n=12) public sector organisations (n=3)	Australia
100		Lindstrom Egholm, C., Rossau, H.K., Nilsen, P., Bunkenborg, G., Rod, M.H., Doherty, P., Bartels, P., Helmark, L. and Zwisler, A-D.	2018	Implementation of a politically initiated national clinical guideline for cardiac rehabilitation in hospitals and municipalities in Denmark	to determine the extent to which Danish CR services in hospitals and municipalities adhere to national recommendations just prior to and two years after the publication of the national clinical guideline.	Moderate, multidisciplinary team where rehab aren't the focus, however fairly detailed information regarding outcomes especially	C - moderate, as reported by implementation team, broader context (political) O - moderate, self-report by participants but the sample size is large and up to four participants for one cardiac rehab site,	Multidisciplinary, cardiac rehabilitation	Quantitative (longitudinal survey)	not reported, 4 for each hospital, 1-4 for each community	134	Acute hospitals (N=36), municipalities (N=98)	Denmark

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
10		Mann, M., Musabyemariya, I., Harding, L., & Braxley, B.	2020	Using Patient-Reported Outcome Measures to Promote Patient-Centered Practice: Building Capacity Among Pediatric Physiotherapists in Rwanda.	To review implementation strategies and lessons learned in a capacity-building program that took place with pediatric physiotherapists in Rwanda.	Moderate, directed to PTs, but the information given for the program as a whole, no single site analyses	inter-rater agreement analyzed S - high, detailed information from implementation team supplemented by participant interviews C - moderate, non-detailed information from participant interviews M - moderate, based on non-validated survey O - low, self-report by clinicians	Rehabilitation, pediatrics (patient reported outcome measures)	Mixed method (pre-, post-, 26 month follow-up surveys and interviews)	65 (43 follow-up respondents)	not reported	various (not specified)	Rwanda
11		McEwen, S. E., Donald, M., Jutzi, K., Allen, K-A., Avery, L., Dawson, D.R., Egan, M., Dittmann, K., Hunt, A., Hutter, J., Quant, S., Rios, J. and Linkewich, E.	2019	Implementing a function-based cognitive strategy intervention within inter-professional stroke rehabilitation teams: Changes in provider knowledge, self-efficacy and practice	To describe research participants' knowledge and self-efficacy related to implementing a cognitive-strategy-based treatment approach, including by discipline and research site, at baseline, post-intervention, and at a 6-month follow-up; 2. To estimate the effect of CO-OP KT on post-intervention and 6-month follow-up changes inrehabilitation clinicians' knowledge and self-efficacy;3. Estimate the amount of clinical practical use of a cognitive-strategy-based treatmentapproach before and after the CO-OP KT intervention, using	High, contributes detailed information on strategies, context and outcomes.	C - high, detailed reporting M - low, anecdotal/opinion only O - medium, uses adapted questionnaire/measures, chart audit	Rehabilitation, stroke	Quantitative (pre-post-, follow up survey)	T1: 65 T2: 52 T3: 39 T4 (6 month follow up - sustainability): 35	5	Acute hospital (stroke in patients)	Canada

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
					indicators from medical records.								
103		Molfenter, S. M., Ammoury, A., Yeates, E. M., & Steele, C. M.	2009	Decreasing the Knowledge-to-Action Gap Through Research–Clinical Partnerships in Speech-Language Pathology	To outline the process that the research team from the Swallowing Rehabilitation Research Laboratory (SRRL) in the hospital undertook to address the identifi ed KTA gap in dysphagia rehabilitation	Moderate, although SL-P focussed, there is very little sustainability detail and what does exist isn't specified with a time period.	S - high, reported by implementation team C - low, interviews with clinicians (only 4) and not informed by framework M - low, interviews as interpreted by authors (no quotes) and non theory guided O - low, opinion-based	rehabiliation, dysphagia	Qualitative (interviews)		4	1 Rehabilitation hosptial	Canada
104		Moore, J. L., Virva, R., Henderson, C., Lenca, L., Butzer, J. F., Lovell, L., ... & Hornby, T. G. (2020).	2020	Applying the Knowledge-to-Action Framework to Implement Gait and Balance Assessments in Inpatient Stroke Rehabilitation.	To assess the effect of the study intervention on clinician adherence to the recommendations and its effect on clinician perceptions and the organization.	High, detailed information, directed to PTs	S - high, detailed information from implementation team C - high, data collected via measures M - low, opinion-based by authors O - high, used clinical chart review	Rehabilitation, stroke (assessment battery)	Quantitative (pre-, post-, follow-up survey and clinical data)		8	1 Rehabilitation hospital (inpatient)	United States
105		Peel, N. M., Travers, C., Bell, R. A., & Smith, K. (2010)	2010	Evaluation of a health service delivery intervention to promote falls prevention in older people across the care continuum.	(1) To identify and assess the extent to which falls safety officers contributed towards the development of an integrated service delivery model for the prevention of falls in older people across the health continuum (2) To investigate and assess the extent to which falls safety officers assisted HSDs key stakeholders to implement falls prevention action and;	Low, Not rehab specific, there is very little sustainability detail and the focus is not so much the sustainability of the EBP, but of the falls safety officer role	S - moderate, info from implementation team C - moderate, from participant interviews M - low, anecdotal/opinion from implementation team O - moderate, used a subscale of a measure but didn't report it clearly	Multidisciplinary, falls prevention capacity and partnerships	Mixed method (evaluation using surveys, reports and key stakeholder interviews)	"nearly 1000"	not reported, all facilites in 16 health districts.	Acute hospital, community, residential	Australia

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
					(3) To make recommendations regarding the ongoing role of Falls safety officers. particularly with regard to the sustainability of falls prevention implementation.								
10		Schreiber, J., Marchetti, G. F., Racicot, B., & Kaminski, E.	2015	The use of a knowledge translation program to increase use of standardized outcome measures in an outpatient pediatric physical therapy clinic: administrative case report	To describe the use of a KT program to improve the knowledge and frequency of use of standardized outcome measures by pediatric physical therapists practicing in an outpatient clinic	High, PT focussed, clear and detailed information	S - high, reported by implementation team/knowledge broker C - high, reported by implementation team/knowledge broker M - low, anecdotal by authors O - low, adapted/non-validated measures of self-reported use; - moderate, chart audit of evidence for use of measures (documented use)	Rehabilitation, pediatric outcome measures	Quality Improvement report	17	4	1 primary clinic, 3 satellite clinics	United States
107		Schröder, K., Öberg, B., Enthoven, P., Kongsted, A., & Abbott, A.	2020	Confidence, attitudes, beliefs and determinants of implementation behaviours among physiotherapists towards clinical management of low back pain before and after implementation of the BetterBack model of care.	(1) To evaluate physiotherapists´ confidence, attitudes and beliefs in managing patients with low back pain before and after a multifaceted implementation of the BetterBack Model of Care, (2) To evaluate determinants of implementation behaviours among physiotherapists	Moderate, directed to PTs, but the information given across all 15 sites, no single site analyses	S - high, detailed information from implementation team C - high, data collected via measures (DIBQ) M - high, data collected via measures (PABT-PT, PCS) O - low, theoretical inference via COM-B	Rehabilitation, low back pain	Quantitative (pre-, post-, 3-month and 12-month follow up surveys)	116	15	Public clinic	Sweden

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
108		Shubert, T.E., Altpeter, M. and Busby-Whitehead, J.	2011	Using the RE-AIM framework to translate a research-based falls prevention intervention into a community-based program: lessons learned	To translate a research-based intervention into a community program, and to assess if similar outcomes to the research trials were achieved	Moderate, PT main target group however the information is not that clear, especially in terms of timelines and how they collected and analyzed it	S - high, reported by implementation/research team C - moderate, reported by implementation/research team in some consultation with staff and centres but unclear how they got this information O - low, anecdotal by authors, although they did provide evidence of spread which required sustainment at original site to work	Multidisciplinary, falls prevention	Mixed methods (evaluation using participant measures and feedback)	2 (PTs) + they trained exercise professionals to take over near and post end of funding period	1	Community center (seniors)	United States
109		Sigler, M., Nugent, K., Alalawi, R., Selvan, K., Tseng, J., Edriss, H., et al.	2016	Making of a successful early mobilization program for a medical intensive care unit	To describe the patient characteristics and endpoints for those who participated in our hospital's early mobilization program.	Low, not rehab specific, although there are OT/PT involved, the intervention is really directed at getting nurses and physicians to involve them in early mobility. The data collection and analysis is unclear, including timelines.	S - high, detailed reporting by implementation team C - moderate, reporting by implementation team based on their anecdotal experience O - moderate, self-report from ICU director (intent to continue program)	Multidisciplinary, ICU mobility	Quantitative (survey and clinical data)	not reported	1 (and 1 unit, ICU)	Acute hospital (academic)	United States
110		Stewart, K., de Vries, T., & Harvey, A.	2019	Implementing accurate identification and measurement of dyskinesia in cerebral palsy into	To describe a knowledge translation (KT) project aimed at improving clinician identification, classification and measurement of	Moderate, target is primarily PT, OT and SLP, but the intervention is only reported at the	S - high, detailed information from implementation (researcher) team M - high, reported by participants in	multidisciplinary, pediatric (cerebral palsy)	Quantitative (pre-, post-, follow-up survey design)	474 participants attended workshops;	not reported (15 work	Rehabilitation hospitals (>45%), not-for-	Australia, New Zealand

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
				clinical practice: A knowledge translation study.	dyskinesia in children with cerebral palsy (CP).	workshop level as opposed to the site level	surveys O - low, self-report by participants in surveys			follow-up survey completed by 163 (manager 3, doctor 4, Nurse 2, OT 46, PT 101 SLP 2, other 5)	shops)	profit organisations (25–30%), private practice (12–15%), university or research facilities (9–11%) and other organisations such as schools or community health.	
1 1 1		Terio, M., Eriksson, G., Kamwesiga, J.T. and Guidetti, S.	2019	What's in it for me? A process evaluation of the implementation of a mobile phone-supported intervention after stroke in Uganda	To evaluate the implementation process of a mobile phone-supported family-centred rehabilitation intervention and to gain knowledge on the mechanisms of impact as well as the contextual factors that might have affected the implementation process and its outcome.	Low, rehabilitation the main target, however the data presented was unclear as to the timeline, and although the authors applied frameworks to guide the study, in some cases they were interpreted inappropriately. Finally, although	S - moderate, reported by the implementation team without many details C - moderate, used process model informed interviews M - moderate, used process model informed interviews	Rehabilitation, stroke (telerehabilitation)	Mixed methods (single case study within an RCT)	12	1	Community based (telerehab)	Uganda

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
						there were two data collection points, no indication of the difference/similarity between these was given in analysis.							
1 1 2		Tilson, J. K., Mickan, S., Howard, R., Sum, J. C., Zibell, M., Cleary, L., ... & Michener, L. A.	2016	Promoting physical therapists' use of research evidence to inform clinical practice: part 3–long term feasibility assessment of the PEAK program.	To report long-term outcomes from a feasibility assessment of an educational program designed to promote the integration of research evidence into physical therapist practice.	Moderate, rehabilitation is the target group but only the educational component of the intervention is described	S - high, detailed description of educational components C - low, minimal data provided as part as reported by authors M - high, data from validated measures O - high, data from clinical chart review (use) O - low, self-report on individual EBP (individual behaviour change)	Rehabilitation, various evidence based practices	Quantitative (follow-up survey)	16	3	Rehabilitation clinics (academic affiliated)	United States
1 1 3		van der Giesen, F. J., van Lankveld, W., Hopman-Rock, M., de Jong, Z. and Munneke, M., Hazes, J. M. W., van Riel, P. L. C. M., Peeters, A. J., Ronday, H. K. and Vlieland, T. P. M.V.	2010	Exploring the public health impact of an intensive exercise program for patients with rheumatoid arthritis: a dissemination and implementation study	To evaluate the implementation of an intensive group exercise program in patients with rheumatoid arthritis (RA)	High, rehabilitation targets and detailed information reported	S - moderate, reported by implementation team in fair amount of detail C - moderate, reported by implementation team in fair amount of detail for the project as a whole, no information on each site M - low, indirect information from participant survey responses	Rehabilitation, exercise program (arthritis)	Quantitative (Survey)	25	14	not reported	Holland

#	Case	Author	Year	Title	Objective	Relevance	Rigour	program	Study Design	Sample size	# sites	Setting	country
11 14		van Twillert, S., Postema, K., Geertzen, J. H., and Lettinga, A. T.	2015	Incorporating self-management in prosthetic rehabilitation: case report of an integrated knowledge-to-action process	(1) To provide an illustrative example of an evidence-informed improvement process in prosthetic rehabilitation in a local setting and (2) To articulate the bidirectional translation work incorporated into an integrated KTA process.	High, rehabilitation professionals are the target group, detailed information is provided	O - low, self-reported willingness to sustain in the future S - high, reported by implementation in detail C - moderate, based on collaborative implementation team views and non-framework informed focus groups with clinicians and patients, no quotes reported from these groups M - low, opinions/anecdotal by authors	Multidisciplinary, leg prosthetic rehabilitation	Quality Improvement report (anecdotal case study)	not reported	1	Rehabilitatoin hospital (inpatient and outpatient)	Holland
11 15		Wimpenny K, Forsyth K, Jones C, Matheson L, Colley J.	2010	Implementing the Model of Human Occupation across a mental health occupational therapy service: communities of practice and a participatory change process	To provide evidence of how to achieve an effective partnership between practitioners and academics.	Moderate, a lot of detailed information discussed for an OT specific intervention. Although implementation and sustainability distinction is often unclear, much of what was discussed as implementation appears to be key to sustainability.	S - high, reported in detail by implementation team C - low, not many contextual factors mentioned and what was there was not reported in detail M - high, reported in detail, used participant quotes to illustrate O - low, anecdotal or self-reported evidence from interviews and implementation facilitator (first author) only	Rehabilitation, care model	Qualitative (participatory action research)	15 (varied but this was the average)	1	Acute hospital, Community	United Kingdom

Table F.2: Second half of the extraction table (columns N-AB)

#	Funding source	EBP	Study Duration	Sustainability planning	Sustainability evaluation	TMF	project stakeholders	knowledge users	Strat-egies	Con-text	Mechan-ism	Out-come	Out-come	Full CMOC
1	National Institutes of Health Acute Lung Injury Specialized Centers of Clinically Oriented Research grant	(1) changing the default MICU activity order from “bed rest” to “as tolerated,” (2) encouraging a change in sedation practice from continuous infusions to “as-needed” boluses, (3) establishing simple guidelines for consultation to rehabilitation therapy, (4) establishing safety guidelines for initiating early rehabilitation, and (5) obtaining full-time dedicated MICU rehabilitation therapist staffing (28). Active physical therapy intervention providing strengthening or mobility exercises both in bed and out of bed, and/or cycle ergometry exercises, based on physical therapist documentation.	8 years	After initial implementation of early rehab, once funding for early rehab program was secured from administration for it to be sustained	up to 5 years post-implementation varied. mostly 2003, 2004, 2005.	none	multidisciplinary', otherwise, no information reported	PT, nurses outcomes research manager, clinical care manager. physician leader, physicians, nursing, respiratory therapy, PT,	Y	Y	N	Y	Sustained	N
2	none	A multidisciplinary standard care process designed by practicing clinicians guides care in all patients. The clinical care manager and the attending physician, along with other members of the interdisciplinary team, use the care process model to formulate	7 years (unclear)	none reported	(3-5 years post- intiial implementation, although some components added over time)	plan-do-study-act for implementation none for sustainability	not reported		Y	Y	Y	Y	Sustained	N

		a care plan for each RICU patient.						OT, pharmacy, and dieticians.							
3	None reported	Mobility for sedentary patients	N/A	none reported	not reported	AHRQ falls prevention guide	not reported	not reported	Y	Y	N	Y	Sustained	N	
4	None reported	Falls prevention (including mobility and environmental scans for walking hazards)	not specified	none reported	not reported	AHRQ falls prevention guide	not reported	not reported	Y	N	N	N	Sustained	N	
5	Victorian Department of Health and Human Services	Experienced advanced musculoskeletal physiotherapists (AMPs) in post operative arthroplasty review (PAR) clinics. AMPs review patients following hip or knee arthroplasty surgery, instead of orthopaedic specialists.	2	none reported	6 months and 1-2 years post-implementation	ictorian Innovation and Reform Impact Assessment Framework was used to assess efficiency, effectiveness (access to care, safety and quality, workforce capacity, utilisation of skill sets, patient and workforce satisfaction) and sustainability (stakeholder engagement, succession planning and availability of ongoing funding).	not reported	PT	Y	Y	N	Y	Sustained	N	
6	Private consulting company	Advanced Musculoskeletal Physiotherapy Implementation Program (AMP Program)	1.5	none reported	6 months post implementation	The Victorian Innovation and Reform Impact	not reported	PT, orthopedic	Y	Y	Y	Y	Sustained	Y	

	contract from the Department of Health and Human Services Victoria	represents the Victoria-wide implementation of advanced musculoskeletal physiotherapists in post-arthroplasty review (PAR) clinics, emergency departments (ED) and neurosurgery outpatient clinics.				Assessment Framework (the VIRIAF)		surgeons, managers							
7									Y	N	N	N	N/A	N	
8	Canadian Institutes of Health Research	Rehabilitation,exercise and nutrition information post-transplant disseminated via in person presentations and website. Developed on the basis of a literature review.	6	Concurrent with implementation planning	3 years post-implementation	5 step Patient-Centered Outcomes Research Institute (PCORI) model for knowledge translation	clinicians, clinician managers, administration, researchers	OT, PT, exercise physiologist, nurse, kinesiologist, physician, dietician	Y	N	N	Y	Sustained	N	
9									Y	N	N	Y	Sustained	N	
10									Y	N	N	N	Sustained	N	
	Canadian Institutes of Health Research (CIHR) QOL Fellowship.	Exercise and cancer research was reviewed, summarized, and utilized to develop CanWell. A 12-week, supervised, community-based, exercise, and education program. Participants are required to participate in supervised exercise twice a week and to exercise independently a third time. Prescribed exercises are individualized on the basis of baseline testing, unique cancer type and stage, and person specific precautions and contraindications (Appendix A). Exercise prescriptions include aerobic endurance (target heart	3		not reported (see website for sustainment)	not reported	clinicians, researchers	nurse, PT, kinesiologist	Y	N	Y	N	N/A	N	
11		rate is 50–80% of maximal heart		none reported											

		rate, depending on abilities), muscle strength (target is muscle fatigue following 2–3 sets of 12 repetitions), and flexibility exercises based on established guidelines [35–39]. Peer support is encouraged during the individualized exercise programs and during group classes. Participants are referred to CanWell through their physician (oncologist or family practitioner), nurse, psychologist, or by self-referral. During the intake session, a physiotherapist, nurse practitioner, or CanWell-trained kinesiologist reviews participants' relevant medical history, establish exercise safety guidelines, and obtain written consent by those interested in participating in the program research. Measurements are completed prior to initiating the exercise program and repeated at 6 and 12 weeks. had nearly 50% drop out rate, mostly due to medical reasons but others as well (vacation, transportation issues)								N	N	N	Y	Sustained	N	
12																	
13										Y	N	N	N	Sustained	N		
14	Canadian Institutes of Health Research, British	4 measures: (1) Gross Motor Function Classification System (GMFCS) (2) Gross Motor Function Measure (GMFM-88)	6 months	none reported	N/A	none reported (CIHR KT definition given)	researchers, central researcher/KB, KBs within each site	PT	Y	Y	Y	N	N/A	N	

15	Columbia Ministry of Children and Family Development Canadian Institutes of Health Research, British Columbia Ministry of Children and Family Development	(3) Gross Motor Function Measure GMFM-66 (4) Motor Growth Curves (MGCs) When used together, this collection of tools provides an integrated, evidence-based approach to clinical practice and can help service providers set and evaluate intervention goals and answer parents' questions about prognosis.	1.5	none reported	6-, 12- months post-implementation	KTA framework	research team, knowledge brokers	PT	Y	Y	Y	Y	sustained	Y
16									N	Y	N	N	N/A	N
17	Edith Strauss Foundation	Enhanced Pulmonary Rehabilitation program is based on the Living well with a Chronic Obstructive Pulmonary Disease (LWWCOPD) program. The enhanced PR program	2	none reported	18 months post implementation	RE-AIM, Determinants of Implementation Behavior Questionnaire (DIBQ) which	researchers, manager (not explicit but taken from author list)	Nurse (3); Physical therapist Social worker Nutritionist Occupational	Y	Y	Y	Y	Reduced level	N

		contains 12 essential education topics including slides and patient handouts which were designed by a team of content experts and they encouraged patient participation and principles of self-management education.				is based on the Theoretical Domains Framework (TDF)		therapist Respiratory therapist								
18									Y	Y	N		N	N/A	N	
19	University Hospitals Bristol NHS Foundation Trust, University of Bristol	ERAS is an approach to the perioperative care of patients that includes the whole patient journey from referral to post-surgical follow-up, incorporating around 20 components.	not reported	none reported	not reported	Normalization Process Theory	managers, clinicians of varied professions	SUR/ANS Surgeons and Anaesthetists, NUR/AHP Nurses and Allied Health Professionals (Dietitian, Physiotherapist, Speech & Language Therapist) and Housekeeper, CLINMAN/MAN Clinical Managers (including Ward Managers and Ward Sisters) and Trust management, Cross-cutting Roles that cut across specialities	Y	Y	Y		Y	Mixed	N	

20	University Hospitals Bristol NHS Foundation Trust, University of Bristol	Enhanced Recovery After Surgery programme (ERAS) is an approach to reduce the body's stress response to surgery and aid rapid recovery, and includes twenty components. Its nutrition components include preoperative carbohydrate loading and early oral feeding post-surgery.	not reported	none reported	not reported	Normalization Process Theory	managers, clinicians of varied professions	SUR/ANS Surgeons and Anaesthetists, NUR/AHP Nurses and Allied Health Professionals (Dietitian, Physiotherapist, Speech & Language Therapist) and Housekeeper, CLINMAN/MAN Clinical Managers (including Ward Managers and Ward Sisters) and Trust management, Cross-cutting Roles that cut across specialities	Y	Y	Y	N	N/A	N
21									Y	N	N	N	N/A	N
22									Y	Y	N	Y	Sustained	N
23	Alberta Innovates, Surgery Strategic Clinical Network (SCN) of Alberta	ERAS places the patient first and makes each person an active participant in the outcomes. Increasing knowledge and gaining new skills are key factors in making changes that will become routine for	4 months	none reported	1-4 years post-implementation	QUERI model (Stetler et al), Theoretic Domains Frameworks (TDF)	physician leaders, leading clinicians (nurses, PT, other) and hospital administrators,	physician leaders, leading clinicians (nurses, PT, other) and hospital administrator	Y	Y	Y	Y	Sustained	Y

	Health Services (AHS), Canadian Institutes for Health Research (CIHR)	clinicians, care providers and patients.							s, and provincial leaders							
24										Y	Y	N	Y	Sustained	N	
25	South London Academic Health Science Network	ESCAPE-pain integrates group education and exercise for people with knee and/or hip osteoarthritis. It promotes self-management in groups of 10–12 people attend twice per week for 6 weeks (12 sessions), with each session comprising 30–45 minutes of exercise and 20–25 minutes of structured education about osteoarthritis and self-management strategies.	not reported	none reported	2+ years post-implementation	none reported	not reported	PT	Y	Y	Y	Y	Mixed	Y	
26									Y	N	N	Y	Sustained	N	
27									Y	N	N	Y	Sustained	N	
28									Y	N	N	Y	Sustained	N	
29									Y	N	N	N	N/A	N	
30									Y	N	N	Y	Sustained	N	
31	Edith Strauss Foundation	“Exer-games room” consisting of two rehabilitation VR games systems (Jintronix and Meditouch Hand Tutor) to perform either arm, leg or balance exercises in addition to their regular treatment sessions.	1	none reported	1 year post-games room opening	Consolidated Framework for Implementation Research (CFIR)	program coordinator, researchers (informal team)	PT, OT, kinesiology students	Y	Y	Y	Y	Sustained	Y	
32	Edith Strauss Foundation	“Exer-games room” consisting of two rehabilitation VR games systems (Jintronix and	1	none reported	1 year post implementation	Consolidated Framework for Implementatio	not reported	not reported	N	N	Y	Y	Sustained	N	

		Meditouch Hand Tutor) to perform either arm, leg or balance exercises in addition to their regular treatment sessions.				n Research (CFIR)									
33	NHMRC Partnership Grant	Falls prevention (non-specific)	N/A	N/A	N/A	Sustainability defined according to Pluye et al, 2004; Shediac-Rizkallah and Bone, 1998	N/A	N/A	Y	N	N	Y	N/A	N	
34	NHMRC Partnership Grant	Falls prevention (non-specific)	N/A	N/A	N/A	Sustainability defined according to Pluye et al, 2004; Shediac-Rizkallah and Bone, 1998	N/A	N/A	Y	N	N	Y	N/A	N	
35	NHMRC Partnership Grant	Stepping On is an effective multi-faceted program for preventing the falls in older people living in the community who have a history of falling or a fear of falling. The program aims to improve self-efficacy in relation to falls, encourage behaviour change to reduce the risk of falling and to reduce falls. The program is conducted in a small group format, consisting ideally of 12 participants. The program consists of seven weekly sessions, a home visit for each participant and a booster group session at three months.		2	none reported	1.5 years post-implementation	differently in each site, author reported how each site defined sustainability.	not reported, but role of participants in program reported: leaders for the Stepping On program (n=14) or had combined roles of program co-ordinator and leader (n=11). Three participants were engaged in program co-ordination activities only.	volunteer (n=5), nurse (n=4), occupational therapist (n=4), health promotion/education officer (n=4), service manager/team leader/co-ordinator (n=4), direct care worker (n=3), health worker (n=3), aged and disability officer (n=2), program/project co-ordinator	Y	Y	Y	Y	Mixed	Y	

								(n=2), community settlement officer (n=1), falls prevention co-ordinator (n=1) and casual worker (n=1)							
36									Y	N	N	Y	Sustained	N	
37	Heart and Stroke Foundation Canadian Partnership for Stroke Recovery, Canadian Institutes of Health Research (CIHR)	Graded Repetitive Arm Supplementary Program (GRASP) is a neurorehabilitation intervention for the paretic upper limb based on intensive, repetitive, and task-specific practice The GRASP community program was adapted from the Home GRASP for the local community center. The program consisted of 10 weeks of 1-hour group classes and individualized homework exercises and had a cost-recovery fee	1.5	none reported	8 months post-initial implementation and 3 months post-grant period	RE-AIM	researchers, community centre, non-profit	OT, bachelor health sciences	Y	Y	N	Y	Sustained	N	
38	Heart and Stroke Foundation Canadian Partnership for Stroke Recovery, Canadian Institutes of Health Research (CIHR)	Video conference based Graded Repetitive Arm Supplementary Program (GRASP) is a neurorehabilitation intervention for the paretic UE based on intensive, repetitive, and task-specific practice The GRASP community program was adapted from the Home GRASP for the local community center. The program consisted of 10 weeks of 1-hour group classes and individualized	1	none reported	8 months post-initial implementation	RE-AIM	researchers, community centre, non-profit	unclear, for sure there are: health sciences student, registered kinesiologist	Y	Y	N	Y	Sustained	N	

		homework exercises and had a cost-recovery fee														
39	West Midlands Strategic Health Authority, National Institute for Health Research (NIHR), Collaboration for Leadership in Applied Health Research and Care (CLAHRC) Oxford	Cognitive behavioural approach (CBA) for Low back pain (LBP) Back Skills Training (BeST) is a group-based intervention that combined a CBA with exercise to improve function and physical activity; clinicians are trained on based using internet-based training (i.e. iBEST)	6 months	none reported	none	Theoretical Domains Framework (TDF), behaviour change technique taxonomy proposed by Michie et al to provide examples of theoretically informed strategies to overcome the corresponding determinants of behaviour change	not reported	PT	Y	Y	Y	N	N/A	N
40									Y	N	N	N	N/A	N
41									Y	Y	N	N	N/A	N
42									Y	N	N	Y	Unsustained	N
43									Y	N	N	N	N/A	N
44	none	Lead Research Occupational Therapist aimed to build research capacity (in regards to the consumption and generation of research) as a complementary and simultaneous process to building capacity for knowledge translation (through the adaptation of evidence to local contexts).	2.5	none reported	2 years post-implementation	not specified	not reported	OT	Y	Y	Y	Y	Sustained	N
45									N	N	N	Y	Sustained	N

46	Canadian Institutes of Health Research (CIHR) Knowledge-to-Action grant Council of Academic Hospitals of Ontario, Academic Health Sciences Centres of Ontario,	The Mobilization of Vulnerable Elders (MOVE) intervention is an interprofessional approach that focuses on early and consistent mobilization of older adults admitted to hospital. The intervention focuses on implementing three key messages into practice: 1) patients should be assessed for mobilization status within 24 hours of admission; 2) mobilization should occur at least three times a day; and 3) mobility should be progressive and scaled	10 months	none reported	20 weeks post-intervention (5 months)	KTA cycle	a physician lead, research coordinator, nursing education coordinator and other key staff members such as allied health professionals	nurses, physicians; administrators; physiotherapists; "other allied health professionals"	Y	Y	Y	Y	Reduced level	N	
47	University of Toronto (Regional Geriatric Program of Toronto), Baycrest Health Sciences, Hamilton Health Sciences, Health Sciences North, Kingston	The Mobilization of Vulnerable Elders (MOVE) intervention is an interprofessional approach that focuses on early and consistent mobilization of older adults admitted to hospital. The intervention focuses on implementing three key messages into practice: 1) patients should be assessed for mobilization status within 24 hours of admission; 2) mobilization should occur at least three times a day; and 3) mobility should be progressive and scaled	2	not formal planning, but factors which could facilitate sustainbility discussed in focus groups 4-8 weeks post-implementation	20 weeks post-intervention (5 months)	KTA cycle; IKT approach	front line clinicians, patient advocates, and healthcare managers. and research team.	patient care managers, directors, physicians, nursing and allied health professionals	Y	N	N	N	N/A	N	

48	General Hospital, London Health Sciences Centre, Montfort Hospital, Mount Sinai Hospital, North York General Hospital, The Ottawa Hospital, St. Joseph's Healthcare Hamilton, Thunder Bay Regional Health Sciences Centre, University Health Network. Council of Academic Hospitals of Ontario, Academic Health Sciences Centres of Ontario, University of Toronto (Regional Geriatric Program of Toronto),	The Mobilization of Vulnerable Elders (MOVE) intervention is an interprofessional approach that focuses on early and consistent mobilization of older adults admitted to hospital. The intervention focuses on implementing three key messages into practice: 1) patients should be assessed for mobilization status within 24 hours of admission; 2) mobilization should occur at least three times a day; and 3)	2	none reported (other than stating not giving/needing external funds to sites for implementation enhanced sustainability)	20 weeks post-intervention (5 months)	IKT approach	At each hospital, the local implementation team included a physician leader, education coordinator and research coordinator	not reported	Y	Y	Y	Y	Sustained	Y	

	Baycrest Health Sciences, Hamilton Health Sciences, Health Sciences North, Kingston General Hospital, London Health Sciences Centre, Montfort Hospital, Mount Sinai Hospital, North York General Hospital, The Ottawa Hospital, St. Joseph's Healthcare Hamilton, Thunder Bay Regional Health Sciences Centre, University Health Network.	mobility should be progressive and scaled										
49								Y	N	N	N	N/A	N	
50								Y	N	N	N	N/A	N	
51								Y	N	N	Y	Sustained	N	

52										Y	N	N	N	N/A	N
53										Y	N	N	N	N/A	N
54	County Council of Norrbotten; Swedish Association of Occupational Therapists (FSA)	The Occupational Therapy Intervention Process Model (OTIPM) is a client centred, top-down, occupation-focused OT model of practice developed with the intention to clarify and integrate the unique contribution of OT into practice. The OTIPM provides a guide to professional reasoning when implementing assessments and interventions, ensuring that occupational therapists are working together with their clients in a way that focuses on the client's own perspective as well as his or her engagement in occupation.	5	none reported	5 and 10 years post-implementation	not reported, although refers to the model which was implemented (OTIPM) as the driving force behind sustaining continued improvement	all OTs on unit	OT	Y	Y	Y	Y	Sustained	N
55	County Council of Norrbotten and Luleå University of Technology	The Occupational Therapy Intervention Process Model (OTIPM) is a client centred, top-down, occupation-focused OT model of practice developed with the intention to clarify and integrate the unique contribution of OT into practice. The OTIPM provides a guide to professional reasoning when implementing assessments and interventions, ensuring that occupational therapists are working together with their clients in a way that focuses on the client's own perspective as well as his or her engagement in occupation.	unclear, 10 years of data but anaylzed retrospectively	starting approximately year 7	7-10 years post-training	not reported, although refers to the model which was implemented (OTIPM) as the driving force behind sustaining continued improvement	all OTs on unit	OT, OTA	Y	Y	Y	Y	Sustained	Y
56	Academy of Neurologic Physical	ProActive Physical Therapy (PAPT) program	2	early', not stated exactly when	3-4 years post-implementation	sustainability defined using Moore et al's	clinicians, researchers, managers,	PT	Y	Y	Y	Y	Sustained	Y

	Therapy, Northwestern University Parkinson's Foundation Center of Excellence	PAPT care path consists of one to four visits approximately every six months to monitor changes and update PD-specific exercise prescription. This proactive, consultative model contrasts the traditional, restorative use of PT to treat functional declines after they occur.				definition, used DSF to guide sustainability phase. sustainability measured using RE-AIM, NHS Sustainability Model, and Clinical Sustainability Assessment Tool Knowledge-to-Action (KTA) Cycle as process implementation model, CFIR for determinants	external implementation advisor,									
57	Northwestern University Parkinson's Foundation Center of Excellence, Academy of Neurologic Physical Therapy Knowledge Translation Summit Grant Award	ProActive Physical Therapy (PAPT) program PAPT care path consists of one to four visits approximately every six months to monitor changes and update PD-specific exercise prescription. This proactive, consultative model contrasts the traditional, restorative use of PT to treat functional declines after they occur.	2	none reported	1 year post-implementation (preliminary data)	Knowledge-to-Action (KTA) Cycle as process implementation model, CFIR for determinants	clincians, researchers, managers, external implementation advisor,	PT	Y	Y	N	Y	Sustained	N		

58	Ontario Lung Association	Pulmonary Rehabilitation (PR) balance training and fall prevention strategies: All patients underwent balance training three times a week for a period of six weeks for a targeted total of 18 sessions, each one lasting 30 min.	1	none reported	6 months post-implementation	none used	not reported	PT, PTA, nurse	Y	Y	Y	Y	Reduced level	Y	
59	none	The inpatient PR programme is 6 weeks long with an option for an additional 4 weeks. An individualized balance session was a maximum of 45 minutes based on performance on the brief-BESTest during the pre-PR assessment.	1	post-implementation	1 year post initial implementation completion	none used	PT (lead author)	PT, PTA	Y	Y	N	Y	Sustained	N	
60	Dutch Ministry of Health, Welfare and Sport, Stichting Beatrixoord Noord-Nederland	'Rehabilitation, Sports and Exercise' (RSE) was introduced and prepared for dissemination in Dutch rehabilitation care. The RSE program specifically targets people with physical disabilities and/or chronic diseases to encourage them to participate in sports and daily physical activities during and after rehabilitation.	3	none reported	15 months post implementation	conceptual framework described by Wierenga et al. (2013)	not reported	not reported	Y	N	N	N	N/A	N	
61	Dutch Ministry of Health, Welfare and Sport, Stichting Beatrixoord Noord-Nederland	The main components of the RSE programme are: (1) intake session on exercise and sports, (2) exercise and sports during rehabilitation, (3) referral to Sports Counselling Centre (SCC), (4) face-to-face consultation, (5) telephone-based counselling sessions and (6) collaboration between SCC and external exercise and sports facilities.	3	none reported	N/A	conceptual framework described by Wierenga et al. (2013)	clinicians, managers, researchers	rehabilitation professionals' unspecified, physicians,	N	Y	N	N	N/A	N	

62	Dutch Ministry of Health, Welfare and Sport	'Rehabilitation, Sports and Exercise' (RSE) was introduced and prepared for dissemination in Dutch rehabilitation care. The RSE program specifically targets people with physical disabilities and/or chronic diseases to encourage them to participate in sports and daily physical activities during and after rehabilitation.	none reported		not reported	not reported		not reported	physiotherapists, exercise therapists	Y	Y	Y	N	N/A	N
63	Dutch Ministry of Health, Welfare and Sport, Stichting Beatrixoord Noord-Nederland	'Rehabilitation, Sports and Exercise' (RSE) was introduced and prepared for dissemination in Dutch rehabilitation care. The RSE program specifically targets people with physical disabilities and/or chronic diseases to encourage them to participate in sports and daily physical activities during and after rehabilitation.		3	none reported	20 months post-implementation	conceptual framework described by Wierenga et al. (2013)	not reported	not reported	Y	Y	Y	Y	Reduced level	N
64	Dutch Ministry of Health, Welfare and Sport, Stichting Beatrixoord Noord-Nederland	'Rehabilitation, Sports and Exercise' (RSE) was introduced and prepared for dissemination in Dutch rehabilitation care. The RSE program specifically targets people with physical disabilities and/or chronic diseases to encourage them to participate in sports and daily physical activities during and after rehabilitation.		3	none reported	15 months post-implementation	conceptual framework described by Wierenga et al. (2013) diffusion of innovations (retrospectively in discussion only)	not reported	not reported	Y	Y	Y	Y	Mixed	N
65	none	Strength after Breast Cancer (SABC) program is an online course to train clinicians	6 months		none reported	2 years post-training (timing of	Proctor's implementatio	not reported at the site level, at the SABC	PT, OT, nurse	Y	Y	Y	Y	Sustained	Y

		interested in exercise rehabilitation to deliver SABC to their patients with breast cancer in outpatient rehabilitation clinics.In 2015, we offered SABC nationwide through an online educational platform			implementation varies/is unclear)	n outcomes framework	program level, researchers only								
66									Y	N	N	Y	Sustained	N	
67	Injury Prevention and Control (Australian Research Collaboration).	Stay on Your Feet (SOYF) was a multi-strategic, community-wide intervention to decrease the number and severity of falls. SOYF addressed footwear/foot-care, vision, physical activity, balance and gait, medication use, and home and public environmental hazards. Multiple strategies including awareness raising, community education, policy development, engaging health professionals, and interventions directly targeting individuals were implemented.	9 months	none reported	5 years post-implementation	none reported	N/A	community nursing, PT, OT and health promotion public health nurses, PT, OT, and geriatric practitioners; health service administrators; individuals from long-term care facilities; community volunteers; and older adults.	Y	Y	Y	Y	Reduced level	N	
68	Ontario Neurotrauma Foundation	Stay on your feet (SOYF) implemented in three Ontario test sites targeting five main strategy areas: awareness raising and information dissemination; community education; policy development; home safety measures; and working with general practitioners and other health professionals.	3	concurrent with implementation	N/A	not explicit, but routinization and institutionalization mentioned in the discussion	not reported		Y	Y	N	Y	Mixed	N	

69									Y	N	N	Y	Sustained	N	
70									Y	N	N	Y	Sustained	N	
71									N	Y	N	Y	N/A	N	
72	none reported	The goal of the StrongWomen Program was to translate the strength training research into a practical application that program leaders could implement in their communities for a broad audience of women. Community leaders assist in executing community-based programs in the following areas: administrative tasks (e.g., registration), program promotion (e.g., fliers, informational meetings), class organization, sched-uling, set up, conducting the classes, and responding to program participants' questions, needs, and feedback. 1 hour and consist of 5 minutes of warm up (e.g., walking, marching in place), 40 minutes of strength training, 5 minutes of balance training, and 5 minutes of cool down (i.e., stretching and flexibility exercises). The StrongWomen Program is a 12-week session with two 1-hour classes per week on nonconsecutive days. Generally, eight to 15 participants per class participate in the 12-week session as a group.	3	1 year post-implementation	3 years post-implementation	none reported	research team	unclear, any person (health care professional or individual with sufficient exercise background) who is trained as a program leader for the StrongWoman program	Y	Y	N	Y	Sustained	N	
73									Y	N	N	N	N/A	N	

74									Y	N	N	Y	Sustained	N
75	Hospital foundation, fundraising initiatives, peer-reviewed research grants	Survivorship Exercise Program (SEP) is to improve the physical and psychosocial wellbeing of cancer survivors during and after cancer treatment through structured exercise. Increase capacity within exercise and cancer by providing meaningful learning opportunities to students interested in exercise and oncology	not reported	none reported	N/A	not reported	not reported, but can reasonably be assumed to be the research team since the program is "driven by research funds"	exercise physiologists, physicians, clinical psychologists, researchers, nurses, and student interns.	Y	Y	N	Y	Sustained	N
76									N	Y	N	Y	Sustained	N
77									Y	N	N	Y	Sustained	N
78	Centers for Disease Control and Prevention	Referral to the falls prevention program described here, not delivery of the program itself. Participants attended a twice-weekly Tai Ji Quan training program for 24 weeks. The program involved a set of tailored Tai Ji Quan–based activities that focused on stimulating and integrating musculoskeletal and sensory systems through self-initiated movements such as ankle sways with feet planted; weight-shifting; trunk rotation, flexion, and extension; and coordinated eyes–head–hand movements.	2	none reported	2 years post-referral period start	RE-AIM "Maintenance was defined as clinician willingness to continue to make referrals after the translational study was completed (after 24 weeks) and the percentage of participants who continued their Tai Ji Quan practice during the 12 weeks after the end of the 24-week program."	not reported	"primary care physicians and other medical specialists, including physical therapists and nurse practitioners"	Y	Y	N	Y	Sustained	N

79									Y	N	N	Y	Sustained	N	
80									Y	N	N	N	N/A	N	
81	National Health and Medical Research Council of Australia	Clinical practice of tactile assessment knowledge by paediatric therapists including 3 items: tactile registration as measured by the Semmes Weinstein Monofilaments, unilateral spatial tactile perception as measured by Single Point Localisation, and bilateral spatial tactile perception as measured by Double simultaneous. For therapists with less time, the Touch-in-2 assessment was recommended.	1 year		none reported	1 year follow up	KTA Model for Improvement PDSA cycles	not reported	PT, OT	Y	Y	N	Y	Mixed	N	
82	None reported	Documentation of dose (frequency, intensity, timing, and type of intervention) for PT Cerebral palsy treatment sessions into the EMR system		1.5	none reported	1 year post initial training of small group, 6 months post training of entire group	Failure Mode Effects Analysis (FMEA) technique Action cycle of the Knowledge to Action (KTA) framework	clinicians (PTs)	PT	Y	Y	Y	Y	Sustained	N	
83	None reported	Research and Evidence in Practice (REP) program which provides training in, and support of, evidence-based practice amongst clinicians and active involvement in research and quality improvement activities.		1.5	not specified, but reported was done	approximately 6-8 months post-implementation	Survey and focus groups based on the Theoretical Domains Framework	researchers, clinicians, managers	OT	Y	Y	Y	Y	Sustained	N	

							Participatory Action Research (PAR) was used to develop a KT capacity-building program for occupational therapy clinicians sustainability not explicitly defined								
84	Australian Government Research Training Program Scholarship	Knowledge of discourse analysis processes, with variations in the ways to conduct discourse analysis.	6 months	none reported	6 months post-implementation	KTA framework	researchers	SL-P	Y	N	Y	Y	Unsustained	N
	none	Constraint-induced movement therapy (CIMT) improves upper limb recovery with 3 components: (1) Intensive graded practice using the affected arm and hand (2) Restraint of the non-affected hand to encourage use of the affected arm and (3) A transfer package of behaviour change strategies aimed at encouraging generalisation of use of the arm into day-to-day life.	not specified		2+ years post-implementation	Theoretical Domains Framework (TDF) Moore's sustainability definition, but focus is on continued delivery of intervention with fidelity to core components	not reported	PT, OT	Y	Y	Y	Y		N
85	Primary Care Partnerships (PCPs) (Victorian Government Department of Health)	Home safety fall prevention intervention (Westmead Home Falls Manual (Clemson, 1997)).	2	none reported	12-18 months post-implementation	RE-AIM Diffusion of Innovations theory	not reported	OT, program coordinators (1 social worker, 1 physiotherapist)	Y	Y	Y	Y	Sustained	N
86				none reported												

87	Rotterdam fund for innovation to establish new initiatives in housing, welfare and care supported all 21 projects	programmes were required to be innovative and (i) enhance the self-reliance of community members and⁄or (ii) integrate health-care, social services and⁄or welfare.	6 months	none reported	approximately 4 years post-implementation (varied)	Sustainability defined according to continuation of the program - Shediec-Rizkallah & Bone 1998, Buchanan 2005 and measured according to routinization/institutionalization - Slaghuis 2011	not reported	Manager (n=19) Coordinator (n=26) Project assistant (n=17) Policy officer (n=4) Communication officer (n=3) Occupational therapist (n=3) Other (n=34)	Y	Y	Y	Y	Mixed	Y
88	The Netherlands Organization for Health Research and Development (ZonMw)	Disease-management programs in the Netherlands are based on the chronic care model as developed by Wagner et al. (2001), which provides an organized multidisciplinary approach to care delivery	2	none reported	2 years post implementation (T2)	Operationalized sustainability according to the routinization measure (eight items, routinization instrument (Short Version); Slaghuis et al. (2011))	Not reported	Nurses, Medical doctors, Dieticians, PTs, others	Y	Y	Y	Y	Mixed	Y
89	Canadian Institutes of Health Research Planning Grant	Falls prevention for MS	N/A	broad planning/recommendations given in this article for non-specific future work.	N/A	RE-AIM: The extent to which an intervention becomes an integrated component of programmatic or service offerings	clinicians, patients, researchers	PT, OT, kinesiologist	Y	N	N	Y	N/A	N

90	VA Polytrauma and Blast-Related Injuries (PT/BRI) Quality Enhancement and Research Initiative (QUERI) Locally Initiated Project	Family Care Model (FCM) outlines a family-centered approach to providing care for Veterans with polytrauma-related injuries.	2 months	none reported	3 years post-implementation	NHS model NHS sustainability index (one item from each domain of the NHS model)	not reported	Staff Nurse, Case Manager, CRRN Social Worker/Social Work Case Manager Psychologist Physician (MD, DO, Physiatrist or Psychiatrist)	Y	Y	Y	Y	Mixed	Y
91	AFA Insurance, Sweden	Behavioral medicine approach Control consisted of educational srategies only while experimental included implementation support	1.5; 6 months training + up to 12 months follow up	none reported	6- and 12-months post implementation	none reported, but they operationalized sustainability according to continued use of EBP components	clinician-researcher	PT	Y	Y	Y	Y	Unsustained	N
92	Rosalynn Carter Institute/Johnson & Johnson Caregivers Program Demonstration Projects no direct funding for project, but taken from various grants + funding for trainees	Environmental Skill-building Program (ESP) involves OTs assessing specific needs, concerns, and challenges of caregivers, the physical and social environment, caregiver management approaches, and dementia patient functionality.	2	none reported	1 year post-implementation	RE-AIM	research and private rehab company	OT	Y	Y	N	Y	Reduced level	N
93		A high intensity resistance training intervention in which therapists were provided a menu of intervention options to tailor treatment to the patient in the following categories: transfers, activities of daily living (ADL),	1	none reported	1-3 months quantitative outcome; 4-6 months qualitative explanation	Practical, Robust Implementation and Sustainability Model (PRISM), RE-AIM	researchers, clinicians, managers	PT, PTA, OT, OTA, and directors of rehabilitation (both speech-language pathologists)	y	y	y	y	Mixed	N

94	none reported	neuromotor training (gait and balance), and strengthening Congenital muscular torticollis (CMT) clinical decision making, specifcally, a 3-page CMT-specific form aligned with the American Physical Therapy Association Section on Pediatrics CMT recommendations	2.5	concurrent (cyclical)	2 and 3 years post-implementation	KTA framework	not reported	OT, PT	Y	Y	Y	Y	sustained	N	
95	NIHR CLAHRC Yorkshire and Humber	Inter-Professional Dysphagia Framework (IPDF) It comprises 5 levels, from Awareness which introduces the risks of dysphagia, through to Consultant Dysphagia Practitioners who undertake specialist investigations, manage ocus on the second level: Assistant Dysphagia Practitioner because it covers the knowledge and skills needed to support safe swallowing and applies to anyone who assists patients to eat and drink.	2 years, 10 months	unclear	1.5 years post-implementation	Ovretveit's [10] three spread strategies, Buchanan et al 2005's sustainability and spread systematic review	unclear; Some combination of researchers and clinicians	OT, SL-P, nurse, clinical support worker	Y	Y	N	Y	Sustained	N	
96	VCF Felice Rosemary Lloyd Scholarship; Monash Health Emerging Researcher Fellowship	Functional maintenance initiatives (FMIs) are programmes instilled by health service providers to prevent in-hospital functional decline. They are recommended as part of best care for acutely hospitalised older persons [1,7]; however, significant variability exists regarding the characteristics that define FMIs. Common FMI features include ward cultures that promote patient independence, exercise	1	none reported	not reported	Diffusion of Innovation theory guided qualitative synthesis by dividing barriers and facilitators amongst 3 stages: Decision to Adopt, Initial Use, and Continued Use	not reported in full for each site, but interviewees a mixture of clinicians, managers and researchers	not reported in full for each site, but interviewees a mixture of PT, OT, nurses, physicians, allied health assistant	Y	Y	Y	Y	Mixed	Y	

97	none	programmes or retraining of activities of daily living, and co-ordinated, multidisciplinary staff teamwork [8]. Studies examining the impact of FMIs during hospitalisation have demonstrated significant benefits across outcomes of importance to patients and health care providers. These include improvements in function [9,10], reductions in the rates of delirium, falls [11,12] and likelihood of residential aged care placement [13], as well as shorter hospital admission duration and readmission rates [14–17]. Concise, evidence based summaries for a range of upper limb interventions were developed to provide all therapists with manageable access to the evidence for each intervention. The recommendations from these summaries were tabulated to form a treatment matrix to guide the selection of appropriate interventions. Recommendations were provided for CYP presenting at different functional levels as classified by Manual Abilities Classification System (MACS), and unilateral versus bilateral upper limb involvement. The table was designed to guide therapists as to which interventions could be considered for different CYP,	2.5	concurrent (cyclical)	2 years post-implementation (3rd PDSA cycle)	Plan-do-study-Act (PDSA)	unclear exactly. Some combination of researchers and clinicians	PT, OT	Y	Y	Y	Y	Sustained	N	

		and the guidelines to provide accessible summaries of the evidence for different interventions. The therapist is then expected to clinically reason which of the evidence based interventions to follow based on an understanding of the child, their personality, strengths, difficulties and goals, and family preference. It is acknowledged that every CYP and family is different, and therefore the pathway should act as a guide as opposed to a recipe													
98	none	Teach back is an effective intervention where the learner is asked to tell the teacher their understanding of what was just taught.	1.5	none reported		10-12 months post training session		Iowa Model of EBP (Titler et al., 2001)	nurses, dieticians, respiratory care practitioners, OT, PT	Y	Y	Y	Y	sustained	N
99	Australian Government National Health and Medical Research Council	Integrated Solutions for Sustainable Fall Prevention (iSOLVE) project to routinize fall prevention in practice. As part of the project 238 AHPs attended interactive fall prevention training workshops including research evidence for fall prevention, its implementation in practice and opportunity to be included in local referral lists used by GPs in the project.	1.5	none reported		3-18 months post-training workshop (varied for participants)		researchers (workshops), interviewed clinicians (implementing workshop concepts)	PT (6), occupational therapy (OT) (4), exercise physiology (EP) (2) and podiatry (3)	Y	Y	Y	Y	Mixed	N
100	Holbaek University Hospital, The Danish Knowledge Centre for	cardiac rehab Danish practice guidelines core components 1.a. Systematic referral 1.b. Management of barriers to patient attendance	2	none reported		2 years post-baseline.		NPT not reported (framed as implementation evaluation, no implementation	government (politically motivated/mandated at national level)	physician, nurse, dietitian and physiotherapist.	y	Y	N	Y	mixed (hospitals sustained,	N

	Rehabilitation and Palliative Care	2. Exercise training 3. Patient education 4. Psychosocial support 5. Anxiety and depression screening 6. Nutritional counselling 7. Smoking cessation counselling 8. Vocational advice				n theories either)							com munities unsustained)	
101	Health Volunteers Overseas.	48-hour pediatric rehabilitation course	2 years, 3 months	concurrent with implementation	26 months post-project conclusion	none reported	reseachers (USA), rehabilitation clinical faculty (Rwanda)	PT	Y	Y	Y	Y	Mixed	Y
102	Canadian Institutes of Health Research Partnerships for Health System Improvement Sunnybrook Research Institute D+H SRI Summer Studentship Award.	Cognitive Orientationto daily Occupational Performance (CO-OP) approach CO-OP is a person-centred treatment approach, framed around the use of cognitive strategies,which is aligned with Canadian Stroke Best Practice Recommendations for cognitive rehabilitation	1 year 7 months	post-implementation (1 year) *unclear if this is when the planning happened or when the results of that plan were implemented. However, this is the only mention of it	6 months post-implementation	Knowledge to Action (KTA) framework	researchers, administrators	OT, PT, OTA/PTA, SL-P, nurse, social worker	Y	Y	Y	Y	sustained	Y
103	None reported	Surface EMG biofeedback to facilitate swallowing rehabilitation	not specified	none reported	not specified	KTA framework	researchers	S-LP	Y	Y	Y	Y	Sustained	N
104	There is funding, but exact source not mentioned	Gait assessment battery (GAB) of 3 standardized outcome measures: 1. 6 minute walk test 2. 10m walk test 3. Berg balance scale	2	concurrently with implementation planning	4 years post-implementation	KTA framework, theoretical domains framework	clinicians, managers	PT, PTA	Y	Y	Y	Y	Sustained	Y

105	Patient Safety Centre of the Queensland Department of Health	Falls safety officers increasing capacity/partnerships for falls prevention in the health service according to Queensland Stay On Your Feet® Good Practice Community Guidelines.	1	none reported	1 year post-implementation of falls safety officer role	interviews based on the Community Capacity Index.	researchers, department of health administrator, knowledge broker (clinician/researcher), clinicians?	"staff from a range of Queensland Health hospitals, residential care facilities, community health and population health departments, as well as local government and non-government organizations. "	Y	Y	Y	Y	Mixed	N
106	none	6 measures: PEDI GMFM-66 GMFM-88 TUG TUDS 30-s walk test	1 year 2 months	none reported	8 months post-implementation	KTA framework	unclear	PT	Y	Y	Y	Y	sustained	N
107	Research Council in Southeast Sweden, Swedish Research Council, Region of Östergötland	BetterBack The BetterBack Model of Care is a biopsychosocial model which encourages stratified intervention delivery and dosing based on the PTs` clinical reasoning regarding risk of pain persistence and progression towards individualised goals.	2	none reported	1 year post implementation	TDF, COM-B	researchers	PT	Y	Y	Y	Y	Sustained	N

108	UNC Chapel Hill School of Medicine	Adapted Stay Safe, Stay Active falls prevention program which is a 12-week balance training course designed to help your balance and prevent falls.	2	concurrent with implementation planning	1 year post implementation	RE-AIM e) "Maintenance refers to the extent to which participants can sustain the benefits they achieved and the extent to which a program becomes institutionalized or part of the routine organizational practices (Glasgow et al., 1999). "	researchers, administrators unclear, but appears to be pulmonary/ critical care fellows and attending physicians from detail given in paper, but the author list is more diverse (PT, nurse)	PT	Y	Y	N	Y	sustained	N	
109	none reported	progressive 8 step mobilization protocol	1.5	none reported	1 year post implementation	none reported		physicians, nurses, PT, OT	Y	Y	N	Y	sustained	N	
110	NHMRC-funded Centre of Research Excellence in Cerebral Palsy (CRE-CP)	The evidence-based Toolkit details the existing reliable and valid tools to comprehensively identify and classify dyskinesia, and measure its severity and impact on activity and participation International	2	none reported	6-9 months post-workshop	KTA framework	researchers	Manager, Medical doctor, Nurse, Occupational therapist, physiotherapist,	Y	N	Y	Y	Reduced level	N	

		Classification of Functioning, Disability and Health.						Speech-Langauge pathologist, Other							
111	Swedish Research Council; Minor Field Studies (MFS)	The F@ce™ intervention (where F stands for (Face-to-face between the OT and the client), @ for Assessment, C for Collaboration and E for Evaluation). If the clients had scored 0 or had not responded to the SMS, a red flag (a message that informed of a non-performed activity) was sent to the OT and they followed-up	2	none reported	6 and 12 months post-workshop (combined data, did not evaluate differences at these timepoints)	i-PARIHS	researchers, project facilitators (clinicians most likely , but unclear)	four OTs, three researchers, three information technology (IT) specialists and two rehabilitation managers	Y	Y	Y	N	N/A	N	
112	University of Southern California, Division of Biokinesiology and Physical Therapy	6-month Physical therapist-driven Education for Actionable Knowledge translation (PEAK) program consisting of four consecutive, interdependent components: 1) acquiring managerial leadership support and electronic resources in three clinical practices, 2) a 2-day learner-centered EBP training workshop, 3) 5 months of guided small group work synthesizing research evidence into a locally relevant list of, actionable, evidence-based clinical behaviors for therapists treating persons with musculoskeletal lumbar conditions–the Best Practices List, and 4) review and revision of the Best Practices List, culminating in participant agreement to implement the behaviors in practice	1	none reported	6 month follow up	Classification Rubric for EBP Assessment Tools in Education (CREATE) model [11] provided the theoretical framework for evaluation	researchers, clinicians, managers	PT	Y	Y	Y	Y	Unsustained	N	

113	Dutch Arthritis Association (grant IMP-03-1)	Rheumatoid Arthritis Patients In Training (RAPIT) program, a group exercise program consisting of supervised aerobic and muscle strengthening exercises, with a frequency of 2 times per week and a duration of 24 months. For the present study, health insurance companies were willing to reimburse only 12 months of the program.		3	none reported	1 year post-implementation	RE-AIM: Maintenance measured as: stakeholders' willingness to continue the program in the future. Maintenance defined as: the extent to which the program became institutionalized or part of the standard routine and policy.	researchers, insurance companies	PT	Y	Y	Y	Y	Sustained to 1 year Unsustained 1+ years due to lack of insurance company support	N	
114	ZonMw and Revalidatie Nederland	Motor skill training in which principles and practices of task- and context-specific training and self-management education were incorporated.	unclear, approximately 1 year	completed, but unclear when	N/A	KTA framework; participatory action research approach	KTA expert (first author and a former physical therapist and human movement scientist), researchers, physical therapists, occupational therapists, and the medical manager. Patients engaged for feedback but not team members	PT, OT	Y	Y	Y	N	N/A	N	
115	Coventry Primary	Assessment tools of the Model of Human Occupation (MOHO)	3	none reported	1 year follow up	participatory action research	clinicians, clinician-	OT	y	y	y	Y	sustained	Y	

Care NHS Trust Research and Development	conceptual model for OT practice		approach, cyclical as recommended.	manager, clinician-researcher	

Appendix G
Full CMOC narratives

Sustained CMOCs

CMOC #	CMOC narrative	CMOC explanation	original text
1	If clinicians or clinician-managers have autonomy over their own work and retain knowledge of the evidence-based practice (C) through ongoing training (S), then they value the evidence-based practice (M) which results in its continued use (O).	Christie et al 2021 conducted an interpretive description study to identify individual, organizational and social factors enabling implementation and sustained delivery of constraint-induced movement therapy (CIMT) programs internationally. The authors noted that clinicians and/or clinician-managers reported having far more agency in the private as opposed to public setting. When clinicians or clinician-managers had agency over their own practice and retained knowledge of CIMT through ongoing training (C), they recognized the value or importance of the clinical practice (M) and reported continued delivery of CIMT up to 2 years post-implementation (O). Christie et al 2021 - 2 years	"Sustainability: Feeling confident in their ability to deliver CIMT programs appeared to stem from experience, with many participants implementing multiple CIMT programs over time. Participants also discussed feeling empowered to act and apply their CIMT knowledge andr skills as shown in this exchange: Facilitator: “What supports helped you implement it into your workplace? Participant 7: Well we’re a private clinic so we just do whatever we want. Facilitator: Just do what you like. That’s an important element isn’t it? Freedom? Participant 7: I mean that’s the one benefit. We will never get rich, but we do what we want." (Christie et al 2021, no page #) "Participants working in the private sector could set their own priorities and felt that CIMT programs were likely to continue." (Christie et al 2021, no page #) "private practitioners had greater autonomy over the prioritisation of interventions in their service and felt very optimistic about continuing to offer future CIMT programs." (Christie et al 2021, no page #) "workplace education sessions on CIMT were integrated into existing team education rosters on a regular basis, as one participant described: When I came back from the.. .course, I put together a ... training package around constraint therapy, and we ran that every six months with our rotational staff. .. . all our rotational staff received the training

CMOC #	CMOC narrative	CMOC explanation	original text
			package that I put together, and the more senior staff.. . were more than welcome to come to .. . sessions as they needed. (Participant 8)" (Christie et al 2021, no page #)
2	If clinicians have autonomy over their own use of the evidence-based practice (C), then the practice will be relevant to them and fit their workflow (O) because of the work clinicians do together to evaluate and modify the evidence-based practice (M) when its adaptability is promoted (S).	Wimpenny et al (2010) conducted a participatory action research study that investigated the sustainability of the Model of Human Occupation (MOHO) across a mental health occupational therapy service. Monthly meetings were conducted in which clinicians worked together to evaluate the worth of MOHO (M1) and modified the practice as needed (M2), which led to MOHO being relevant to clinicians and fitting their practice context for up to 1 year post-implementation (O). Clinicians were able to accomplish this because they have the professional autonomy to make key decisions regarding their practice and that in relation to MOHO (C). Wimpenny et al 2010 - 1 year	"Over time, MOHO came to be viewed as an indispensable resource, but the process of knowledge assimilation was complex. Although the aim of the process was for the therapists to master an understanding of the MOHO concepts and tools, what emerged was a kind of deconstruction and reconstruction of the theory. This allowed the therapists to personalise and integrate MOHO. The therapists needed to exercise autonomy to use MOHO knowledge as they deemed appropriate: to modify and adapt it in order to meet both their human and practice needs." (Wimpenny et al 2010, page 512) "Therapists needed opportunity to identify, share and discuss their fundamental concerns. They needed to reflect upon their identity and beliefs." (Wimpenny et al 2010, page 512) "It was interesting to note this fusion of personal stance and MOHO. Although practice focuses on expert knowledge and professional competency, the way in which a practitioner delivers such practice is a highly personal art form (Andresen and Fredericks 2001). This need to personalise practice theory should not be underestimated." (Wimpenny et al 2010, page 513)
3	If there is a positive workplace atmosphere concerning research (C), then the evidence-based practice will be continued by clinicians and the	Russell et al (2010) evaluated the impact using physiotherapists as knowledge brokers to facilitate the use in clinical practice of four evidence-based measurement tools designed to evaluate and understand motor function in children with cerebral palsy in 28 organizations in Canada. If the organization has a positive research culture as assessed using an adapted measure (C), then a cerebral palsy measure is	"Our results showed that a strong research culture and supervisor expectations were the significant factors in predicting familiarity and use of only one of our measurement tools, the GMFCS. The GMFCS is used not only by PTs but by other clinicians as well, and therefore PTs might have had greater expectations to use this tool, especially when communicating with other service providers." (Russell et al 2010, page 14) "Research culture of the organization had a significant impact on

CMOC #	CMOC narrative	CMOC explanation	original text
	organization (O) because the clinicians perceive positive social pressure and/or expectation from influential colleagues to perform the practice (M) when clinical champions are identified and prepared (S).	more likely to be used for up to 12 months post-implementation (OR = 3.0, 95% CI 1.1 to 7.9) (O) because clinicians feel managers and other clinicians expect them to use the measure (M). Authors suggested that this is linked to the use of the knowledge broker strategy, which in itself had strong management support. Hopkins et al (2007) published a quality improvement report which described how they transformed an ICU culture to facilitate early mobility. The authors used a validated measure of organizational culture to demonstrate the the positive social atmosphere of the organization, including the good communication and collaboration amongst clinicians (C). This workplace culture facilitated the continued delivery of the early mobility program by clinicians for up to 5 years post-implementation (O) because clinicians felt that there is social pressure or expectation for them to perform the practice (M) when an audit and feedback strategy was used. In this case, the audit and feedback strategy was unusual in that it was for the individual projects as a whole as opposed to the individual, but all clinicians could see the progress of all projects. Russell et al 2010 - 1 year Schröder et al 2020 - 1 year Yang et al 2021a - 10 months	GMFCS familiarity over the six-month intervention (OR = 3.6, 95% CI 1.5 to 8.7) (Table 4). Both research culture (OR = 3.0, 95% CI 1.1 to 7.9) and supervisor expectation for use of measurement tools (OR = 2.6, 95% CI 1.1 to 6.0) were significant predictors in explaining changes in reported use of the GMFCS from 'none' to 'some' and supervisor expectation (OR = 2.0, 95% CI 1.0 to 3.9) when examining the difference between 'some' versus 'high' use" (Russell et al 2010, page 13-14) "In the present study, clinical managers and clinical champions were likely important facilitators in providing opportunities for positive social support, reinforcement of action plans and motivating colleagues intentions to use the MoC. However, this is likely to require more regular focus over time to maintain a facilitatory effect on motivation and opportunity related determinants." (Schröder et al 2020, page 11) "The use of a checklist and "audit-feedback" coaching was useful in improving the implementation fidelity. The fidelity checklist was helpful to identify missing elements of the program delivery and to facilitate intervention fidelity.30 As training service delivery staff is an essential component of successful implementation,31 the training workshop embedded with the fidelity checklist prior to the program and workplace coaching sessions based on the audit results were able to provide sufficient knowledge to support program fidelity. " (Yang et al 2021, page 6-7 (pre-print)) "After adding sleep to their usual computerized nursing charting package, the authors expected that sleep would be charted regularly. This expectation, of course, was not realized. After several rounds of staff education, sleep charting improved to approximately 80% of the time. This was short of the authors' goal of greater than 90% compliance. Therefore, the authors implemented a formal consolidation process, where they tracked noncompliance with sleep charting, providing regular feedback to the staff. The initial measured

CMOC #	CMOC narrative	CMOC explanation	original text
		Hopkins et al 2007 - 3-5 years Gramlich et al 2020 - 1-4 years	noncompliance rate for charting sleep in RICU patients in January of 2004 was 14% (Fig. 3). The results of the consolidation effort are seen over the ensuing 24 months, where the authors improved the noncompliance rate to 0% in August of 2005. The subsequent rebound to about 5% noncompliance was expected, but could be subjected to further maintenance measures. The 95% compliance rate, however, met the authors' goal of greater than 90% compliance, so they continue to track sleep charting using time series data to determine if further intervention is required." (Hopkins et al 2007, page 88-89) "The authors developed and posted a goal grid that allowed the staff to see all the projects currently under way to improve patient care. Each staff member is part of some project; however, all staff often are not aware of all unit projects. Along with the RICU projects, the posted data from outcome measures, so that staff can link projects directly with results (Hopkins et al 2007, page 89) "At the system level in Intermountain Healthcare, the RICU has become recognized as a leader in developing models of care. Teamwork approaches and the nurse as the central team member also have received system recognition. Nursing research and development projects in the RICU were instrumental in helping LDS Hospital to achieve magnet nursing status. Development of the Intensive Medicine Clinical Program across Intermountain Healthcare has allowed other ICUs to benefit from the lessons learned in the RICU. LDS Hospital's RICU and staff are now, after 7 years, being recognized for their contribution to patient care." (Hopkins et al 2007, page 89) "for ERAS practices and where compliance to ERAS evidence based practices was measured through audit, the ERAS way would become the standard of care. Interviewees repeatedly stated that in absence of continued measurement of compliance, ERAS practices declined." (Gramlich et al 2020, page 8-9)

CMOC #	CMOC narrative	CMOC explanation	original text
4	If key stakeholders in the organization are committed and the social atmosphere is positive (C), then clinicians will continue to use the evidence-based practice (O) because they will be able to effectively divide the labour for the practice amongst themselves (M) when communication amongst professionals is optimized using interprofessional education strategies and collaborative approaches to implementation and/or sustainability (S).	Liddle et al (2018) explored how physiotherapists, occupational therapists, exercise physiologists and podiatrists were sustaining fall prevention practice in primary care and the factors that influenced their fall prevention practice. Via interviews, clinicians reported mixed sustainment of the program 18 months post-implementation across all the sites. In the sites where clinicians did continue to deliver the falls prevention program (O), clinicians reported effectively dividing the labour amongst themselves (M). They were able to do this because educational strategies early in implementation were used to create an environment where internal collaborators were committed and the social atmosphere of the organization promoted communication and collaboration amongst clinicians (C). Other authors (e.g. Molfenter et al 2018, Cramm et al 2013) reported slightly different strategies to create and maintain the same effect, including getting external collaborators to commit to the program by developing academic partnerships and using a collaborative approach. Liddle et al 2018 - 3-18 months Molfenter et al 2009 - not reported Cramm et al 2013 - 4 years Van der Braak et al 2020 - 18 months Herbert et al 2017 - not reported	"Collective action was evident where AHPs were taking charge on fall prevention within their practice and sphere of influence. Some were already enacting elements of the iSOLVE approach that they found easy to adapt to current work practice, for example, using additional assessment tools or purchasing and using additional equipment." (Liddle et al 2018, page 7) "AHPs found working with other health professionals complex especially when roles overlapped or were unclear. The workshops had value in improving inter-professional understanding and collaboration and supporting practice" (Liddle et al 2018, page 7) "The clinician participants felt more self-assured about engaging in novel or experimental treatment protocols as a result of their partnership with the SRRL. They reported that this practical experience facilitated more effi cient learning than learning from a manual. Clinicians reported a sense of reassurance in the treatment when it was supported by the SRRL." (Molfenter et al 2009, page 86) "Factors that contributed to the successful implementation at the MCI were that the HCPs were already working together for many years in an existing PR program and that they were familiar with the LWWCOPD program prior to implementation" (Van der Braak et al 2020, page 15 (pre-print)) "In addition, the acknowledgement of and ability to use members' resources were found to be valuable in engaging partners' involvement and achieving synergy in community care partnerships." (Cramm et al 2013, page 209) "Data collectors were considered to be crucial in this process, and participants reported that it was challenging when this resource wasn't available (due to project specific funding ending and posts not being filled), and data analysis tasks fell to them:

CMOC #	CMOC narrative	CMOC explanation	original text
		Lovarini 2012 - 1.5 years van Twillert 2015 - not reported	I would like to be able to produce the feedback for people 'cause people have put a lot ofeffort in … on the other hand, you know, I don't have the time to personally go and trawl through and get all that data. (SUR/ANS-HN-8)" (Herbert et al 2017, page 10) "Stakeholders remained positive throughout, using their authority to secure support and action within their team, a feature of hierarchical control (Fig. 1). For example, 'Once I realise something is important and we need to sort it out … I think the manager's job is to create the environment whereby hopefully the work is a success' (PSL 3)." (Ilott et al 2016, page 5) "For Lyn, a Falls Advisor within a large heath service, it was a challenge continuing the program within local health centres due to an ongoing and protracted restructure of the health service. The uncertainty surrounding future work roles and services made program planning a difficult task" (Lovarini 2012, page 155) "Therapists and the medical manager provided the amputation-specific information and knowledge on the organizational context, and the KTA expert with skills in participatory action research conducted the articulation, translation, and integration work. This form of genuine partnership led to shared ownership of the improved functional prosthetic training focused on active learning of patients with LLA which now has become part of usual care." (van Twillert et al 2015, pg 645) "Engagement of a rehabilitation physician. For many professionals, the engagement of physicians in the implementation was reported as a facilitator for the implementation and continuation of the programme (Tables IIIc and IVc). Since physicians play a key role in the multidisciplinary team, it was important that they had a positive attitude towards the RSE programme. Furthermore, professionals explained that an enthusiastic and committed physician could enable

CMOC #	CMOC narrative	CMOC explanation	original text
			the implementation by creating support from their physician colleagues." (Hoekstra et al 'professionals' 2017, page 16)
5	If the clinical champion is dedicated to the evidence-based practice (C), then the evidence-based practice will continue to be used by clinicians (O) because clinicians (and the clinical champions) feel confident in their ability to perform the practice (M) when ongoing training and consultation are provided to them(S).	Russell et al (2010) evaluated the impact using physiotherapists as knowledge brokers to facilitate the use in clinical practice of four evidence-based measurement tools designed to evaluate and understand motor function in children with cerebral palsy in 28 organizations in Canada. Authors reported that the knowledge broker strategy was effective during implementation, and the continued presence of the knowledge broker post-implementation (C) contributed to the sustained use of measures for up to 12 months (O). Building on results from a survey of self-reported knowledge of the evidence-based measures at 12 months follow-up, the authors proposed that the result was due to the maintenance in clinician confidence in their ability to use the measures due to the ongoing training and consultation provided to both clinicians and clinical champions post-implementation. Russell et al 2010 - 1 year MacDonald et al 2021 - 3-4 years	"This multi-centre study showed that by providing modest financial remuneration (two hours/week for six months), ongoing resource materials, and personal and intranet support, a KB embedded within a clinical site was effective in increasing self-reported knowledge and use of specific evidence-based measurement tools. These reported changes were sustained at 12 months." (Russell et al 2010, page 16) "Key strategies to aid the spread and sustainment included a program facilitator to lead stakeholder meetings and organize implementation strategies; site champions to facilitate local implementation; organizational programs to maintain resources and mentor staff; and monthly meetings for monitoring program barriers and facilitators, delivering feedback, and providing informal support. " (MacDonald et al 2021, page 4 (pre-print))
6	When clinical champions and new leaders are identified (S) then there is a leader or	Lovarini (2012) conducted interviews with various stakeholders in a falls prevention initiative implemented in diverse community organizations. Staff members for a municipal council reported if there is a dedicated clinicial	"The Program Ceased, then Recommenced If the necessary conditions for program sustainability weren't met, the program ceased but then re-commenced when the conditions could be met. At the Council, Lesley, a program co-ordinator and leader implemented three programs in 2008 and included four programs in her work plan for 2009. For

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	their trained successor in the organization who is dedicated to the evidence-based practice (C) resulting in the continued use of the evidence-based practice (O) because someone is working to drive the practice forward by continuing to define the necessary actions and procedures (M).	champion, then the falls prevention initiative will be continued (O) because the champion is working to drive the clinical practice forward (M1) by continuing to define the necessary actions and procedures for the clinical practice (M2). Identifying and training a clinical champion is seen as highly important, with a program coordinator for the municipality stating that "If you don't have a champion, it [the program] won't work" (pg 193). Lovarini 2012 - 1.5 years	Lesley, program sustainability rested on a number of conditions. Chief amongst them was the availability of a "program champion": "If you don't have a champion, it [the program] won't work" Lesley considered herself to be the program champion at the Council; she was trained and experienced in program implementation and had a personal belief in the program benefits. But when, Lesley's role at the Council was expanded, she no longer had enough time or energy to promote the program. As a result, an insufficient number of program participants were recruited to enable any of the four programs planned for 2009 to proceed. When asked if the Council would be implementing any programs in 2010, Lesley responded "no". Thus, it seemed, that despite Lesley's earlier planning, program sustainability would not be realised at the Council. However, in early 2010, conditions at the Council changed. Lesley was able to create time within her work schedule to implement the program, additional program funding became available and there was an opportunity to train an additional staff member in program implementation. Hence despite Lesley's statement at the end of 2009 that she would not be sustaining the program, the program was back on the agenda at the Council for 2010. From the experiences of the Council, we can see that the program ceased when the conditions necessary for program sustainability could not be met but that the program re-commenced when the conditions were more favourable. Providing these favourable conditions continued, the program would continue at the Council" (Lovarini 2012, page 193-194)
7	When sustainability specific planning is conducted to address the needs of clinicians (S) then there are committed stakeholders in the organization (C)	McEwen et al (2019) conducted a pre-, post-, follow-up evaluation of the implementation of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach. The authors found that improvements in CO-OP use from the implementation period were maintained through chart audits (O). Authors proposed that this result is due to the clinicians believing it is right	"The maintenance of improvements may have been facilitated by the individual teams' ownership of implementation goals and strategies and the comprehensive sustainability plan that was implemented after the formal implementation support period" (McEwen et al 2019, page 13) 'The 2 programme coordinators emphasized the engagement of physicians in the implementation of the programme, and the support

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	which results in the evidence-based practice continuing to be used by clinicians (O) because clinicians will believe it is right for them to be involved and take ownership of the practice (M).	for them to be involved so they take ownership of the clinical practice (M) when strategies such as collaborative sustainability specific planning are used to create a context where there are a committed group of internal stakeholders (C) McEwen 2019 - 6 months Hoekstra et al 2017 'professionals' - not reported Ford et al 2015 - 3 years	from rehabilitation professionals within the organization to implement and continue the RSE programme." (Hoekstra et al 2017 'professionals', page 13) "In addition to these strategies, respondents indicated that organizational attributes often associated with successful implementation also affected sustainability. These included (1) the presence of a champion, (2) incorporation into new staff orientation, and (3) leadership support. A champion plays an important role in ensuring that a tool continues to be utilized. Since social workers were identified as the staff that currently use the FCM, it is not surprising that they were seen as its champions. A respondent from one PRC summed it up in saying, “Social workers are most aware of the phases—coordinate the next steps.”" (Ford et al 2015, page 9)
8	If the evidence-based practice is complex and/or requires extra time to use but there is management support for it (C) then the practice will continue to be used by clinicians (O) because they have a positive attitude and continue to be confident in their ability to perform the clinical practice (M) when academic partnerships or	McEwen et al (2019) conducted a pre-, post-, follow-up evaluation of the implementation of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach. This is a complex rehabilitation intervention in which clients are taught to use problem-solving cognitive strategies to acquire personally-meaningful functional skills, and health care providers are required to shift control regarding treatment goals and intervention strategies to their clients. Recognizing the complexity of the practice, the implementation team developed academic partnerships and built a coalition of stakeholders to not only gain management support, but include them as key members of the project coalition (C). The academic partners helped develop educational materials and lead the educational meetings. Study authors proposed that this facilitated positive attitudes	"We addressed health system components (e.g., engagement of decision makers), as they are believed to be important in moving evidence to practice in complex environments, particularly when shifts in culture, attitudes, and behaviour are required [41, 42]. It is also well understood that support from management is a significant implementation facilitator [37, 38, 43], and that it is closely linked to more receptive staff attitudes [38]. " (McEwen et al 2019 page 4-5) "To address these anticipated challenges, we began with an equal knowledge user and researcher partnership, and used the Knowledge to Action (KTA) framework as a foundation for our KT program development [30]. " (McEwen et al 2019, page 4) "The CO-OP KT intervention was associated with significant improvements in knowledge, aspects of self-efficacy, and aspects ofpractice related to the multi-site implementation ofthe CO-OP Approach in inter-professional stroke rehabilitation teams. Knowledge, self-efficacy in promoting cognitive strategy use and self-efficacy in client-focused therapy were all

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	coalitions are developed (S).	(M1) and confidence in clinicians' ability to perform the clinical practice (M2), linking it to chart audits indicating the continuation of the clinical practice until the end of the study period at 6 months follow up (O). McEwen et al 2019 - 6 months Hoekstra et al 2017 - not reported MacDonald et al 2021 - 4 years Richmond et al 2018 - not reported Sirkka et al 2014 - 5-10 years van der Braak et al 2020 - 18 months iBEST - 2 years Ford et al 2015 - 3 years	maintained 6-months after the CO-OP KT intervention ended. " (McEwen et al 2019, page 12) "For the continuation phase, support from managers and physicians was emphasized as an important influencing factor, since these professionals can have an impact on decision-making processes" (Hoekstra et al 2017 'professionals...', page 16) "Perfect scores were reported in in two NHS sustainability factors: “clinical leadership engagement and support” and “fit with the organizational culture.” (MacDonald et al 2021, page 8 (pre-print)) "Recommendations to increase sustainability beyond the point of the intervention phase were elicited from staff members from hospitals that participated in the MOVE iT and MOVE ON pilot projects. These strategies can also be effectively applied to MOVE. • Establish a clear presence of leaders on the unit who are supportive of the intervention and can help to monitor and/or reinforce intervention activities" (MOVE sustainability stategies webpage) "participants needed support from their managers and peers to run a CBA programme, and would consider condensing the number of treatment sessions to encourage patient attendance." (Richmond et al 2018, page 10) "The participants emphasized the importance of the management being sensitive and attentive in terms of the atmosphere in the OT group, especially during periods when the improvement work was perceived as stressful and time-consuming. This was expressed as: “It has been stressful and difficult to do your regular work, plus the improvements.... If we had not been guided to make these changes, we would have failed long ago.... It is necessary that the improvement work is scheduled in advance ... and that all [occupational therapists]

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			were supposed to participate" (2011)." (Sirkka et al 2014 'occupational', page 94) "Our study also highlights, in accordance with the literature (7,33–35), the importance ofsupport at both the organizational and the individual level for improvement work to implement changes that become sustainable" (Sirkka et al 2014 'occupational', page 95) "This project had strong support from the director of the PR program (JB) who was also an investigator in this study" (van der Braak et al 2020, page 15) "Factors that contributed to the successful implementation at the MCI were that the HCPs were already working together for many years in an existing PR program and that they were familiar with the LWWCOPD program prior to implementation." (van der Braak et al 2020, page 15) "information received during staff training about the FCM may have strengthened their perceptions related to staff involvement and enhanced their understanding of the benefits associated with implementing the FCM" (Ford et al 2015, page 6)
9	If there is sufficient demand for the evidence-based practice from patients or from other healthcare providers via referrals, and there are committed stakeholders who support the practice	Macdonald et al (2021) use data from interviews, implementation documents and clinical charts to build on the previously published implementation outcomes (Rafferty et al 2019) and describe the sustainability outcomes of the proactive physical therapy for Parkinson's disease program. Initiated in one outpatient rehabilitation clinic, evidence from clinical chart reviews indicates that it was sustained by clinicians with high fidelity four years post-implementation (O). Authors	"Our sustained implementation strategies using the EMR, centralizing education, and programmatic support of a facilitator and champions have helped this program to be successful for more than four years." (MacDonald et al 2021, page 10 (pre-print)) "Use of evaluative sustainment frameworks and assessments enabled the appraisal of ongoing implementation strategies and further tailor to site specific needs." (MacDonald et al 2021, page 10 (pre-print)) "There was increased adoption by outpatient clinics, physical therapists, and referrers (Table 1). Furthermore, the four initial

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	in the organization (C), then it will continue to be delivered by clinicians (O) because they regularly evaluate the worth of the clinical practice (M) as part of developing a formal implementation blueprint, assessing for readiness, identifying barriers and facilitators to sustainability and other sustainability specific planning (S).	suggested that this was in part due to the sustained, high demand for the program from patients, which was indicated both by increased referrals to the original site, and the spread of the program to two other clincs (C). The authors proposed that core strategies such as developing a formal implementation blueprint, sustainability specific planning and assess for readiness and identify barriers and facilitators to sustainability gave clinicians the opportunity to work together to evaluate the worth the Parkinson's initiative (M), ultimately leading to its sustainment. MacDonald et al 2021 - 4 year Rafferty et al 2019 - implementation only Kelly et al 2020 - 2 years	referrers increased their overall PT referrals (PAPT program and other PT) from 115 referrals in the 2016 fiscal year to 167 in the 2019 fiscal year, a 45% increase." (MacDonald et al 2021, page 8 (pre-print)) "Defining sustainability goals early in the implementation process, applying implementation frameworks, and using sustainability assessments, may increase the maintenance of a novel evidence-based, clinical program" (MacDonald et al 2021, page 2 (pre-print)) "Once established, the team responsible for establishing and appraising the literature required to underpin the pathway experienced the same barriers as have been reported many times in the literature, including both time restraints and confidence to critically analyse the evidence [29–31]. It was therefore essential that therapists involved had not only a sufficient time frame for completing their sections, but also the right level of support to allow them to feel confident to search and appraise the literature [32]. In this study, this was achieved through therapists working in pairs to complete their sections, with support from both their managers and the onsite research team to overcome these barriers. Even so, the development of the pathway took nearly two years to be completed" (Kelly et al 2020, page 6)
10	When the evidence-based practice is adapted and strategies are tailored to the local context (S) then key stakeholders are retained and remain committed, clinicians and/or managers perceive clear benefits of the	Lovarini (2012) conducted interviews with various stakeholders in a falls prevention initiative implemented in diverse community organizations. The authors found that several organizations required a number of conditions to continue to deliver the falls prevention program (O). These include stakeholders who are committed to the clinical practice, clinicians and/or managers percieve clear benefits of the clinical practice and that it is superior to alternatives, and that there is sufficient demand from patients for the clinical practice (where	Figure 8.1 Lovarini 2012, page 155 "In response to changing circumstances, organisations needed to use a variety of strategies to enable the program to continue. For example, at Rural Food Services, a physiotherapist from the local government funded health service was available for their first program but not for subsequent programs. To enable their second program to proceed, additional program funds were made available by the service manager enabling a local physiotherapist from the private sector to be engaged" (Lovarini 2012, page 155) "In summary, for the program to be sustained, the program must offer

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	evidence-based practice over others, and there is sufficient demand from patients for the practice (C), which results in the evidence-based practice continuing to be delivered by the organization (O) because both the clinicians and managers recognize the advantage and alignment of the practice (M).	applicable) (C). These contextual factors allow for both manager and clinicians to recognize the value and importance of the clinical practice (M). Strategies including tailoring strategies to the local context and promoting adaptability faciltated this process. Lovarini 2012 - 1.5 years Christie et al 2021 - 2 years Hoekstra et al 2019 - 20 months Shubert et al 2011 - 1 year	ongoing benefits and value to the organisation and the people associated with it. The program must not conflict with the nature of the service provided by the organisation and must offer advantages over other programs." (Lovarini 2012, page 178) "The Program was Sustained If the conditions necessary for program sustainability were met then the program was sustained. Urban Community Health implemented many programs over a number of years and intended to keep the program going. For Urban Community Health, the program would be sustained providing it was valued by the organisation and given the same "status" as other services, there were enthusiastic staff trained in program implementation and there was ongoing support for the program from management as well as local community-based organisations, with whom they had developed program partnerships." (Lovarini 2012, page 192-193) "Group-based programs enabled CIMT to be offered to multiple people using existing resources, as one participant explained: So it's a group setting with four patients .. . We tried the one-to-one too, but at first it's more demanding, if you think about resources. So initially we are always a physical therapist and an occupational therapist supervising these four patients.. . then, depending on how good the patients are able to perform the training by themselves, we can be one [or] one and a half therapists for four patients (Participant 4)" (Christie et al 2021, no page #) "Although maintenance of the core components of CIMT is critical to the delivery of effective programs, adaptation beyond the traditional face-to-face, one-to-one, two-week model must be considered. To sustain program delivery within existing resources, participants in this studydescribed a range of CIMTdelivery models including group-based programs, individual therapy and student supported models." (Christie et al 2021, no page #)

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			"The received counseling was diverse as illustrated by the constructed profiles. Interestingly, the “counseling as intended” profile included only 6.6% (N=113) of the patients indicating that the majority of the patients did not receive counseling according to the original protocol (i.e., four telephone-based sessions)" (Hoekstra et al 2019, page 9) "The plan was to translate the original SASA intervention “as is”. In the process of translating the research intervention into a sustainable community-based program, numerous adaptations were necessary to facilitate adoption and implementation of the program with fidelity by the site" (Shubert et al 2011, page 513)
11	When building a coalition has facilitated resource sharing (S) then there is management support and adequate resources (C) resulting in the evidence-based practice remaining financially viable (O) because the available resources have been allocated appropriately and the key clinical practice processes are defined by the	Lovarini (2012) conducted interviews with various stakeholders in a falls prevention initiative implemented in diverse community organizations. Stakeholders of one community health organization reported that they had adequate resources, equipment and space for the falls prevention program (C) because they had built strong partnerships with other organizations in the area, facilitating resource sharing. This allowed them to continue the program for at least 1.5 years post-implementation because the stakeholders collectively defined the process of the clinical practice and agreed upon the resources they were willing and able to contribute (M). In this way, no stakeholder was over-extended or over-burdened.	"10.10 Having a Program Network Developing networks and working in partnership with others were important strategies used by organisations to sustain the program. The experiences of Urban Community Health highlight this finding. 10.10.1 Working in Partnerships Urban Community Health has implemented many programs since 2007 and intend on sustaining the program. While management support for staff time and training was vital, other sources of funding and resources have contributed to the sustainability of their program. Partnerships with local community organisations such as Councils, Registered Clubs and Neighbourhood Centres have resulted in additional funding and resources that have enabled the program to not only continue over time but continue at low cost. These types of partnerships have resulted in a variety of ongoing support for the program such as: access to venues at no cost, access to community transport services, funds for program equipment and refreshments, free use of laptop computers and data projectors and assistance with marketing and promotion of the program." (Lovarini 2012, page 195) "Tracey, the program co-ordinator, summarised the situation at Regional Community Health well:

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	key stakeholders (M).	Lovarini 2012 - 1.5 years Perez et al 2016 - 1 year Santa Mina et al 2012 - 1 year Teriö et al 2019 - 1 year	I believe it [the program] is sustainable because we are ongoing and we are sustaining it and it's not costing us lot of money. The girls are all trained, they're quite enthusiastic about delivering it, it's getting the punters [older people] in the door and we're doing that through the hospital and our advertising in the community, and yes we'll run at least two a year while the numbers remain the way they are. " (Lovarini 2012, page 160) "The cost of having an experienced clinician was considered to be a very important and a necessary way of assuring therapeutic value of the games and cooperation by the rest of the team members in referring patients. The cost for this part-time clinician to work an additional ½ day/week was absorbed by the program. A knowledge translation research grant helped support the initial costs of the additional staffing for the remaining hours of the game's room was operational. A more sustainable solution was then found. A cost-effective use of kinesiology students who require clinical placements and internships was realized" (Perez et al 2016, no page #) "Research—through hypothesis generation and testing, and the provision of pilot data for research funding opportunities—is the driving force behind the [Survivorship Exercise Program]" (Santa Mina et al 2012, page e137) "One OT said: "It can really work, it can, this is very good, ah this is a good, a very good approach to rehabilitation, you see and can really, very, it's very cost-effective […], all we need is a calling and a phone." (Teriö et al 2019, page 9)
12	When building a coalition has facilitated resource sharing (S) then there is	Cramm et al (2013) surveyed members of 21 partnerships who implemented community care programs in Holland up to four years earlier. Regression analysis demonstrated that continued intervention activities as assessed by a measure	"findings suggest that the sustainability of innovative programmes in community care is achieved more readily when synergy is created between partners. Synergy was more likely to emerge with boundaryspanning leaders, who understood and appreciated partners' different perspectives, and could bridge their diverse cultures and were

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	management support and sufficient non-financial resources for the evidence-based practice (C), resulting in the continued use of the practice by clinicians (O) because the human resource needs of the clinical practice can be divided between stakeholders who are working together to operationalize the practice (M).	created by Slaghuis et al 2011 (O) was positively influenced by leadership support (b = 0.32; P < 0.001) and availability of non-financial resources (b = 0.25; P = 0.008) (C). Using results from a validated measure, the authors identified that partnership synergy acts as a mediator or this relationship (b = 0.39; P < 0.001). Using a realist lens informed by the theories underpinning this review, this result indicates that stakeholders acting in partnership are able to divide the human resource needs amongst themselves (M1) as they interact with one another effectively (M2) as part of a collaborative coalition supporting the sustainment of the community care program (O). "Synergy is the degree to which the partnership combines the complementary strengths, perspectives, values and resources of all partners in the search for better solutions (Gray 1989, p. 5), and is generally regarded as the product of a partnership (Lasker & Weiss 2003). The synergy that a partnership can achieve is more than simply an exchange of resources among its partners. Theoretically, when partners effectively merge their perspectives, knowledge, and skills to create synergy, they create something new and valuable"	comfortable sharing ideas, resources and power. In addition, the acknowledgement of and ability to use members' resources were found to be valuable in engaging partners' involvement and achieving synergy in community care partnerships." (Cramm et al 2013, page 209) "Partnerships that are capable of creating synergy among members are more likely to achieve sustainability, thereby meaningfully contributing to the delivery of health and social services in the community and the improvement of population well-being."(Cramm et al 2013, page 213) "Essential to the success of the program was the PT/OT leadership that created multidisciplinary involvement." (Sigler et al 2016, page 343)

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		Cramm et al 2013 - approximately 4 years post-implementation Sigler et al 2016 - 1 year	
13	If new healthcare policies increase the complexity of the evidence-based practice (e.g. as a result of healthcare crises such as the COVID-19 pandemic) but there remains a sufficient patient demand (C), then organizations will continue to deliver the practice (O) because clinicians and managers still perceive the value, importance and benefits of the adapted practice (M) when adaptations to conform to new regulations are made (S).	Yang et al (2021b) conducted a mixed methods evaluation based on RE-AIM to estimate the effectiveness and explore the process of the virtual GRASP program (upper limb rehabiliation) delivered by a community centre and non-profit via videoconferencing for stroke survivors. A previous study from 2019-early 2020 reported the implementation and short-term maintenance of the in-person GRASP program by these organizations (Yang et al 2021a). The major healthcare policy changes as a result of the COVID-19 pandemic made a shift to virtual delivery necessary, adding complexity to the evidence-based practice as instructors had to learn to deliver the program via a new medium and the organization had to update recruitment and screening procedures. Although recruitment was noted to take longer than expected, a sufficient number of participants were recruited from a wode-ranging geographical are (i.e. beyond the regional boundaries expected from an in-person intervention) (C). The organization has continued to deliver the program, as authors report that 10-week classes have been delivered twice over a period of 8 months since the virtual implementation supported by the research team was delivered (O) because clinicians perceive that there are still benefits to the adapted virtual practice compared to the in-person practice. In	"The GRASP community program consisted of ten weekly one-hour group classes and individualized homework exercises. The organization had delivered the inperson GRASP community program in a local community center since April 2019. However, due to the COVID-19 pandemic and related policies for social distancing, the organization decided to adapt the in-person GRASP community program into a virtual program (ie, virtual GRASP program) delivered via videoconferencing." (Yang et al 2021b, page 7 (pre-print)) "The champion meetings, continued adaptations of clinical tools, and electronic resources for PAPT users were sustained through healthcare staffing changes (including champion transitions), as well as less common changes such as moving facilities and a pandemic." (MacDonald et al 2021, page 10 (pre-print)) ESCAPE Pain: Covid-19 support webpage

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		fact, clinicians noted that in some ways virtual is superior, such as reaching people who ordinarily would have had constraints reaching the physical location. Yang et al 2021b - 10 months MacDonald et al 2021 - 3-4 years	
14	If there are committed managers and other key stakeholders within and external to the organization (C), advisory boards, workgroups and/or a coalition can be enacted (S) to incorporate and provide access to key individuals so clinicians will believe it is right for them to be involved and take ownership of the evidence-based practice (M), resulting in organizations continuing to	In one in a series of studies on ReSpAct, an intervention to increase physical activity promotion in rehabilitation services in the Netherlands, Hoekstra et al (2017) aimed to identify professionals' perceptions of factors that facilitate or hamper the implementation and continuation of the program. Interview respondents noted several facilitating factors, but Hoekstra and colleagues particularly stressed collaboration amongst the clinical team within the organization, and with external local and national partners (C) as key for the continuation of the physical activity promotion program by organizations 20 months post-implementation (O). The authors suggested that this context may have triggered a sense of local and nationwide ownership of the intervention (M) due to key strategies the implementation team had used, including building a coalition and using advisory boards and workgroups, which brought the key local and national partners in contact with clinicians. In other words, the direct involvement and access to key stakeholders encouraged clinicians to percieve that it is right	"In line with previous literature [27,39] we found that good communication and collaboration between members of the multidisciplinary team (e.g. sports therapists, physiotherapists, physicians) during implementation seems also essential for successful continuation. Again, 'local ownership' may facilitate this process." (Hoekstra et al 2017 'Professionals' perceptions ' page 96) "To overcome future barriers, professionals suggested continuing the nationwide collaboration among organizations. Again, to ensure the continuation of this collaboration, a (group of) professionals or a foundation should be responsible for this. In the same way, a 'nationwide ownership' should be established." (Hoekstra et al 2017 'Professionals' perceptions ' page 96) "Facilitating factor - Socio-political context: 1) Collaboration among organizations stakeholders in rehabilitation care at national level [and] 2) Collaboration with and (financial) support from the local municipality" (Hoekstra et al 2017 'Professionals' perceptions" page 87) "The implementation of [ReSpAct] is supported by the Netherlands Society of Physical and Rehabilitation Medicine. This society has established an accredited working group on exercise and sports that aims to integrate exercise and sports into the rehabilitation in order to

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	deliver the practice (O).	for them to incorporate physical activity promotion into their practice, and take ownership of the program. Hoekstra et al 2017 'Professionals' perceptions - not reported Hoekstra et al 2014 - protocol Hoekstra et al 2019 - 20 month Sigler et al 2016 - 1 year Gramlich et al 2020 - 4 years	support an active lifestyle in persons with a disability during and after the rehabilitation period, which is in line with the aims of the RSE programme. Consequently, the dissemination of the [ReSpAct] programme in 18 Dutch rehabilitation centres and hospitals has large potential to be successful." (Hoekstra et al 2014 page 11) "The national coordinators were able to create a culture in Dutch rehabilitation care in which rehabilitation professionals believe in the idea to integrate physical activity promotion in Dutch rehabilitation care and experienced the need to collaborate with each other on national-level [34]." (Hoekstra et al 2019, page 8) "Overall, it was found that the [Advanced Musculoskeletal Physiotherapy] Program has strong support from other departments, including nursing, orthopaedics and allied health – a key requirement for the sustainability of the program." (PricewaterhouseCoopers Australia (PwC) for the Department of Health and Human Services Victoria 2015, page 41) "Essential to the success of the program was the PT/OT leadership that created multidisciplinary involvement. The leaders ofthe MICU PT/OT team actively involved nurses, respiratory therapists, and physicians when addressing mobilization. This active involvement strengthened the trust and understanding among the different disciplines and enhanced the mobilization process (Alisha Turner, Assistant MICU Director, oral communication, March 1, 2015). In addition, new staffmembers in the PT/OT departments who rotated through the MICU were educated by PT/OT leadership about this program." (Sigler et al 2016, pg 343) "Identify champions on the unit who will continue to promote mobility and motivate staff to continue with the intervention activities" (MOVE Sustainability strategy recommendations webpage)

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			"The primary lesson learned is that it is essential to have the collegial support and commitment of oncologists to drive the development of this type of survivorship programming. The sep has benefitted from significant personal and professional investment by several oncologists and nurses—investments have lent gravity to the program within the administration." (Santa Mina et al 2012, page e141) "In order to plan for and to succeed at sustainability, leaders must balance resources used for ERAS with benefits, reinforce practice changes, identify competing change initiatives, identify consistent expectations around ERAS as standard of care, and establishment of core data sets and a plan for audit of practice. Based on the interviews, the role of leaders evolves during the implementation to sustainment process." (Gramlich et al 2020, page 4) "The role of leaders in sustaining ERAS was to reinforce positive outcomes attributed to ERAS, and to make decisions that indicated ongoing, consistent support of ERAS becoming standard AHS practice." (Gramlich et al 2020, page 4)
15	When a formal implementation blueprint is collaboratively developed based on a readiness assessment, and ongoing audit and feedback are used (S) to create an environment where clinicians and senior management are committed to the	Moore et al (2020) conducted a longitudinal study amongst stroke inpatients in a single rehabilitation hospital to assess the effect of a multi-component implementation intervention on clinician use of three standardized outcome measures, and its effect on clinician perceptions and the organization. The authors highlighted the use of sustainability specific strategies including the use of a collaborative approach to develop a formal implementation blueprint based on readiness assessments, and ongoing audit and feedback to monitor adherence in relation to the goal of 85% measure use as particularly important to the sustained use	"Audit and feedback was frequently used, which alone results in modest improvements in clinical practice.35 Although the critical elements of audit and feedback are unknown, the intervention included components that may increase its effectiveness, such as feedback by a supervisor or respected colleague, frequent feedback, specific goals, and action-plans (85% adherence and codevelopment of KT interventions to target reported barriers).36" (Moore et al 2020, page 7) "We successfully implemented the assessment battery with high levels of adherence to recommendations, likely because of using the bundle of knowledge translation activities, facilitation, and use of a framework to codevelop the plan. These changes in practice were sustainable, as determined by a 4-year follow-up. " (Moore et al 2020, page 1)

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	evidence-based practice and are exposed to demonstrated evidence of its benefits (C), then the practice will continue to be used by clinicians (O) because senior management will provide the necessary resources and make procedural decisions for the clinical practice that ensures its integration into the normal clinical workflow so clinicians have confidence in their ability to perform the evidence-based practice (M).	determined via clinical chart audits at 4 year follow up (O). This is because these strategies created an environment in which internal stakeholders at all levels of the organization including clinicians and senior management are committed to the clinical practice and are exposed to demonstrated evidence of its benefits (C), which encouraged senior management to provide the necessary resources for the practice and make decisions surrounding the policies and procedures for the clinical practice that ensures its integration into the normal clinical workflow, such as formally including the use of these measures in job descriptions, in the electronic medical record and in yearly performance appraisals (M1). According to surveys completed by clinicians, they had greater confidence in their ability to perform the clinical practice throughout implementation and sustainability phases (M2) Moore et al 2020 - 4 years Gustavson et al 2021 - 4-6 month Hanson et al 2011 - N/A Ford et al 2015 - 3 years	"First, we aim to seek multiple stakeholder inputs (eg, patients, administrators, and other health care providers) throughout the implementation to better address concerns with understanding of the proposed practice change, adoption and modification of high-intensity resistance training, and communication barriers.35 A second implementation strategy is to perform regular check-ins with the therapists and follow-up training sessions, as needed, to enhance self-efficacy to administer evidence-based practice in the SNF. " (Gustavson et al 2021, page 117) "Where the stakeholders' actions led to a change in procedure, institutionalization occurred.8,27 Institutionalization took place at Site 1 when the painting of pavement kerbs to identify a change in height was taken over by the city works department as a routine part of their pavement marking renewal process each year. In a similar fashion, when stakeholders' actions led to a change in existing policy, routinization occurred.17 When an organization in Site 3 changed their policy to routinely supply a medication side-effects printout when consultations resulted in the prescription of a medication known to place patients at risk of falls, the policy change became a part of this organization's day-to-day practice." (Hanson et al 2011, page 529) "Participation in the change process was related to staff involvement and staff attitudes indicating that staff was involved in the implementation of the FCM and felt empowered by that participation. Their participation helped staff understand the benefits of the FCM (credibility) and see that resources were made available and procedures modified as needed to support implementation of the FCM (infrastructure)." (Ford et al 2015, page 6)
16	If the evidence-based practice is an expected part of duties due to the	Kavanagh et al (2020) conducted a qualitative descriptive study using semi-structured interviews and observation to identify barriers and facilitators to sustaining functional	"Integrating FMI interventions and communication processes within usual operations was felt to aid implementation and sustainability: Geriatrician 3 (Q4, Initiative A): "… [interventions] became an order in the computer. They were ordered [by nurses] into the computer

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	benefits it has for the organization (C), then the organization will continue to deliver the practice (O) because the labour has been adequately divided to fit the workflow of clinical teams (M) when the practice is adapted and strategies are tailored to the local context (S).	maintenance programs for hospitalized older adults. The authors reported that if functional maintenance programs had become an expected part of duties due to the benefits it has for the organization through reduced patient length of stay, for example (C), then the organization will continue to deliver the maintenance program (O) because the labour has been adequately divided up to fit the workflow of clinical teams (M) when strategies such as promoting adaptability and tailoring strategies are used. In this case, fitting protocols for the functional maintenance program into routine paperwork and rounds fit the clinical workflow well. Kavanaugh et al 2020 - not reported Lovarini 2012 - 1.5 year Mann et al 2020 - 26 months	system… So the CNAs (nursing assistants) would also have it [printed] on their worksheets… That was very useful." Geriatrician (Q2, Initiative D): "… when they (clinical team) would do their walk-around rounds, they always asked specifically about mobility (the initiative's target). So it's very much about understanding what the opportunities are on the units and then fitting it in." (Kavanaugh et al 2020, page 3812) "For many organisations, there were wider benefits associated with implementing the program. Polish Services for example felt that the program offered an opportunity for the organisation to gain greater recognition and exposure: Plus in, in addition I guess you know because it's a research program, for us as an organisation it's also um it's, it's a good exposure of what we do, you know in, in eh among other service providers and it, it brings up also its good also in negotiations for future fundings that we are involved with this type of projects so we are not just service deliverer but we also you know can, can contribute on other levels you know the research level as well. And it gives the community's needs also a bits of wider uh recognition and you know and exposure. Agnieska, Service Manager" (Lovarini 2012, page 169) "We never used functional outcome scales previously. We now use the patient-specific functional scale. It helps us in formulating goals: Now we focus more on needs of the patient rather than just the physiotherapist's expectations. Using the PSFS has also helped us with our clinical decision making. If a patient is progressing, we continue with the same treatment, but if they are not, then we change the treatment. —Respondent The staff now uses the PSFS to help assess patients and form goals. We now measure goals more quantitatively, like timing how long a patient can stand. —Respondent The physios now use the PSFS with each initial evaluation. It helps

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			with discharge planning and progression ofthe patient. —Respondent" (Mann et al 2020, page 601)
17	If patients and clinicians perceive a receipt of benefits, and there are adequate financial resources and/or a viable business model for the evidence-based practice, then even if the practice is considered complex (C), it will be continued by the organization (O) because clinicians recognize the value and importance of the clinical practice (M) when positive patient or family feedback is obtained (S).	Liddle et al 2018 explored how physiotherapists, occupational therapists, exercise physiologists and podiatrists were sustaining fall prevention practice in primary care and the factors that influenced their fall prevention practice. Via interviews, clinicians reported that they perceive benefits for patients and for themselves, and believe they have adequate resources for the fall prevention program, even though they recognize there are program complexities related to interdisciplinary collaboration and communication (C). In this context, the clinicians continued to deliver the fall prevention program for up to 18 months (O) because both the clinicians and patients recognize the value and importance of the clinical practice (M). This information was obtained through receiving informal feedback from patients, often related directly to clinicians. Christie et al 2021 conducted an interpretive description study to identify individual, organizational and social factors enabling implementation and sustained delivery of Constraint-induced movement therapy (CIMT) programs internationally. The authors reported that both clinicians and patients saw the benefits of the program, including altering patients' lives noticeably (C). This resulted in clinicians continuing the deliver the program for at least 2 years post-implementation(O) because both the	Figure 1 pg 4 (Liddle et al 2018) "Positive outcomes led in some instances to ongoing community demand for CIMT. Four participants working in the private sector described how people in their local community heard about CIMT programs being offered and the positive outcomes achieved, and this generated interest and ongoing demand for programs; People contact me from all over the place.. . so there's definitely a demand. Word of mouth... so I do get quite a few .. . recommendations from patients to other people.. . It's actually getting busier rather than staying the same (Participant 1)." (Christie et al 2021, no page #) "Participants who used a group-based model for CIMT delivery also explained that they saw additional benefits for CIMT participants, including peer support which increased participant motivation and adherence during the program and supported their recovery: One big advantage of the group setting is the patients are talking.. . I think it's easier to motivate each other.. . Because if you're sitting alone, one-to-one, it's maybe more dependent on the relation between therapist and the patient.. . I think in a group setting it's: "You have done this good!". You get feedback from other participants.. .There are opportunities for a lot of good discussions about personal experience regarding coping with reduced upper limb function: "How do you do this at home?" .. . And they're talking about both motor problems and maybe also social problems.. . I think the patients have to take more responsibility for their training in the group setting. They are less dependent on the therapist... They know what to do when they're at home, more than in the one-to-one setting (Participant 4)." (Christie et al 2021, no page #) "Participants also discussed that seeing positive upper limb outcomes,

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		clinicians and patients recognize the value and importance of the clinical practice (M). This information was obtained through receiving informal feedback from patients, often related directly to clinicians. Liddle et al 2018 - 3-18 months Christie et al 2021 - 2 years Cramm et al 2014 - 2 years Harrison et al 2015 - 6 months Hoekstra et al 2019 - 20 months Lovarini 2012 - 1.5 years Molfenter et al 2009 - not specified Peel et al 2010 - 1 year	and the subsequent impact on a person's return to valued roles and activities, were motivators that influenced their decision to continue offering CIMT: I had a patient.. . he got home.. . he was excited... he went and pursued getting a driving evaluation and that's after five years of having almost no change in his life. But then [following the program] he had a resurgence of just feeling like he actually could start living again. That's rewarding (Participant 2)." (Christie et al 2021, no page #) "The ability of professionals to effectively improve quality of chronic care delivery as a result of the disease management approach is expected to have positively influenced professionals' views on this approach making them more motivated to change their old ways and making the new working method part of their daily routine practice." (Cramm et al 2014, page 152) "Affective commitment to change assesses staff perceptions about their desire to support the change based on a belief in its inherent benefits [24]. In this study, it is correlated with staff perceptions that the implementation of the FCM would improve efficiency (benefits)" (Ford et al 2015, page 6) "PT4: "It's definitely beneficial. I mean you see the difference just through the … through the weeks that we trained them and the patients do notice and they comment that they notice a big difference."" (Harrison et al 2015, page 6) "all testified to the benefits of balance training for patients with COPD. This positive view may, in part, have been attributed to the feedback provided in the form of patients' pre and post brief BESTest scores which served not only to inform the content of the program but to demonstrate areas of balance on which the training had an effect" (Harrison et al 2015, page 7)

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			"Professionals and patients were positive about the program. Sixteen institutions (89%) formally agreed to continue the program. " (Hoekstra et al 2019, page 1) "This study demonstrated that after a three-year program period, the "Physical Activity Counseling Centers" were sustainably implemented in Dutch rehabilitation care. The multifaceted implementation strategy, including financial incentives, intensive MI training courses and advisory support, might have contributed to these successful and promising findings. The positive experiences from both professionals and patients as well as patients' increased physical activity levels after rehabilitation show that "Physical Activity Counseling Centers" are a promising strategy in the connection of rehabilitation care and community-based physical activities" (Hoekstra et al 2019, page 7-8) "Rachel found that the program was well-received by some program participants: I saw a couple at the Christmas party...our community lunch activity...and I asked how they were and they said "excellent, thanks to you. We're still doing our exercises". There's one older lady and I see her still walking briskly around the neighbourhood. She gained great improvement and said that after three months, she could now walk up the steps of the railway without hanging on, and felt quite confident with that. While Rachel felt that not all program participants would claim such benefits, the positive responses from some program participants, gave her sufficient motivation to plan for a second program in 2008 and a desire to continue the program in 2009" (Lovarini 2012, page 159) "Several clinicians noted that the sEMG biofeedback therapy allowed them to appreciate change over time in the form of gradual improvements in patient performance across sessions. Importantly, one clinician commented that working with this technique gave her "hope" for the patient and instilled in her the impression that there was "true rehabilitation potential." In this respect, the motivation derived from

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			receiving performance contingent feedback in a treatment session was experienced not only by the patient but by the clinician responsible for providing verbal encouragement to the patient. (Molfenter et al 2009, page 86) "The evidence from key stakeholder interviews in the initial phases of project implementation highlighted the lack of local readiness and capacity, especially in the acute sector, to undertake falls prevention. The prior falls prevention activities may not have been sufficient (due to limited resources and capacity) and the health provider characteristics, organizational context and the attitudes held may not have been conducive to effectively translate evidence-based policy into practice. Requesting sectors to work across the health continuum requires major collaboration and an organizational change process. The project initially encountered strong resistance, when sectors were unable to see the benefit of working outside their own area and felt the need to 'get their own house in order' first." (Peel et al 2010, page 1258)
18	If the evidence-based practice aligns with organizational priorities (C), then the evidence-based practice will continue to be delivered by the organization (O) because clinicians understand the value, benefits and importance of the clinical practice (M)	Bailes et al (2019) conducted a mixed methods evaluation to describe the implementation and sustainment of documentation of dose (frequency, intensity, timing, and type of intervention) for PT Cerebral palsy treatment sessions into the EMR system by occupational therapy clinicians in one pediatric medical centre with 8 outpatient clinics. The authors reported that the appropriate document would continue by the organization for 6-8 months post-implementation (O) if the organization continues to prioritize the practice (C) because clinicians understand the value, benefits and importance of the clinical practice (M) when strategies such as quality monitoring and	"The care process model has been linked to improved outcomes for patients (see Measuring effectiveness of the care process). The authors have shared care process protocols, data collection tools, and management strategies to bring about lasting changes. At a more global level, the authors have shared some of their experiences with fellow members of the Institute for Healthcare Improvement's 100K Lives Campaign. They also have presented some of their results in national forums [22,23] and are beginning to publish them in peer-reviewed journals [19]. These successes are shared with staff, fostering pride in collective accomplishments." (Hopkins et al 2007, page 89) "Sustainability enablers: Engagement of stakeholders, Alignment with national and Victorian health reform initiatives, Incorporating the workforce project into standard practise" (PwC Advanced Musculoskeletal Physiotherapy Report 2015, page 14)

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	when quality monitoring is used to facilitate the relay of clinical data to clinicians (S).	facilitating the relay of clinical data back to clinicians are used Ford et al (2015) assessed the sustainability of the Family Care Map, a family-centered approach to providing care for Veterans with polytrauma-related injuries, in four Department of Veterans Affairs Polytrauma Rehabilitation Centers. They noted mixed sustainability results across sites and between different core components of the clinical practice. Specifically, they found that core components related to documentation and measurement of the Family Care Map were not sustained by organizations (O). The authors suggested that this would hinder the ability of organizations to use data for quality monitoring and/or relaying clinical data back to providers, and may indicate that other components of the clinical practice may not be continued in the longer term. Hopkins et al 2007 - 3-5 years PwC Advanced Musculoskeletal Physiotherapy Report 2015 - 6 months Bailes et al 2019 - 6-8 months Christie et al 2021 - at least 2 years Cramm et al 2014 - 2 years Ford et al 2015 - 3 years Hoekstra et al 2017 - (implementation) Hoekstra et al 2019 - 20 months	"The frequent feedback and data about the services delivered to children with CP provided impetus for ongoing engagement. This included informal data sharing, formal staff meeting presentations, and positive recognition of team members, as improvements were made and sustained across each location. (Bailes et al 2019, page 239-240) "Another unintended, but positive, consequence was that therapists identified a desire to use this standardized system for all patients on their caseload, not only those with CP." (Bailes et al 2019, page 240) "Participants also discussed that seeing positive upper limb outcomes, and the subsequent impact on a person's return to valued roles and activities, were motivators that influenced their decision to continue offering CIMT: I had a patient… he got home... he was excited... he went and pursued getting a driving evaluation and that's after five years of having almost no change in his life. But then [following the program] he had a resurgence of just feeling like he actually could start living again. That's rewarding (Participant 2" (Christie et al 2021, no page #) "The ability of professionals to effectively improve quality of chronic care delivery as a result of the disease management approach is expected to have positively influenced professionals' views on this approach making them more motivated to change their old ways and making the new working method part of their daily routine practice." (Cramm et al 2014, page 152) "Staff perceptions related to benefits, credibility, staff involvement, and staff attitudes are significantly correlated with staff beliefs that the ideas in the FCM have been integrated into standard practices within the PRC (item H in Table 3)" (Ford et al 2015, Page 7) "While the care teams are more family-centered, only some practices

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		Hopkins et al 2007 - 3-5 years Liu et al 2013 - 5 months	associated with the FCM are being widely implemented. For example, respondents indicated that each PRC [Polytrauma Rehabilitation Center] routinely assigns a staff point of contact, incorporates family goals for the patient into their treatment plan, and posts goals in the patient's room. These findings suggest that these practices have become standard practice—an important aspect of sustainability [29–30]. However, several practices (see items 7–10 in Table 4) related to the documentation or measurement of the FCM have not been widely adapted. For each practice, only 34 to 54 percent of the staff indicated that these practices were being done in their PRC. Research indicates that ongoing measurement and feedback or issues associated with measuring the effect of change serve as both facilitators and barriers to sustainability of change in a quality improvement collaborative [16,31–36]. The absence of such documentation or measurement could be an indicator that practices may not be sustainable over the long run, especially if new staff do not receive an orientation to the FCM." (Ford et al 2015, Page 10) "A commonly mentioned facilitating factor for both phases was the fact that the content of the RSE programme was in line with the organizations' vision and/or wishes" (Hoekstra et al 2017, page 15) "During the three-year period, rehabilitation professionals were actively supported and motivated which gave the opportunity to experience the added value of the "Physical Activity Counseling Center" in rehabilitation care [34]. As a result of their positive experiences, it is possible that the professionals became internally motivated to continue the RSE program" (Hoekstra et al 2019, page 8) "Along with the RICU projects, the posted data from outcome measures, so that staff can link projects directly with results. The staff is educated regarding the stepwise process of transformational change and their ability to see the larger picturedhow change in care can improve outcomesdis increasing. The changes brought about by the

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			care process model resulted in a RICU staff view of ‘‘that’s the way we do it here in RICU,’’ so that these new approaches are institutionalized on the local (RICU) level." (Hopkins et al 2007, page 89) "One of the other goals of this project is work with participating sites to develop a measure for assessing mobility that can be easily incorporated into paper and electronic medical records that are not too onerous for healthcare providers to use; its development will facilitate sustainability of this strategy." (Liu et al 2013, page 6) "An interesting finding, as reflected in the theme “Developing a mutual occupational therapy culture”, is the fact that the group established a culture where the improvement work became an integrated part of their practice. These findings suggest, in line with others (23), that not only did the use of theoretical knowledge become sustainable but also the improvement of practice in itself, something that ensures the continuous implementation of (updated) evidence-based OT practice." (Sirkka et al 2014, page 96)
19	If the evidence-based practice aligns with organizational priorities and has become an expected part of clinical duties (C), then it will continue to be delivered by the organization (O) because key participants bought into and took ownership of the	Both Sutton et al (2018) and Herbert et al (2017) reported on the results of qualitative interviews concerning the implementation and sustainability of the Enhanced Recovery After Surgery (ERAS) program. The authors reported that the prioritization of ERAS made the clinical practice an expected part of clinicians duties (C), which helped sustain the delivery of ERAS by the organization because clinicians bought into and took ownership of the ERAS program (M1), when key participants worked continuously to drive them forward and keep clinicians engaged (M2) when strategies such as identifying and	"What provides a supportive environment [for sustainability]? 1) Leaders’ pride in outcomes and confidence that ERAS practices will be standard AHS practice, 2) Explicit resources sustainability plan, 3) Establish core dataset; align with AHS data collection; assess skillset required for data management" (Gramlich et al 2020, pg 5) "Program champions are important to implementation and long-term sustainability. During all program stages (planning, implementation and sustainability) it is important to have one or more key individuals driving the program forward. A program champion can gain support for the program within the organisation (with staff and management), and outside the organisation (other stakeholders and clientele). The aim of the champion is to keep the program moving forward" (Hill et al 2011, page 24)

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	practice and are continuously working to drive it forward (M) when clinical champions and other leaders are recruited (S).	preparing clinical champions, or recruiting and training for leadership are used. Gramlich et al 2020 - 1-4 years Herbert et al 2017 - not reporte Sutton et al 2018 - not reported	"Engagement with the ERAS programme was attained through both bottom-up influences of enthusiastic clinicians who evolved into ERAS leads or 'champions' for the programme, and top-down pressure from the trust." (Herbert et al 2017, pg 4) "…there was some bit ofprotected time given to some of the thoracic staffto take some time out and that'show it got so micro-managed and how it got so embedded in thoracics. (NUR/AHP-CO-24)" (Herbert et al 2017, page 6) "Cohesive, visible leadership of the programme amongst the consultant medical staff was considered to be a key facilitating factor for successful implementation: I think the most important person to have really signed up and really driving it forward is a consultant surgeon who's taking the lead for a particular area. (NUR/AHP-CC-4) Having leadership at the nursing level was reported as being equally important to be able to drive the programme forward on the ward. The vision for many was for ERAS to be nurse-led: Arguably, just as important, from the nursing perspective, is making sure that you've got senior members ofthe nursing team that are able to sort of push it forward, as well. Because … the day-to-day running ofERAS is very much down to the nursing staffon the ward. (NUR/AHP-HN-10) .. it would be nice ifoverall nurses would realise that this is something that they deliver and it's extremely important for the patients' recoveries. It's probably more important than the surgery itself. Um, and they should take it as an ownership ofit. (SUR/ANS-TH-14) " (Herbert et al 2017, pg 5) "The development of that shared investment in ERAS hinged on the role ofenthusiastic clinicians or nursing staff who had evolved into 'leads' or 'champions' and secured initial buy-in for the programme (cognitive participation: enrolment):

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			I think the strongest factor is, erm, sort of a senior member of the team with a really key interest in that as an area. So for instance in thoracic surgery, I'm not sure about all the consultants, but there's at least one consultant that is very keen–was very keen—to implement it, and was very keen to push it forward, and very keen to maintain it, as well. (NUR/ AHP-CC-4) The crucial work of these 'champions' was seen to have been enacted alongside top-down pressure from the Trust" (Sutton et al 2018, page 8)
20	Especially if there is turnover in an organization, ongoing training is needed (S) to signal that the evidence-based practice is an expected part of duties (C) so that clinicians continue to feel confident in their ability to perform the practice (M), resulting in continued expertise amongst clinicians (O).	An evidence-based home safety fall prevention intervention was implemented in Australia (Clemson et al 2014). Even though the intervention became an expected part of duties for every OT, clinicians and program managers reported in interviews that any level of turnover (C) threatened the continued organizational capacity for the clinical practice (O). In alignment with suggestions from interviews, study authors recommended conducting ongoing training to sustain organizational capacity for the falls prevention program (O). Authors note that following the study, a falls prevention clinical champion emerged who is conducting ongoing workshop sessions in one of the regions under study. Gramlich et al (2020) suggest the use of ongoing training to maintain capacity capacity for a clinical practice (in this case Enhanced Recovery After Surgery) works because clinicians are able to continue to feel confident in their ability to perform the practice (M)	"When all occupational therapists in the services provided the intervention this enhanced the potential for retaining skill and knowledge within the local area. But there is still a need, particularly in areas of higher staff turnover, to build and pass on 'corporate knowledge.' This requires mentorship and continued access to training. The alternate delivery approach of specialisation had a positive outcome in terms of the emergence of a falls champion from the project who is continuing to provide workshops across the state" (Clemson et al 2014, page 332) "Increased capacity: At the individual level, acquiring or improving the knowledge or skills of community members; at the community level, gaining community resources such as trained people, new equipment or facilities. 'I personally took the facilitator training for the [exercise programme] so that I can provide ongoing training within our community.' (Site 3, Participant 12)" (Hanson et al 2011, page 528) "Once the initial competency of the physiotherapist, measured against the competency standard, has been established, a plan for ongoing learning and competency should be developed, together with their mentor and/or clinical supervisor...Ongoing competency in the current healthcare climate may also involve elements of: implementation of learning and assessment processes to address specific learner needs, for

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		Clemson et al 2014 - 18 month Hanson et al 2011 - N/A AMP Clinical Education Framework - N/A Gramlich et al 2020 - 4 years Sirkka et al 2014 - 10 years	example, lack of confidence due to infrequent exposure to specific conditions/procedural skills, or lapsed currency of practice following an extended break from clinical practice." (AMP Clinicial Education Framework 2014, page 25) "What sustains ERAS capacity? Ongoing need for continuous education (e.g., as staff changes)" (Gramlich et al 2020, page 5) "To spread and sustain ERAS, interviewees described using multiple education and communication formats with a variety of content that appealed to different ERAS groups. The importance of ongoing positive reinforcement to address change fatigue and pockets of change resistance was stressed." (Gramlich et al 2020, page 7) "All 21 occupational therapists at the unit took part in this improvement work, but over the years occupational therapists entered and left the workplace. However, 14 occupational therapists continued to work at the unit and took part in the entire 10-year improvement work process. The improvement work is still ongoing as the implementation of the OTIPM has continued to raise new issues for improvement." (Sirkka et al 2014 'occupational', page 91)
21	If clinicians have adequate time to reflect on the evidence-based practice (C) then the practice will continue to be used by clinicians (O) because they are able to gain confidence in their ability to perform	Kelly et al (2020) conducted a cyclical quality improvement project to standardize and improve upper limb provision in one residential rehabilitation unit for children and young people with acquired brain injury. In the published paper, the authors discussed barriers and facilitators during three Plan-Do-Study-Act (PDSA) cycles. They reported that the clinicians took longer than expected to fully uptake the standardized clinical pathway into their practice, but that this lengthy uptake period in combination with the concise nature of the EBP	"The use of audits on a yearly basis has allowed an objective overview of change in practice, which, in combination with surveys of staff attitudes has allowed a more objective measure of uptake of use of the pathway in practice [11]. These have shown that despite all the strategies that were employed, uptake into practice has remained lengthy. This is likely to be due to a combination of factors, including therapists understanding and valuing the new information, and both wanting to, and having the confidence to change existing practice that has been well engrained into their routine practice." (Kelly et al 2020, page 6) "ensuring the pathway was easily accessible to its intended audience

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	the clinical practice (M) when audit and feedback is used (S).	(C) meant that clinicians were able to fully understand the value, benefits and importance of the clinical practice (M1) and are able to gain confidence in their ability to perform the clinical practice (M2). Ultimately, this led to the continued use of the clinical practice 2 years post-implementation, with a higher fidelity to the intended practice than at 1 year post-implementation (O). The authors suggested this increase may have been due to the higher confidence reported in year 2 when compared to year 1. Audit and feedback may have provided the opportunity for clinicians to gain confidence and better understand the value of the practice. Kelly et al 2020 - 2 years	was important. The pathway itself was deliberately made concise, with accessible summaries of the evidence and clear tools to assist the whole team of therapists in their clinical decision making, to overcome the time and academic barriers" (Kelly et al 2020, page 6)
22	If an organization prioritizes the evidence-based practice such that clinicians have adequate time and there are adequate financial resources (C) when strategies such as accessing new funding are used (S), then clinicians perceive social pressure to understand and	Harding et al (2018) evaluated the sustainability of post-arthroplasty review clinics that were implemented in Victoria, Australia to provide orthopaedic patients with comprehensive, high-quality physiotherapy. Using data from 6-months , 1- and 2-years post-implementation, the authors found that workplace capacity was sustained over this time period by both retaining the original clinical workforce and training others as part of staff leave and succession planning (O). The strong business case for the clinics meant that there were adequate financial resources available for clinicians throughout the evaluated time period (C), which encouraged continued capacity because clinicians perceived	"Workforce capacity Increased orthopaedic specialists capacity. The capacity of orthopaedic specialists to see new and complex patients was increased by 551 hours. Average orthopaedic specialist time saved was 14 minutes per OOS (range 7 to 28 minutes) (Table 3). The value of this time ranged from $14 to $64 per OOS. The annual forecast savings of increased surgeon capacity per PAR clinic was $11,950 (range $6149 to $23,400) (Table 4). Increased physiotherapy workforce. Eighteen physiotherapists were involved in this project and workforce retention for the duration of the project was 100%. Physiotherapists had a mean of 16 years of experience (range 6 to 33 years), 15/18 (83%) had completed relevant post graduate studies and one physiotherapist was enrolled in a higher degree. Two physiotherapists from two regional sites failed to meet the recommended selection

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	perform the practice (M) resulting in continued expertise (O).	social pressure to understand and perform the clinical practice (M). In fact, the business case in this instance meant that the clinicians were saving the healthcare system money versus the previous care pathway, thus adding further pressure to maintain capacity to run the clinics. Harding et al 2018, 2 years Barnett et al 2004 - 5 years	criteria set by the lead sites. Twelve of the 18 (67%) physiotherapists had previously worked in other AMP clinics. Of the 10 sites, six sites trained more than one physiotherapist (Table 2), which enabled the PAR clinic to continue during planned staff leave and support succession planning." (Harding et al 2018, page 101-102) "'Prioritization' as an enabler, and 'no longer a priority' as a barrier confirm that priority setting of a health issue is an important element in capacity building" (Barnett et al 2004, page 286)
23	If there is turnover in the organization but the necessary expertise is still present on the clinical team (C) when ongoing training in conducted (S), then clinicians will continue to use the evidence-based practice (O) because there is social pressure or expectation for them to perform it (M).	Gustavson et al (2021) identified a high and low sustaining organization following the implementation of a high intensity resistance training program, then conducted a multiple case study to compare the differences between the two sites. In the site where clinicians did continue to deliver high intensity resistance training 4-6 months post-implementation (O), it was reported that the full-time clinicians trained the temporary physiotherapists on their own time to ensure that they had the necessary expertise to use the practice (C). Authors suggested that this created social pressure and expectation that they would perform the practice (M). Gustavson et al 2021 - 4-6 months Barnett et al 2004 - 5 years Wimpenny et al 2010 - 1 year	"[The high sustainability site] reported training [part-time, coverage] therapists—outside of research oversight and on their own time—to ensure conformity of rehabilitation approaches by all therapists treating any appropriate patients in the facility. Collectively, [the high sustainability site]'s team chose to create a culture where high-intensity resistance training was the standard of care and expected any therapist treating patients in the facility to approach care delivery in the same manner for continuity and better outcomes." (Gustavson et al 2021, page 116-117) "When asked what made involvement in [Stay on Your Feet] related activities possible, the most common of the 510 responses was that it was 'part of normal work role' (41%)" (Barnett et al 2004, page 285) "I think we all egg each other on. I think we all have mixed feelings at different times, someone will be quite positive about MOHO and there will be others for whom it's not going well or it doesn't seem as relevant …" (Wimpenny et al 2010, page 511) "The threat to sustainability created by a loss or turnover of key individuals has been identified by the literature and was also found in the current study.14,31 Heavy reliance on the manpower provided by

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		Hanson et al 2011 - N/A Liddle et al 2018 - 3-18 months	key individuals or highly invested volunteers can threaten sustainability if such players move on to other job roles or burn out. While having appropriate individuals around the table is highly beneficial toprogrammes,11 it is important to have balance and diversity to guard against a loss of momentum or expertise if such individuals leave the project.1" (Hanson et al 2011, page 531) "fully integrating fall prevention in practice was complex. Some were grappling with multiple stakeholders and funding mechanisms and expressed doubt in their own ability to motivate clients or the wisdom of building their business model on prevention." (Liddle et al 2018, page 7)
24	If clinicians have adequate time and expertise, and perceive benefits of using the evidence-based practice for themselves (e.g. faster) (C) then they will continue to use it (O) because they are confident in their ability to perform the practice (M) when licensure standards are updated to encompass and/or clarify the competencies required by the	A PwC report was commissioned by the healthcare service that implemented and sustained the Advanced Musculoskeletal Physiotherapy (AMP) program in the short-term, and wanted to know if they should and could sustain the program in the long-term. Through the use of clinical data and interviews with clinicians and patients, the author found that clinicians perceived that they had adequate time and expertise, and the AMP program conferred benefits to them in terms of professional development (C) that they wanted to and were confident in their ability to (M) continue to sustain their delivery of the practice past the 6 month evaluation period (O). Strategies including changing credentialing and/or licensure standards were used. This included creating advanced licensure requirements for physiotherapist to work as an Advanced Musculoskeletal Physiotherapist and deliver the innovation. This also included work to alter	"Both availability of infrastructure and AMP satisfaction are not impeding factors on the sustainability of the program. The AMP(s) were found to be confident with the case load of patients across the program and were predominantly working independently, only seeking the specialist's input on an as needs basis. It was further reported that the program helped build rapport with other departments and provided opportunity for professional growth." (PwC AMP Report 2015, page 41) "The program also offered staff the opportunity to learn new skills and expand their role as Tracey explained: I have got the assistance of one RN and one EN… they will be facilitating [the program]and I am using it as an exercise for my nurses to learn those facilitation skills…I am trying to foster that side of their nursing skills and this is a good vehicle to do that with. I encourage them [the community nurses] to deliver education to the community and we involve ourselves in primary health care principles and community nursing principles of which Stepping On is one of those…one of those vehicles that we can um…ah… actively participate in primary healthcare ventures, or health promotion ventures." (Lovarini 2012, page 156)

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	evidence-based practice (S)	continuing education requirements to shape professional practice towards AMP clinics. PwC AMP report 2015 - 6 months Lovarini 2012 - 1.5 years	
25	If clinicians perceive that an evidence-based practice has meaningful benefits for patients and they have the time to perform it (C), then they will continue to use the practice (O) because they have a positive attitude about it when the required resources have been allocated in the workplace (M) following adaptations to fit the practice to their clinical workflow (S).	Harrison et al (2015) conducted a prospective cohort study in which the rehabilitation hospital site implemented balance training three times per week for pulmonary rehabilitation patients. In follow-up interviews, clinicians reported that although they perceived that the balance training provided benefits to patients, they did not have the time to complete it 3 times per week, even though this is what is recommended by research evidence (C). Clinicians expressed negative attitudes towards balance training in its current form (M) because it was not adapted to their workplace. O'Hoski et al 2020 report that immediately following the cohort study, balance training was adapted to 2 days per week with a higher patient to physiotherapist ratio, giving clinicians enough time to complete the training with patients (C). The result is that balance training was continued 1 year following implementation (O) which the authors proposed was because clinicians have positive attitudes towards the clinical practice now that they recognize that the resources allocated for the intervention matched its resource needs (M).	"Despite recognizing the benefits of balance training at improving measures of balance control associated with a risk of falls, HCPs initially expressed negative attitudes regarding the sustainability of balance training. However, when prompted, HCPs were able to identify a number of strategies to improve the ease of delivering balance training, including reducing the number of training sessions to twice a week (which deviates slightly from the evidence on the effectiveness of balance training in patients with COPD [24]). Determining the optimal number of balance training sessions to achieve a meaningful improvement in balance and fall risk required would be an important area for future research" (Harrison et al 2015, pg 7) "The clinicians also said that it was difficult to supervise balance training while concurrently supervising patients engaged in other PR exercises. To eliminate this barrier, they opted to provide balance training to all patients in the inpatient programme rather than to only those with a history of falls or balance problems. This lower staff-to-patient ratio was achievable because the patients were provided with exercise logs (see the Appendix) and pictures of the exercises and were for the most part expected to complete the exercises independently." (O'Hoski et al 2020, no page #)

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		Harrison et al 2015 - 6 months O'Hoski et al 2020 - 1 year	
26	If clinicians have adequate time and financial resources (C), then there will be continued capacity for the evidence-based practice (O) because clinicians will continue to feel confident about being able to perform the practice and understand their specific tasks and responsibilities (M) when ongoing training is conducted (S).	Kavanagh et al (2020) conducted a qualitative descriptive study using semi-structured interviews and observation to identify barriers and facilitators to sustaining functional maintenance programs for hospitalized older adults. The authors reported that maintaining capacity for the program was an important outcome for the sites (O). Respondents reported using an ongoing training strategy embedded in the orientation procedures to ensure clinicians new to the organization would have the knowledge and confidence necessary to deliver the program (M). This fit the tight funding climate in the organization and within the allotted time for orientation (C). Kavanagh et al 2020 - not reported	"Integrating the FMI was also felt to reduce reliance on additional funding during the Continued Use phase once "start up" funds were exhausted. An example was the integrating of initiative training into routine learning and development schedules for staff: Geriatrician (Q2, Initiative D): "… we didn't want to put money into people to provide education, or people to develop interventions… because that's not going to be sustainable… make sure that it (education) gets embedded within routine sessions on the wards… when new people get hired, that it's part of their [orientation] package." (Kavanaugh et al 2020, page 3812)
27	If adequate documentation systems are in place (C), then the organization will continue to deliver the evidence-based practice (O) because clinicians believe that it is right for them to be involved	Both Sutton et al (2018) and Herbert et al (2017) reported on the results of qualitative interviews concerning the implementation and sustainability of the Enhanced Recovery After Surgery (ERAS) program. Sutton highlighted that when record keeping and documentation procedures for ERAS were clear within the organization (C), then the organization would continue to deliver the program (O) because the clinicians believed that it is right for them to be involved and that they can make a valid	"Once protocols and care pathways were established it was important for ERAS to be kept visible so that teams held onto their beliefs in its legitimacy. This might be achieved by the sharing of audit data, for example on reduced length of hospital stay or reduced complications for patients, to be fed back to team members to encourage them to persist with implementation work: I think a lot of the wards very much appreciate and see the benefits of everything as part of the enhanced recovery. I think sometimes you forget what those benefits are, and I think having it reiterated every now and then really makes a difference. Just to kind of get that motivational push as to why you need to put that effort in and why you

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	and that they can make a valid contribution when the practice stays visible (M) through the relay of clinical data to clinicians (S).	contribution to it (M) when strategies such as facilitating the relay of clinical data to clinicians is used to keep the program visible. In this case, the authors reported feeding back administrative indicators of patient outcomes to clinicians so they could see improvements over time. Sutton et al 2018 - not reported	need to get your patients up and out of bed. (NUR/AHP-CC-3)" (Sutton et al 2018, page 7)
28	If adequate documentation systems are in place (C), quality monitoring can be used (S) to provide evidence for clinicians to understand the potential value and importance of the evidence-based practice (M) resulting in clinicians continuing to see benefits in the practice for themselves (O)	Sirkka et al (2014a, 2014b) described how long-term improvement work based on the Occupational Therapy Intervention Process Model (OTIPM) evolved in an occupational therapy unit, and the clinicians experiences with this evolution using focus groups and improvement documentation. Authors reported that in earlier phases of implementation, clinicians had recognized the short-comings of existing documentation and record systems as they did not reflect the basic concepts of the OTIPM. Based on earlier updating of the documentation system (C), and yearly appraisal to ensure the optimal record keeping system remains in place (S), clinicians have been able to see benefits to their practice by using OTIPM, including streamlining their workflow, allowing them to better communicate with other healthcare professionals and even be recognized as being a successful unit that others should look to emulate (O). This outcome occurred because clinicians were able to understand the value, benefits and importance of	"Our sustained implementation strategies using the [electronic medical record], centralizing education, and programmatic support of a facilitator and champions have helped this program to be successful for more than four years." (MacDonald et al 2021, page 10 (pre-print)) "[Implementation strategies from year 1] include site-specific modifications at the suburban clinics related to implementation strategies of...staff support of clinical processes and paperwork" (MacDonald et al 2021, page 4 (pre-print)) "One clinician specifically expressed “I find it to be just as applicable for a low level client in a wheelchair as for someone who is able to stand on a balance board.” (Perez et al 2017, page 5) "The feeling of being pressurized was related to organizational changes with cost savings and shorter hospital stays for clients, and this changed over time. The feeling of being relieved emerged gradually when the participants saw how the implementation of the OTIPM generated improvements in their daily practice." (Sirkka et al 2014 'Occupational therapists'...', page 954) "manuals, including key words, were revised in accordance with basic concepts from the OTIPM and recommendations from the FSA...This

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		the clinical practice (M) when strategies such as quality monitoring using the documented clinical are used. Macdonald et al 2021 - 4 years Perez et al 2017 - 1 year Sirkka et al 2014 - 5 years	phase led to a manual that came to change the content and quality of the documentation in the client record extensively as compared with previous editions. Throughout the improvement work, these experiences and changes in the manual formed a base for the annual review of client records." (Sirkka et al 2014 'a process...'; page 433)
29	If there is adequate expertise on the clinical team for the evidence-based practice (C), then it will continue to be delivered by the organization (O) because clinicians will have worked together to periodically appraise the worth of the practice (M) when they use tools to assess sustainability readiness, barriers and facilitators, and use the assessment information to tailor strategies and	MacDonald et al (2021) conducted a mixed methods evaluation of the process of sustaining the ProActive Physical Therapy (PAPT) program in practice over four years. Through the use of measures and clinical data, the authors reported that when expertise is present on the clinical team (C) the clinical practice will continue to be delivered by the organization for up to 4 years post-implementation (O). Interviews with clinicians revealed that the continued delivery of PAPT occurred because clinicians worked together to periodically appraise the worth of the practice (M) by using tools to assess sustainability readiness, barriers and facilitators, then integrate this information back into implementation strategies they were using and the adaptations they made to PAPT itself. MacDonald et al 2021 - 4 years Herbert et al 2017 - not reported	"the champion trained an additional therapist and educated the clinical-team due to staff sustainability barriers. Use of evaluative sustainment frameworks and assessments enabled the appraisal of ongoing implementation strategies and further tailor to site-specific needs. After administering the CSAT & the NHS Sustainability Model, the facilitator could assist the sites to identify adaptations to meet their site-specific sustainability barriers." (MacDonald et al 2021, page 10 (pre-print)) "Participants reported that ERAS-related data collection and subsequent monthly feedback facilitated implementation as it highlighted areas that needed improvement. Supportive data and relevant feedback was therefore considered key to sustaining ERAS efforts: Because we could get some realistic data month on month back about length of stay, about patient experience, about compliance with nutritional drinks, about every kind of aspect of the enhanced recovery programme. And that started to focus it and really embed it into practice. (NUR/AHP-CO-24) (Herbert et al 2017, page 10)

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	promote adaptability (S).		
30	When ongoing training is conducted (S) then clinicians will continue to have adequate knowledge of the evidence-based practice (C), resulting in its continued use (O) because clinicians maintain confidence in their ability to perform the practice (M).	McEwen et al (2019) conducted a pre-, post-, follow-up evaluation of the implementation of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach. The implementation team conducted educational meetings during the implementation phase to teach clinicians the basic information regarding the complex CO-OP approach, ensuring there was adequate expertise for the clinical practice on the team (C). Following implementation, ongoing training was offered via mentorship from clinical champions at each site and free access to an online version of the CO-OP workshop and consolidation session for new team members which had the effect of maintaining knowledge of CO-OP and increasing clinicians' confidence in their ability to perform CO-OP in clinical practice (M). Ultimately, this was reflected in chart audits, were there was maintained increase in CO-OP use by clinicians from pre- to post-implementation and follow-up (O). Calo et al (2020) surveyed clinicians who had completed the online Strength after Breast Cancer (SABC) training program for outpatient rehabilitation clinics 2 years earlier to assess the implementation of the program. According to the barriers, facilitators and sustainment reported by respondents, if there are sufficient financial resources, a positive organizational climate and	"Changes in knowledge occurred after the workshop and were largely maintained but not augmented during the support period, whereas changes in self-efficacy occurred predominantly during the support period rather than after the workshop. The audit of medical records revealed some limited evidence of practice change. " (McEwen et al 2019, page 12) "the champion trained an additional therapist and educated the clinical-team due to staff sustainability barriers." (MacDonald et al 2021, page 10 (pre-print)) "Our findings suggest that the online training was sufficient to successfully implement the SABC program in outpatient rehabilitation clinics with high levels of adoption, fidelity, reach, and capacity for sustainability." (Calo et al 2020, page 2) "Over three fourths of respondents implemented SABC in outpatient rehabilitation clinics and among those, 93% were still delivering it. These high levels of adoption and capacity for sustainability may stem from staff values and a supportive organizational climate towards SABC...With only 14% of respondents mentioning lack of interest from management as an implementation barrier, it is reasonable to assume that most rehabilitation clinics stimulated an organizational climate that made it appealing for clinicians to try implementing this new offering." (Calo et al 2020, page 5) "...a high number of respondents said that third-party payers covered the costs for delivering SABC programming to patients. Cost reimbursement may have facilitated the initial adoption of the program, and subsequent sustainability, by relieving common concerns related to financial burden." (Calo et al 2020, page 5)

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		sufficient expertise for SABC on the clinical team (C), then the clinician will continue the program for up to 2 years following training (O). The authors opined that that online training program was a large reason for this, as it gave clinicians the knowledge and skills they needed to feel able to enact SABC (M). Schröder et al (2020) evaluated physiotherapists´ confidence, attitudes and beliefs in managing patients with low back pain before and after a multifaceted implementation of the BetterBack Model of Care in outpatient rehabilitation clinics in Sweden. The authors noted that although there was expertise for the clinical team for the clinical practice due to the use of implementation strategies such as educational meetings (C), clinicians' knowledge and confidence in their abilities decreased from immediately post-implementation to 3-months follow up, before returning to the same level at 12-months follow-up (M). Authors suggested that this decrease is due to the real-world practice and associated ongoing training that the clinicians undertook post-implementation. Ultimately, authors linked the maintenance of high confidence to the continued use of BetterBack for up to 1 year via the COM-B model (O). McEwen 2019 - 6 months MacDonald et al 2021 - 3-4 years	"Our hypothesis that physiotherapists' confidence, attitudes and beliefs in managing patients with LBP improve after a multifaceted implementation of the BetterBack MoC was confirmed. The PTs´ confidence in managing patients with [low back pain] improved already at directly after, 3 as well as at 12 months after the implementation." (Schröder et al 2020, page 9) "In the present study we could utilise an existing regional infrastructure (implementation forum) as a top-down strategy to action mandatory MoC education for all PTs in the public health care region. Our rational was to reach all PTs within the organisation to improve guideline adherent care, despite the potential of including both early adopters and laggards. This representative sampling may partly explain why there was no short-term effect but only a long-term effect on PTs´ attitudes and beliefs as this is likely to require longer time and real-world practice" (Schröder et al 2020, page 11)

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		Calo et al 2020 - 2 years Schröder et al 2020 - 1 year	
31	If there are adequate financial resources for the evidence-based practice (C) then it will continue to be delivered by organizations (O) because the practice is valued by individuals in charge of funding decisions (M) when quality monitoring systems are used at the organizational level (S).	Walker et al (2020) explored the perspectives of physiotherapists on the influence of commissioning arrangements on the sustainability of a group rehabilitation programme for osteoarthritis (ESCAPE-pain). In the UK, clinically led, statutory clinical commissioning groups are responsible for planning and commissioning local healthcare services. When these commissioning groups did not provide funding for ESCAPE-pain, some organizations were able to find other ways to obtain adequate financial resources for the initiative. The example given by study authors is of an organization which met the cost of ESCAPE-pain by finding money within their own budgets (C) because stakeholders who controlled funding at the organizational level saw the importance and benefit of the initiative (M) when strategies such as developing quality monitoring systems are used. Ultimately, this allowed for the continued delivery of ESCAPE-pain by the organization for up to 2 years (O). Walker et al 2020 - at least 2 years Gramlich et al 2020 - 1-4 years Herbert et al 2017 - not reported Sutton et al 2018 - not reported	"Some providers reported that once they had implemented ESCAPE-pain and shown it was successful, they hoped CCGs would be convinced of its clinical and financial benefits and then fund the programme's on-going delivery and scale-up across sites. However, this was not the case, and providers had to continue to meet the costs of delivering ESCAPE-pain from their own budgets: 'We were hoping to secure money from commissioners…we didn't manage to secure that money. But then we decided that well, this is a quality initiative and we value it, so we'll keep going with it' (Alex, Head of MSK Services and Extended Scope Physiotherapist). " (Walker et al 2021, page 13 (pre-print)) "Outcome data supports positive reinforcement of good outcomes for staff and patients" (Gramlich et al 2020, page 5) "So, it's kind of tricky that way. I would like to see it expand to all the surgeries and have ERAS for all because it does make a difference. I'm worried about sustainability because ERAS for colorectal has been at this site for quite some time. But research has shown that if the data isn't monitored, it does drop off and it's so true. They're just not self-sustained. They need somebody to still have the meetings, still bring the group together, and still talk about the data otherwise I'm fearful that it will just drop off. Clinician_15" (Gramlich et al 2020, page 6) "Participants reported that ERAS-related data collection and subsequent monthly feedback facilitated implementation as it highlighted areas that needed improvement. Supportive data and relevant feedback was therefore considered key to sustaining ERAS efforts: Because we could get some realistic data month on month back about length of stay, about patient experience, about compliance with

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			nutritional drinks, about every kind of aspect of the enhanced recovery programme. And that started to focus it and really embed it into practice. (NUR/AHP-CO-24)" (Herbert et al 2017, page 10) "Data feedback was felt to be integral to improvement efforts. It was used to motivate changes, highlight areas requiring work and made implementation successes visible. Monitoring, and data feedback is a widely discussed activity to maintain programme visibility [9, 10, 12] and this study suggests that adequate resources should be made available to sustain this valued process." (Herbert et al 2017, page 11) "Resource issues had meant that when funding streams attached to ERAS implementation—such as Commissioning for Quality and Innovation payments (CQUINs) that facilitated data collection by dedicated staff—came to an end, teams were no longer provided with such feedback, thus threatening the long term adoption (or success) of ERAS, defined within NPT as embedding and integration." (Sutton et al 2018, page 7)
32	When a dissemination organization is started to collect money related to either program training or certification (S) so there are adequate financial resources for the evidence-based practice (C) then it will be continued at the program level (O)	The authors and/or stakeholders in several implementation projects identified in this review created dissemination organizations with the goal to sustain (and spread) the program as a whole, as opposed to sustain the practice at the clinician or organizational level. For example, Seguin and colleagues started a dissemination organization as early as 2008 to coordinate and conduct ongoing training in the StrongWomen program via a train-the-trainer strategy. This creates an environment in which there is adequate and growing capacity for clinicians to deliver the program, in in addition to generating sufficient financial resources (C) to sustain the StrongWomen initiative at the program level (O)	Tai Ji Quan: Moving for Better Balance - program license fee; training course fee Klose Training: Strength After Breast Cancer Certification Course "After the program period, rehabilitation institutions were provided with the opportunity to become a paid member to continue the RSE program in their institution. An interesting finding was that almost all institutions (89%) were willing to pay for the continuation, and the number of “Physical Activity Counseling Centers” further increased. The possible reason behind this success is the intensive implementation strategy including both active (e.g., meetings, training courses) and more passive activities (e.g., financial incentives)." (Hoekstra et al 2019, page 8)

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	because the available financial resources are allocated appropriately by the individuals in charge of the program (M).	by charging a reasonable cost-recovery fee. The program is continued because the available financial resources are allocated appropriately by the individuals in charge of the program (M) Tai Ji Quan: Moving for Better Balance website - 8 year Klose Training: Strength After Breast Cancer Certification Course - 6 years Hoekstra et al 2019 - 20 months Seguin et al 2008 - 13 years	"A paid membership on the RSE program in which institutions have to pay the program owners became a successful solution not only to continue the "Physical Activity Counseling Centers," but also to continue this nationwide collaboration between rehabilitation institutions. At the same time, this gives the opportunity to monitor whether the RSE program is continued with acceptable implementation levels." (Hoekstra et al 2019, page 8-9) "The StrongWomen Ambassador training program is another component of program growth and sustainability. Seven ambassadors conduct workshops in Alaska, Arkansas, Colorado, Kansas, Oregon, and Pennsylvania. These individuals participate in a more extensive training process than the workshop provides, and they are then qualified to hold workshops within their own states to train new program leaders. Ambassadors are also important for program sustainability by serving as local resources for program leaders." (Seguin et al 2008, page 7)
33	If there are adequate financial resources (C), then clinicians and organizations will continue to deliver the evidence-based practice (O) because clinicians believe it is right for them to be involved and take ownership of it (M) when there is an implementation advisor or a data expert to relieve	MOVE is an initiative that aims to promote early mobilization practices for vulnerable seniors admitted to hospitals. Following an initial evaluation using an interrupted time series design (Liu et al 2018), a dissemination organization for the initiative was formed (website) and the initiative scaled-up in additional sites across Ontario and newly implemented in Alberta (Holroyd-Leduc et al 2019). In the original study by Liu et al (2018), it was found that in a setting where there were adequate clinical resources for MOVE such that no infusion of financial resources were needed (C), the initiative is sustained by organizations for up to 5 months post-implementation (O). Authors proposed that this result occurred	"[The] results are important given that the intervention was implemented without new resources aside from funding for a research coordinator; this indicates buy-in and facilitates sustainability." Liu et al 2018 pg 117 "MOVE is an intervention that can be implemented and sustained without the requirement for new clinical resources. We effectively utilized existing clinical resources and considered the local context and barriers. Additionally, this study demonstrated that this intervention can be spread beyond urban academic hospitals to smaller rural community hospitals located within another province. " Holroyd-Leduc et al 2019 pg 8 "...highlighted that it is important to continuously create awareness, knowledge and support related to performing physical activities during and after rehabilitation among all members of the multidisciplinary

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	clinicians of the research or implementation burden (S).	because clinicians and organizations have taken ownership of the clinical practice (M) when they are not reliant on external or additional support to perform the clinical practice directly. That being said, financial resources to support the use of an implementation advisor and data expert were considered by authors to be important to set up the administrative structure for the research project and the ongoing delivery of MOVE. Holroyd-Leduc et al (2019) reported similar findings in their study of MOVE in the new sites following scale-up. Liu et al 2018 - 5 months Holroyd-Leduc et al 2019 - 5 months Hoekstra et al 2017 - not reported	team. To ensure that this will continue on the longer term, we recommend to appoint (a group of) professionals working in the organization who are responsible for a structural embedding of physical activities into rehabilitation. In this way, 'local ownership' is created, which has been previously shown to contribute positively to successful sustainability" (Hoekstra et al 2017 'professionals', page 96)
34	If there are external best practice guidelines supporting the evidence-based practice and the practice produces benefits for patients, clinicians and organizations (C), then it will continue to be used by clinicians (O) because clinicians and other relevant	Sirkka et al (2014a, 2014b) described how long-term improvement work based on the Occupational Therapy Intervention Process Model (OTIPM) evolved in an occupational therapy unit, and the clinicians experiences with this evolution using focus groups and improvement documentation. The OTIPM aligns with best practice guidelines and has been found to have benefits for clinicians, patients and organizations by increasing patient flow and reducing length of hospital stay (C). Clinicians are continuously appraising the OTIPM as they seek to update or modify their practices within the model as best practice guidelines are updated (M). Through interviews with clinicians and by	"Re-evaluate the adoption of the OTIPM and the developed documents that sustain the adoption A review of client records showed a need for individual support to further improve the documentation; Changes made to interventions based on occupations Methods implemented for individual feedback on documentation" (Sirkka et al 2014a 'process..' page 432) "New evidence from scientific articles was added to the intervention process and to all OT programmes The OT programmes were thereafter continuously updated with new evidence from scientific articles." (Sirkka et al 2014a 'a process...' page 432) "Keep the evidence-based practice based on the OTIPM sustainable This main pattern consists of two phases, conducted between 2010 and the time of study in 2013, that reflect an additional shift in the focus of

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	stakeholders (e.g. managers) appraise and modify the practice as the guidelines are updated (M) when small cyclical tests of change are conducted (S).	reviewing quality improvement documents, the authors of this proposed that these components have led to the continued use of the OTIPM for up to 10 years. Sirkka et al 2014a - 5 years Sirkka et al 2014b - 10 years Kelly et al 2020 - 2 years	the improvement work. This shift was characterized by repeating the improvement work from earlier phases, but the intentions as well as the results of the work were on a higher level. Compared with earlier phases, the focus was now on keeping the evidence-based practice, based on the use of the OTIPM, updated and sustainable. " (Sirkka et al 2014a 'a process...' page 434) "The driving forces behind the improvement work were not only found in the occupational therapists' work with the OTIPM, but in external changes such as increased client flow, shorter hospital stays, new policies and recommendations" (Sirkka et al 2014a 'a process...' page 435) "the use of audit and staff survey have provided bench marks for current practice and allowed further PDSA cycles to be planned and implemented." (Kelly et al 2020, page 6)
35	If the evidence-based practice is perceived to be beneficial by clinicians (C), then they will continue to use it (O) because the clinicians have worked together to evaluate its worth (M) during local consensus discussions (S).	Wimpenny et al (2010) conducted a participatory action research study that investigated the sustainability of the Model of Human Occupation (MOHO) across a mental health occupational therapy service. Monthly meetings were conducted in which clinicians discussed how to operationalize MOHO in practice, and worked through issues that arose in its use. Using information from interviews with clinicians and quality monitoring documents, authors reported that clinicians perceived that working together to evaluate the worth of a set of practices (M) meant that all saw the benefits in using MOHO (C) leading to the continued use of MOHO by clinicians for up to 12 months (O).	"Within monthly meetings, therapists shared assessment outcomes and case formulations following their use of the [assessment] tool. They reflected upon how the assessment was conducted, how ratings were scored, how long it took, how assessment outcomes were shared and how therapy goals were recorded. Those who started using the tool and found it beneficial supported those who were less sure. The outcome of this inquiry cycle led to all the therapists agreeing to use the OCAIRS as one of their initial assessment tools of choice" (Wimpenny et al 2010, page 509) "This cycle provided a space for critical discourse, which led to consciousness raising or 'conscientisation', a term used by Friere (1970) to denote the ability of participants to use knowledge for their own active efforts." (Wimpenny et al 2010, page 509) "Quarterly audits consistently improved from 0% to between 80% and 100% with structured forms that prompt for the expected

CMOC #	CMOC narrative	CMOC explanation	original text
		Wimpenny et al 2010 - 1 year Gutierrez et al 2016 - 2-3 years Sirkka et al 2014 'occupational' - 5-10 years	documentation. Clinicians are open to feedback based on the chart audits, both collectively and individually, which is attributed to the collegial culture within SJRMC-PT and consensus on achieving 100% compliance" (Gutierrez et al 2016, page 118) "As reflected in the theme “Transforming thought and action”, the improvement work involved a lot of individual reflections and collegial discussions to change clinical reasoning and acting in practice" (Sirkka et al 2014 'occupational', page 95)
36	If there is a demonstrated receipt of benefits for clinicians or patients (C), then the evidence-based practice will continue to be delivered by organizations (O) because clinicians have a positive attitude about the practice (M) when favourable clinical information is relayed to them (S).	Cramm et al (2014) conducted a longitudinal study of 22 Dutch disease-management programs to estimate the predictive role of demonstrated improvements in quality of care (C) on the continued use of the clinical practice up to to years following implementation (O). Using multilevel regression analysis, authors reported that quality of chronic care delivery immediately post-implementation ($p< 0.001$) and quality changes in the first ($p< 0.001$) and second ($p< 0.01$) years predicted the continued use of the clinical practice. Authors proposed that the ability of clinicians to improve patient care (C) positively influenced their attitudes towards disease-management practices (M), resulting in continued use (O). Cramm and Nieboer 2014 - 2 years Gramlich - 1-4 years Hopkins et al 2007 - 3-5 years Hitch et al 2019 - 2 years	"This study showed that increased organizational support and system implementation leads to changes in behavior of professionals. The ability of professionals to effectively improve quality of chronic care delivery as a result of the disease management approach is expected to have positively influenced professionals’ views on this approach making them more motivated to change their old ways and making the new working method part of their daily routine practice. Unsuccessfully improving quality of care delivery may have resulted in preference for old working habits, with the danger of discontinuation of the new working method within the disease-management approach by professionals." (Cramm et al 2014, page 152) "Data demonstrating ERAS practice changes and improved outcomes was a commonly cited motivating factor at all leadership levels." (Gramlich et al 2020, pg 5) "The staff is educated regarding the stepwise process of transformational change and their ability to see the larger picture how change in care can improve outcomes is increasing. The changes brought about by the care process model resulted in a RICU staff view of ‘‘that’s the way we do it here in RICU,’’ so that these new approaches are institutionalized on the local (RICU) level." (Hopkins et al 2007, page 89)

CMOC #	CMOC narrative	CMOC explanation	original text
		Rafferty et al 2019 - 1 year Richmond et al 2018 - N/A	"Academic outcomes (such as participation in formal quality assurance and research proejcts, publications, conference presentations, grants and higher degrees by research student supervision) are the most easily quantified. Such outcomes increase the sustainability of such positions in several ways, by supporting the career progression of incumbent academics, founding a track record to attract funding, providing opportunities for clinician professional development, and disseminating research findings and knowledge translation for the broader professional good. Perry et al. [18] noted that records of such outcomes are not always kept in health services, potentially due to the perception they are only relevant in academic circles. The Lead Research Occupational Therapist has spent significant time highlighting the meaning of these outcomes to clinical work, as these links were not initially recognised by the workforce. A database of knowledge translation activities is now in place in this service, and referred to regularly." (Hitch et al 2019, page 6) "walking and balance performance was assessed and shared with participants, increasing awareness of potential vulnerabilities and the potential for improvements over time." (Rafferty et al 2019, page 1652) "The therapists who delivered a CBA in practice, spoke of the positive experiences this provided. In particular, they were surprised to see that patients had benefited from the programme, and felt they improved with each session they delivered. "…that group really like the ...the map...the brain and there's one or two of them that have really ... they love that idea and…I actually brought a picture into that session from the explain pain book so they could look at that...you know the homunculus man stuff and some of them were really fascinated by that and I thought, I must bring that in more in everyday practice I think." " ID337" (Richmond et al 2018, page 10)

CMOC #	CMOC narrative	CMOC explanation	original text
37	If the use of the evidence-based practice results in demonstrated benefits for the organization (C) via robust quality monitoring (S) executives will understand the novelty, and the added value, benefits and importance of the practice (M) such that they provide access to a new, steady funding stream (O).	Post-arthroplasty review clinics were implemented in Victoria, Australia to provide orthopaedic patients with comprehensive, high-quality physiotherapy. At 6 months post-implementation the program was evaluated by a external consultancy firm. Results indicated strong cost-savings associated with the program (AUD$38 per patient visit (baseline $63, clinic $35, representing a reduced pathway cost of 44%) while reducing wait times and achieving high levels of patient and provider satisfaction (PwC, 2015). This resulted in a strong business case for the continuation of Advanced Musculoskeletal Physiotherapy clinics (C). The business case was presented to the health service following the pilot period so that executives in the health service could understand how the clinic differed from other practices (M1) and recognize its added value (M2). The health care service ultimately decided to continue to fund 10/13 post-arthroplasty review clinics, making 10/13 sites financially viable for up to 2 years post-implementation (i.e. until the most recent evaluation of the clinics (Harding et al 2018)) (O). The most recent evaluation continues to report similar benefits to those 6 months post-implementation (Harding et al 2018) (C). Harding et al 2018, 2 years PricewaterhouseCoopers Australia (PwC) for the Department of Health and Human Services Victoria 2015, 6 months	"To date, 10 out of the 13 AMP models have had business cases for continuation of service with ongoing funding approved at a health service level – with three pending decisions. This is despite a tight funding climate and competing major priorities which is an encouraging outcome and is reflective of the positive outcomes achieved by the AMP Program" pg 8 "A cost-recovery model was also implemented to cover ongoing expenses associated with program delivery. The cost-recovery model includes donations from participants. The participants have generously supported the sep and have viewed the donation as nominal compared with the equipment (exercise bands, a stability ball, and a yoga mat) and services received in the sep. It should be noted that participants are not obligated to contribute any money and that they receive the exercise program and associated materials regardless of their donations." (Santa Mina et al 2012, page e138) "Oncology programs must intensify their pursuit of funding to develop, implement, and maintain cancer exercise programs. Financial support may come from the government (in jurisdictions in which health care is publicly funded), national granting agencies, insurance companies, private donors, or corporate sponsors. Through successful grant applications, small amounts of research funding may be acquired for feasibility studies, followed by larger grants to support adequately powered randomized controlled trials. This approach will not only improve the body of evidence in cancer and exercise, but finance the capital equipment costs and generate institutional support for sustained cancer exercise programming." (Santa Mina et al 2012, page e140) "The center has explored the feasibility of charging a program fee of $85. Even with the fee, classes have been filled to capacity. Scholarships were made available for individuals who could not afford the program fee. Based on the fee structure, the facility has been able to pay for the instructor's time, offer scholarships, and cover overhead

CMOC #	CMOC narrative	CMOC explanation	original text
		Santa Mina et al 2012 - 1 year Shubert et al 2011 - 1 year Calo et al 2020 - 2 years Dinglas et al 2014 - 5 years Hanson et al 2011 - not reported Yang et al 2021 - 8 months	costs" (Shubert et al 2011, page 514) "Almost three fourths of respondents (72%) were compensated for delivering [Strength After Breast Cancer] programming in their clinics via third-party payers." (Calo et al 2020, page 4) "a high number of respondents said that third-party payers covered the costs for delivering SABC programming to patients. Cost reimbursement may have facilitated the initial adoption of the program, and subsequent sustainability, by relieving common concerns related to financial burden" (Calo et al 2020, page 5) "After evaluation of the QI project, the hospital administration funded an ongoing, early rehabilitation program starting the next fiscal year, July 2008 onward. In addition to maintaining the QI project components described above, a new protocol for sedation management and delirium screening was implemented to formalize changes made during the QI project starting July 2009" (Dinglas et al 2014, page 1231) "I'm hoping that they are going to be ongoing but when there is not the direct money, when there is not the direct resources, many, many, many other priorities evolve and take precedence.' (Site 2, Participant 1)" (Hanson et al 2011, page 528) "Perhaps it is not surprising that a significant barrier reported by stakeholders was the need for continued and committed financial and human resources. The same concern is commonly cited in the research literature.5,15,28 Despite a growing body of literature on sustainability, it is still a challenge to look beyond money as the prerequisite for maintaining community projects into the future." (Hanson et al 2011, page 531 "The program consisted of 10 weeks of 1-hour group classes and

CMOC #	CMOC narrative	CMOC explanation	original text
			individualized homework exercises and had a cost-recovery fee. In the first iteration, the GRASP participant manuals and equipment were given to the participants free of charge. In the second iteration, the cost of the manual was included in the pricing" (Yang et al 2021, page 2)
38	If there are demonstrated benefits for patients and clinicians perceive benefits of using the evidence-based practice for themselves (e.g. faster) (C), then clinicians will maintain their expertise for the practice (O) because clinicians have determined how effective and useful the practice is for them and patients (M) when quality monitoring is used (S).	Harding et al (2018) evaluated the sustainability of a state-wide implementation of post arthroplasty review (PAR) clinics for patients following total hip and knee arthroplasty, led by advanced musculoskeletal physiotherapists in collaboration with orthopaedic specialists. Through the use of patient interviews and data from standardized measures, the authors demonstrated that the PAR clinics benefitted patients directly in terms of increasing their satisfaction with their care and supporting good patient outcomes. Furthermore, interviews with physiotherapists running the clinics revealed that they saw the PAR clinics as benefiting them directly by facilitating their professional development and/or giving them the opportunity to use the full scope of the skills (C). The authors attributed these contextual factors to the 100% retention of the PAR workforce, and thus the continued capacity for the clinical practice after 2 years (O) because clinicians have determined how effective and useful the practice is for them and their patients. Harding et al 2018 - 1-2 years Hill et al 2011 - N/A	"With excellent patient satisfaction and state-wide benchmarking of patient outcome measures in place across all 10 health services, our findings provide strong evidence to support this AMP model as an integral part of the solution to meeting public hospital demand. High workforce retention and continued operation of AMP roles in every health service demonstrates the model has been successful in creating a flexible and sustainable workforce. Optimising the talents of our skilled health professionals will be crucial to improving patient care and advancing safety, quality, and innovation into the future" (Harding et al 2018, page 104-105) "Managers, staff, partners and clients will require evidence of the effectiveness of the program to embrace the new program and sustain the program long term...Once you have identified the need or demand for the program the next step is to present empirical evidence supporting the effectiveness of the program. Greater stakeholder engagement is possible where there is evidence of potential benefits" (Hill et al 2011, page 8)

CMOC narratives for unsustained and reduced level CMOCs

CMOC #	CMOC narrative	CMOC explanation	Original text
39	If stakeholders do not have authority over the decisions related evidence-based practice, then deprioritization of the practice by the organization (C), will result in its discontinuation (O) because individuals making prioritization decisions do not value the practice over others (M). Building a coalition and developing a quality monitoring system could help develop the necessary support with individuals who do have the authority to prioritize the evidence-based practice within the organization (e.g.	Lovarini (2012) conducted interviews with various stakeholders in a falls prevention initiative implemented in diverse community organizations. The authors found that several organizations stopped delivering the falls prevention program (O) when the initiative stakeholders did not have ultimate authority over the decisions related to the clinical practice (C): 'Yeah…I don't know… I mean I think you never know in Health what decisions are going to be made tomorrow that are going to blow everything under water completely and maybe you know…yeah.' Sophie, Program Coordinator and Leader (page 192). Organization executives who made decisions about what to prioritize valued other initiatives over the falls prevention program (M). This occurred despite there being stakeholders who are committed to the initiative, the clinicians and/or managers perceiving clear benefits of falls prevention program and that it is superior to alternatives, and having sufficient patient enrolment (C). Participants suggested that in the case where they don't have agency over their own practice, management and/or executive support was key. Suggested strategies to get the support of managers	"The Program was Sustained If the conditions necessary for program sustainability were met then the program was sustained. Urban Community Health implemented many programs over a number of years and intended to keep the program going. For Urban Community Health, the program would be sustained providing it was valued by the organisation and given the same "status" as other services, there were enthusiastic staff trained in program implementation and there was ongoing support for the program from management as well as local community-based organisations, with whom they had developed program partnerships. Jillian and Sophie, the program coordinators were careful in their program planning to ensure these conditions were met, but there may be a limit to what they could reasonably control as Sophie explained: 'Yeah…I don't know… I mean I think you never know in Health what decisions are going to be made tomorrow that are going to blow everything under water completely and maybe you know…yeah.' Sophie, Program Co-ordinator and Leader For now however, the conditions necessary for program sustainability at Urban Community Health were being met and hence the program was continuing." (Lovarini 2012 page 192-193) "A lack of professional autonomy was perceived to threaten longevity in allied health assistant led initiatives." (Kavanagh et al 2020, page 3808) "When considering CIMT program implementation and sustainability, the influence of organisational leaders to drive and

	management and/or executives) (S).	included building a coalition to integrate them into the implementation team and developing quality monitoring systems to convince them of its importance. Lovarini 2012 - 1.5 years Kavanagh et al 2020 - not reported Christie et al 2021 - 2 years Walker et al 2021 - 2 years	sustain practice change is important, particularly in public health settings where clinicians require management approval to support practice change. Consistent with Jolliffe et al. (2019), who found that a supportive workplace culture improved adherence to evidence-based upper limb rehabilitation guidelines, we also found that a supportive workplace culture, including support from leaders, was critical for CIMT program sustainability. For participants working in the public sector, whilst many outlined that they would continue to deliver CIMT, they often indicated that program continuation would be influenced by ongoing leadership support. Importantly, in three interviews, participants discussed their positive experiences of implementing CIMT but also highlighted how if there was a shift in organisational priorities or if support from the multidisciplinary team was removed, CIMT programs were unlikely to be sustained." (Christie et al 2021, no page #) "...commissioning arrangements for MSK physiotherapy services need to allow providers the flexibility to deliver interventions that best meet the needs of their patients, rather than delivering interventions that fit within the constraints of existing funding regimes, which largely have an activity-based focus. The emergence of integrated care systems in England and the move to a more strategic, integrated and outcome-focused approach to commissioning have potential to support the spread and sustainability of interventions such as ESCAPE-pain." (Walker et al 2021, page 17 (pre-print))
40	If there is a lack of financial resources and the evidence-based practice is not part of expected duties (C), then there is no social expectation to perform it (M) and	An Australian organization that provides physical and occupational therapy for children with cerebral palsy wished to implement assessments of tactile impairments (Auld et al 2019). Using multi-faceted educational strategies including written information, demonstration videos, workshops and on-call mentoring, the implementation team ensured that the	"Results indicated that a 12-month intervention including written information, demonstration videos, a face-to-face workshop, equipment provision, and on-call mentoring successfully increased Knowledge of what tactile assessments should include and how they should be carried out. Secondly, results showed that improving Knowledge and removing major clinician-level Barriers can make some improvements to Practice and assist in the identification of less obvious Barriers, such as external funding models for assessment, or tactile treatment Knowledge,

	therefore the practice will not continue to be delivered by clinicians (O).	majority of clinicians reported they had sufficient knowledge of tactile impairment in children with cerebral palsy (pre 3/12; post 9/12) and equipment choices (e.g. Monofilaments – pre 1/12; post 10/12) to confidently assess tactile impairments (M). Although the intervention sustained clinician knowledge, the small improvement in self-reported use of tactile assessments 3 months following the intervention was not sustained at 12 months (O). Extrapolating from data collected from a survey of clinicians at 12 months post-implementation, study authors suggest that the lack of sustained use of tactile assessments resulted from the presence of organizational barriers including lack of time, challenges with the pay-per-service funding model and tactile assessment being outside of their expected duties (C). Auld et al 2019 - 1 year post-implementation Hill et al 2011 - N/A Hoekstra et al 2017 - N/A	which need to be addressed with further research and Knowledge Translation interventions" (Auld et al 2019, page 2354) "Sustaining falls prevention programs over time, in some cases without federal, state or local government funding is an issue that needs to be addressed. Many falls prevention programs are developed with short term (several months to one year) funding. Without a strong up-front focus on sustainability, many programs do not persist beyond the initial duration of funding (Cassell & Day 2002; Clemson, Mathews, Dean, Lovarini & Alam 2008)" (Hill et al 2011, page 5) "Almost all professionals expressed their uncertainty about the continuation of the programme after 2015 (Table IVa), which was thought to be related to the expected changes in the financial system of the Dutch rehabilitation care. Since, in general, financial resources for healthcare have been under pressure, professionals were worried about the future, and some managers were therefore restrained in their decisions to expand the SCC." (Hoekstra et al 2017 'professionals', page 13)
41	If record systems have not been updated or data warehousing has not been used (S) such that there are not adequate documentation procedures in place	McEwen et al (2019) conducted a pre-, post-, follow-up evaluation of the implementation of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach. Drawing on information from the clinical chart audit and survey of clinicians, authors reported that the record keeping and documentation procedures for CO-OP were inadequate,	"Our audit of the medical records provided some concrete evidence of practice change, in that no records mentioned aspects of CO-OP use prior to the KT intervention and 20% mentioned it after. However, in real terms, only eight of 40 charts audited post intervention had any documentation related to use of the CO-OP Approach, and one site showed no evidence at all. Although this is likely evidence of incomplete implementation of CO-OP, it was also probably compounded by the lack of relevant documentation structures.

	(C) then informed decisions surrounding the policies and procedures for the evidence-based practice cannot be made (M), resulting in a reduced level of sustained use by clinicians (O).	resulting in continued but reduced use of the clinical practice (O) because the necessary work to set policies and procedures for the clinical practice was not completed (M). Drawing on informal feedback from clinical teams, the authors stated that the strategy of changing record keeping systems should have been used to address this contextual barrier. McEwen 2019 - 6 months	During the implementation support period, all teams asked the implementation facilitators for advice on documentation. We had not developed documentation structures, because we believed that sites would develop their own procedures that fit within their existing site-specific systems. In hindsight, the time and energy required to develop documentation procedures might place on front-line providers, in addition to learning and implementing a new technique that includes new terminology, was too burdensome. In future similar projects, we recommend providing a documentation framework or guidelines as a starting point that teams can then modify to suit their context." (McEwen et al 2019, page 13)
42	When new documentation procedures are in place but data is not relayed to clinicians (C) such that they do not perceive that the new evidence-based practice is superior to existing practice pathways (M) then they will not continue to use the evidence-based practice (O). Using educational strategies, and audit and feedback to provide the opportunity for clinicians to perceive the difference and	Sutton et al (2018) conducted qualitative interviews informed by Normalization Process Theory to explore ERAS implementation and sustainability. Although the necessary record keeping procedures were put in place in all sites (C) by changing record keeping procedures during implementation, some clinicians indicated that they didn't think they would continue using ERAS (O). In these cases, clinicians reported that they did not perceive a difference between ERAS and the practice they were doing before, beyond the current practice now requiring more paperwork (M). Hopkins et al (2007) described the use of educational strategies and audit and feedback to provide the opportunity for clinicians to perceive the difference and superiority of ERAS.	"Processes of developing protocols within ERAS were understood by a number of participants across the different specialities as constructing an evidence-based tool to aid patient recovery, but conversely the introduction ofnew protocols was viewed by some staff as an exercise of“ticking the boxes” (NUR/AHP-HN-10) that had not improved patient care: It’s difficult to say now whether it’s [ERAS] going to continue, erm because from some perspectives it’s just another document to fill in, it’s not actually making an impact to patient care. Especially for head and neck patients because we’ve always done certain, certain things, and I don’t, don’t know if it’s made an impact in it. (NUR/AHP-HN-12) This may have been because they believed that they were already providing good quality patient care pre-ERAS. " (Sutton et al 2018, page 9) "Some interviewees indicated that rather than requiring major change ERAS had just formalised practice that was already being enacted before the programme’s introduction, by means of the development and introduction of ERAS protocols to direct this practice: I don’t think there was too much change, it’s more about formalising it all. But, er, in terms of changing practice I don’t

	superiority of the new evidence-based practice has been suggested (S).	Sutton et al 2018 - not reported Hopkins et al 2007 - 3-5 years	think it really has particularly changed. (SUR/ANS-HN-8) These views may have been linked to participants' particular roles within a team or ERAS in general, or the specialism in which they were working." (Sutton et al 2018, page 6) "After adding sleep to their usual computerized nursing charting package, the authors expected that sleep would be charted regularly. This expectation, of course, was not realized." (Hopkins et al 2007, page 88)
43	If none or inappropriate clinical champions or leaders were recruited (S) such that the right people did not lead the intervention project or were not identified as clinical champions (C), then the evidence-based practice will not be continued by the organization (O) because clinicians and/or managers do not believe it is right for them to be involved (M).	Herbert et al (2017) conducted qualitative interviews informed by Normalization Process Theory to gain an understanding of the facilitating factors and challenges of implementing and sustaining the Enhanced Recovery After Surgery (ERAS) program. They reported that in one site the project had been discontinued (O) because clinicians did not believe it is right for them to be involved (M) when key stakeholders from varied disciplines were not involved in leading the implementation project or identified and prepared as clinical champions so that all internal stakeholders are committed to performing the clinical practice (C). Herbert et al suggest that identifying multiple clinical champions such that there is representation from each major discipline may be helpful in this scenario. Herbert et al 2017 - not reported Hoekstra et al 2017 'implementation' - N/A	"… but I think it is an issue having two anesthetists running it because actually the vast majority of what's required is actually the ward stuff, and it's hard for us to take leadership of the ward stuff. It really needs to come either from the nurses or from the surgeons, erm, so, I think that's partly why I feel we've stalled at the moment because …the bit that we're much more involved in which is the in-theatre bit and the pre-op assessment bit, well, that was, kind of, already in place anyway. (SUR/ANS HN-8)" (Herbert et al 2017, pg 5) "It is commonly reported in the literature that the time and energy invested in a programme by a clinical 'champion' is central to successful programme implementation [30]. However, the present study highlighted the fragility of this 'centre pin' approach, as the over-reliance on one individual threatened implementation. The multimodal care approach of ERAS requires diverse professional groups to cooperate across multiple clinical boundaries. The findings suggest that having several champions who can operate across the differing disciplines to drive the programme forward may be a stronger leadership approach." (Herbert et al 2017, pg 11) "physicians were not actively engaged. As most organizations in both clusters sustained the program after its implementation, both strategies seem feasible, yet only in different settings (large- vs small sized organizations). Besides the organization's size, the current organizational circumstances seem also important for

		Lovarini 2012 -1.5 years Kavanagh et al 2020 - not reported	managing this tension. In the context of a re-organization, regardless of size, management's buffering of physician resources seems most feasible. Still, a balance needs to be maintained: as physician engagement coincided with stable high fidelity and was found crucial for longer term sustainability [29], the extent to which the active engagement of key professionals can be traded off against their relatively scarce time and high costs remains limited." (Hoekstra et al 2017, page 11) "a belief in the program was necessary to keep the program going: To drive it [the program] you have to have someone who's a believer. If they don't believe it they are not going to do it, and they're not going to push it. You have to think it's worthwhile, because if you're indifferent, the result will be different. You will let things slide.... Lesley, Program Co-ordinator and Leader (Lovarini 2012, page 179) "Considering the crucial role of change drivers, careful consideration of factors such as professional scope and/or authority to alter or implement initiative components appears indicated when identifying such personnel. Health care assistants, for example, may lack this authority with possible impacts upon adoption rate and timeliness of initiative adaptations. This was evident in three of the four Victorian sites, each led by an allied health assistant, who identified this as a prominent threat to their ongoing sustainability (Figure 1)." (Kavanagh et al 2020, page 3813)
44	If patients and caregivers have not been educated such that they have adequate knowledge of the evidence-based practice (S), they may complain	Gustavson et al (2021) identified a high and low sustaining organization following the implementation of a high intensity resistance training program, then conducted a multiple case study to compare the differences between the two sites. In the site where clinicians did not continue to deliver high intensity resistance training 4-6	"I think one thing that we struggle with is the fact that this facility is a geriatric population. So, not only are they acute, but they're also like 95, and probably weren't doing any exercise at all before they got here. I know in the office, I have gotten a lot of complaints, not specific to [the high-intensity resistance training intervention], "your therapists are pushing me too hard and they're being mean to me." You feel that way, I guess, because you haven't gotten up off the couch in 12 months. But

	or not buy in (C), then clinicians will not continue to use the evidence-based practice (O) because they are not confident in their ability to perform it at a level which is appropriate and/or acceptable to the patient (M).	months post-implementation (O), there was a lack of patient buy-in to the training program (C) such that clinicians did not feel able to perform the clinical practice (M). Liddle et al (2018) suggest that strategies such as educating patients and caregivers in the benefits of the clinical practice (in this case a falls prevention program) might be beneficial. Gustavson et al 2021 - 4-6 months Klingbeil et al 2018 - 10-12 months Liddle et al 2018 - 18 months	this is how we're going to get you better and getting them to be on the same page with you is challenging. (SNFL1, SLP & Director of Rehab, 6-10 years of experience) (Gustavson et al 2021, page 115) "Self-efficacy (patient's and therapist's) and perception of intervention effectiveness positively impacted practice change; however, these determinants did not overcome the challenges in the SNF context (of SNF-L) that existed in a reimbursement-driven system with discordant team dynamics, and challenges with overcoming preconceived notions regarding patient responses to high-intensity resistance training. " (Gustavson et al 2021, page 116) "Survey questions also asked for comments on barriers to implementation and general feedback on the teach back strategy. Consistent barriers cited by both nurses and non-nurses included time, parent anxiety, language barriers and stressed or disinterested parents. Some staff also shared that they continued to feel awkward, that teach back was cumbersome to use and that they needed help to remember to use it consistently" (Klingbeil et al 2018, page 84) "Clients did not necessarily see they had a particular risk of falls, or that hazards needed to be addressed, or that exercise would be beneficial. Several AHPs expressed the view that persuading clients to act was the most difficult part of their fall prevention work: "I did a home visit with a gentleman who was 94 and he had never had a fall ... I had a lot of trouble even convincing him that a home visit might be a good idea." (Private OT, ID12). "So the tricky bit in physio is getting people to do it...if you're talking to someone who's never exercised in their life and trying to persuade them why to follow something - that is the hardest bit I think." (Private physiotherapist, ID7)" (Liddle et al 2018, page 4)

45	When key members of the clinical team are not involved in advisory boards and workgroups or collaboratively developing a formal implementation blueprint (S), there may be a lack of expertise, communication and commitment within the team for the evidence-based practice (C), leading to clinicians not continuing to use the practice (O) because no one or not enough people are working to drive the practice forward (M).	Sigler et al (2016) wrote a case report describing the successful development, implementation and sustainment of an early mobilization program in a single ICU. However, the authors noted that prior to this successful project, the sustainment of a mobility program was unsuccessful. Specifically, authors stated that contextual factors including a lack of necessary expertise, communication and collaboration on the clinical team (C) led to the discontinuation of the program (O) because not enough people are working to drive the clinical practice forward (M). The authors later found success and overcame these barriers by using strategies which incorporate key members of the clinical team by developing a formal implementation blueprint using a collaborative approach amongst all clinicians, and using advisory boards and workgroups. Sigler et al 2016 - 1 year Liddle et al 2018 - 3-18 months	"In late 2013, pulmonary/critical care fellows and attending physicians at UMC developed an early mobilization program for the medical ICU (MICU). This was not the first attempt made to improve the mobilization of critically ill patients at UMC; however, previous efforts had been unsuccessful and, ultimately, reversion to usual care had occurred. Observational analysis revealed that barriers to early mobilization included poor selection and application of analgesia and sedation regimens for patients on mechanical ventilation; a lack of understanding of the function and capabilities of PT and OT; poor communication among nurses, physicians, and PTs/OTs; and poor focus by the care team on increasing the physical activity of patients." (Sigler et al 2016, page 343) "Multiple issues can prevent an early mobilization program from being successful. These barriers include inadequate analgesia, use of non=ideal sedatives (eg, benzodiazepines), oversedation of mechanically ventilated patients, a culture that does not prioritize early mobilization, or a lack of staff to perform early mobilization." (Sigler et al 2016, page 345) "communication between health professionals was limited, where AHPs could receive little or no information about clients referred to them and receive little or no feedback regarding clients they referred to other health professionals, compounding misunderstandings of how AHPs could work together." (Liddle et al 2018, page 5)
46	If clinicians do not have the time, and there is a lack key stakeholder support for the evidence-based practice (C) since strategies such as building a	Mann et al (2020) administered a follow-up survey 26 months following the end of a capacity-building program for the use of patient-reported outcome measures composed of educational strategies and implementation support for pediatric physiotherapists in Rwanda. The authors reported that even though clinician's	"Interviews and clinical observations held 26 months after the conclusion of the ARRSP revealed that PROMs were not regularly completed. Two frequently cited reasons included lack of promotion of the measures by department managers and the feeling among therapists that they were too time-consuming." (Mann et al 2020, page 602)

	coalition have not been used to engage these individuals (S), then clinicians will use the practice at a reduced level (O) because there is a lack of social pressure or expectation f if adequate documentation systems are in place or them to perform it (M).	perceived knowledge and competence in the use of the patient reported outcome measure (the Patient-Specific Functional Scale (PSFS)) remained high (no more than a 10% difference in perceived competency between immediately post-training and 26 post-implementation, with no competency below 80% of respondents indicating high competence), the clinician reported barriers of lack of time and sufficient management support (C) led to mixed sustainment 26 months post-implementation. Specifically, 33% (14) respondents said they used the measure a lot, 37% (16) quite a lot, 19% (8) a little bit and 12% (5) not at all, representing a sustainment rate of 70% of clinicians who might be considered to use the measure most of the time (O). Authors proposed that the lack of management support recognized by clinicians and the lack of integration of key external stakeholders into the implementation project recognized as an issue by the study authors themselves meant that there is a lack of social pressure or expectation for the clinicians to perform the practice (M). Mann et al 2020 - 26 months	"The post-grant evaluation found that perceived confidence in establishing functional goals; selecting functional, meaningful treatment activities; and progressing those activities remained high 26 months after the grant period ended." (Mann et al 2020, page 602) "By eliciting support from multiple levels of the health system including the Ministry of Health, hospital administration, and physiotherapy department managers, we believe that sustainability of new methodologies and practice techniques could have been enhanced. " (Mann et al, page 603) "Interviews conducted 26 months after the conclusion of the project revealed mixed success in sustainability of the use of PROMs, although perceived confidence remained high" (Mann et al, page 596)
47	If clinicians do not have the time (C), then they will not continue to perform the evidence-based practice (O) because	Gustavson et al (2021) identified a high and low sustaining organization following the implementation of a high intensity resistance training program, then conducted a multiple case study to compare the differences between the two sites. In the site	"For SNF-L, while therapist and patient self-efficacy in addition to perceived effectiveness of the high-intensity resistance training intervention was present, therapists agreed it was insufficient to overcome system barriers that hindered complete practice change: 'Maybe like a mixture of everything. You're doing this, you have

	the necessary resources have not been provided, and decisions surrounding the policies and procedures for the practice have not been made to ensure its integration into the normal clinical workflow (M) when the practice has not been adapted (S).	where clinicians did not continue to deliver high intensity resistance training 4-6 months post-implementation (O), clinicians reported in interviews that a major barrier was a lack of time (C) because the necessary resources have not been provided and decisions surrounding the policies and procedures for the clinical practice have not been made to ensure its integration into the normal clinical workflow (M). Gustavson et al 2021 - 4-6 months Hanson et al 2011 - N/A Herbert et al 2017 - not reported	to do this [high-intensity resistance training intervention], and you have to change documentation [for the intervention], and you have to do [group therapy]. And all that was all at one time.' (SNF-L9, PTA, 0-5 years of experience" (Gustavson et al 2021, page 114) "therapists at SNF-L spoke about feeling more stress related to implementation of the high-intensity resistance training intervention in the context of the system pressures. 'But the day-to-day hardest part was, how do I fit my ADLs and do high-intensity training and do all the additional additives that we were having added on with the [group therapy requirements], that I felt like a lot of us became to have like an overwhelmed sandwich.' (SNF-L20, COTA, 0-5 years of experience)" (Gustavson et al 2021, page 114) "'I'm not given the time to continue to look and create opportunities to get knowledge out there.' (Site 1, Participant 10)" (Hanson et al 2011, page 528) "a few participants reported that it was challenging when project-associated resources ended: …it's more difficult now because we don't get allocated time. So everything's done on the run, whereas when we were doing the project nurse we were given specific hours. (NUR/AHP-TH-18)" (Herbert et al 2017, page 6)
48	If there is inadequate time or opportunity for the clinicians to gain and/or share their knowledge of the evidence-based practice (C) since ongoing training or train-the-trainer strategies have not	Ilott et al (2016) conducted a case study to understand the processes, mechanism and outcomes associated with the spread and sustainability of the implementation of the Inter-Professional Dysphagia Framework (IPDF) amongst OTs, SL-Ps, nurses and clinical support workers in 25 wards in one UK hospital. They found that the necessary capacity for the clinical practices associated with the IPDF was not continued after 1.5	"Only 6 of the 25 ward based Trainers delivered any dysphagia training. This finding mirrors what is known about train-the-trainer interventions: with reports of behaviour change among trainers but that the training may not be cascaded [18]. Trainers expressed their disappointment, attributing this to workload pressures." (Ilott et al 2016, page 11) "'I'm not given the time to continue to look and create

	been used (S), then not enough clinicians will be confident in their ability to perform the practice (M) resulting in clinicians no longer having the expertise for the practice (O).	years (O) despite planning to use a train-the-trainer strategy to conduct ongoing training sessions to reach all key clinicians on the wards. The planned ongoing training sessions rarely occurred because the trainers did not have time to devote to educating their colleagues in addition to attending to their own workload. Ilott et al 2016 - 1.5 years Hanson et al 2011 - N/A	opportunities to get knowledge out there.' (Site 1, Participant 10)" (Hanson et al 2011, page 528)
49	If there is turnover in key stakeholders (especially the leader or clinical champion) (C) and new leaders or champions are not recruited (S), then the evidence-based practice will not be continued by the organization (O) because there is no one or not enough people working to drive the clinical practice forward by continuing to define the necessary actions and procedures for the clinical practice (M).	Kavanagh et al (2020) conducted a qualitative descriptive study using semi-structured interviews and observation to identify barriers and facilitators to sustaining functional maintenance programs for hospitalized older adults. They reported that participants in at least 3 of the 9 sites reported that turnover was perceived as a large barrier (C) to the continuation of functional maintenance programs by the organization (O): "What we found was that every time an AHA (allied health assistant) came or left, the [therapist] rotated, the [exercise] group would go back to like a seated programme … And it was like, 'No, that's not how it happens!'." Physiotherapist (Q1, Initiative G). This outcome was proposed to be due to having no one or not enough people working to drive the program forward (M1) by continuing to define the necessary actions and procedures for the clinical practice (M2).	"Loss of staff considered to be change drivers was felt to be particularly detrimental to initiative sustainability due to their influential passion and ability to fit the initiative within the organisation's environment: Occupational therapist (Q4, Initiative C): "Look what happened… [the lead geriatrician] moved [away] and pretty soon you and I (interventionists) weren't there anymore… there were a series of geriatricians that came and went and came and went; and didn't have his – I can't say level of expertise, but his personality, and drive for it." Allied health assistant (Q3, Initiative H): "… their passion and their thoughts on the programme determine how the programme runs and the support we get as well. So that has been a big challenge. If there hasn't been that support, then we've been floundering." (Kavanagh et al pg 3812) "Despite Rachel's desire to continue the program in 2009, the precarious nature of the budget - "the budget is not looking great at the moment" - Rachel's increased workload and the departure of both Alice and Cathy from the organisation resulted in a greatly diminished capacity to sustain the program. With a lack of trained staff and continued funding from the organisation unlikely, the program ceased at Regional Welfare in 2008. Thus,

		Lovarini (2012) conducted a grounded theory study in which she aimed to explore the factors affecting the sustainability of Stepping On, a community-based falls prevention program, and to develop an understanding and explanation for how such programs can be sustained over time. A core finding by Lovarini was that turnover of trained staff was often devastating to the falls prevention program, as the often small organizations delivering the program did not have adequate succession plans in place (C). In these circumstances, delivery of the program ceased (O) as there was no longer anyone to drive the program forward (M). Indeed, when the only clinical champion left one of the programs and was not replaced (C), the program was not continued (O) because there is no one working to drive the clinical practice forward (M1) or defining the necessary actions and procedures for the clinical practice (M2). Interestingly, the champion later returned and the falls prevention initiative was re-started. Kavanagh et al 2020 - not reported Lovarini et al 2012 - 1.5 years Herbert et al 2017 - not reported	despite a motivation to sustain the program, Regional Welfare simply did not have the capacity to do so." (Lovarini 2012, page 160) "For Nicole, having a motivated and committed person was necessary to co-ordinate, lead and sustain the program: 'I think it would take a very motivated, committed health promotion officer in this position or equally motivated health...multicultural health person...someone within health to push that.' Although Nicole was able to implement eight programs over a three-year period, a restructure of the organisation in 2007 resulted in a job change for Nicole and no guarantee from management that the program would continue as part of the restructured service. These changing conditions meant that there was no longer anyone available to co-ordinate and lead the program...A later check in 2009, confirmed that the program had not recommenced and that there were no plans to resurrect the program at Rural Community Health in the near future." (Lovarini 2012, pg 194) "Whilst a few suggested that it was key to have one person to focus enthusiasm and push implementation forward, many reported that implementation had been stymied when such an individual had left and the skills and support they offered had not been replaced. A “centre pin” (SUR/ANS-TH-16) approach was not considered conducive to sustaining implementation efforts: I think there’s certain key things that need to be addressed … key boxes that need to be ticked by an enhanced recovery programme to make sure it is sustainable … so it can’t be reliant on one individual or one role, because – well, for obvious reasons. If you take that person out of the equation then the whole thing will come crumbling down. (NUR/AHP-CC-4)" (Herbert et al 2017, page 5)
50	If there are inadequate financial	Walker et al (2020) explored the perspectives of physiotherapists on the	"Many MSK providers decided to absorb the costs of delivering ESCAPE-pain, even if contracts did not cover all of the

	resources or no business case for the evidence-based practice (C), then it will not continue to be delivered by clinicians or the organization (O) because it was not valued enough by individuals in charge of funding decisions (M). Accessing new funding via another source or adapting the practice to create a business case for it have been suggested (S).	influence of commissioning arrangements on the sustainability of a group rehabilitation programme for osteoarthritis (ESCAPE-pain) using qualitative case studies of organizations. In the UK, clinically led, statutory clinical commissioning groups are responsible for planning and commissioning local healthcare services. When these commissioning groups did not provide funding for ESCAPE-pain (C) because they were perceived by clinicians as not valuing or seeing the importance of the initiative, ESCAPE-pain was discontinued by the organization (O). Suggested strategies to address these barriers to include accessing new funding via another source, or adapt the practice so that there is a business case for it. Walker et al 2020 - at least 2 years Barnett et al 2004 - 5 years	associated clinical activity. Providers recognised that this was not an ideal financial situation, and raised concerns that this potentially threatened their ability to sustain ESCAPE-pain in the long term: '…there's a risk if we do this activity, we don't get paid for it and we can't sustain that for very long' (Alex, Head of MSK Services and Extended Scope Physiotherapist). Providers carefully monitored and managed activity levels across the wider service to mitigate the impact of the number of ESCAPE-pain sessions. Providers talked about needing to be more effective at managing and discharging patients with conditions that required fewer appointments, or getting more experienced senior clinicians to treat more complex patients to expedite discharge. However, many providers described high levels of demand for their services, which meant they were already 'losing money' on contracts irrespective of the additional activity caused by ESCAPE-pain: 'we probably treat patients over and above what we were contracted to and we lose money on the service' (Dennis, Clinical Lead for MSK and Extended Scope Physiotherapist). In some cases, providers had to stop delivering ESCAPE-pain because they were no longer able to make it work within the constraints of local funding arrangements: 'the commissioners said 'no, we won't commission that'… so I got a three-line whip from my manager to say we have to stop' (Amy, Consultant MSK Physiotherapist). " (Walker et al 2021, page 12 (pre-print)) Providers expressed frustration about the lack of engagement by [health service commissioners] to support the local scale-up of ESCAPE-pain, as they believed it would be a more effective approach than it being led at a provider level. " (Walker et al 2021, page 13 (pre-print)) "MSK providers described a relationship with commissioners that was disconnected and framed as 'them and us'. Service managers and clinicians thought they had little power to

			influence commissioning decisions despite the fact that these decisions had a direct impact on how they ran their services and the care they offered patients: '[Director of therapy services] has contact with commissioners for MSK, so I have to influence her to give the right message' (Nadia, Head of Physiotherapy)" (Walker et al 2021, page 13 (pre-print)) "The most common reasons for why an activity had ended, among the 168 comments, were 'resources and funding ceased' (41%)" (Barnett et al 2004, page 285)
51	If knowledge of the evidence-based practice declines (C) due to a lack of patient recruitment and/or ongoing training (S), the use of the practice will not be continued (O) because clinicians are no longer confident in their ability to perform the clinical practice (M).	Sutton et al (2018) reported the results of qualitative interviews concerning the implementation and sustainability of the Enhanced Recovery After Surgery (ERAS) program. The authors found that if there are not enough patients or inadequate demand for the clinical practice (C), then the practice was reported by respondents not to be sustained (O). Without an adequate number of patients, clinicians were not confident enough in their abilities to continue to perform the practice (M), and thus failed to recognize and sustained ERAS in eligible patients. Using varied and targeted recruitment strategies may be helpful, but as Christie (2021) and Terio (2019) note, strategies which rely on the engagement of external stakeholders who are not invested in the program may not work well. Strategies which involve building networks with other healthcare professionals for referrals or with patients directly may be needed. Hanson (2011), Lovarini (2012) and Liddle (2018) all note that word of mouth amongst	"to support skill maintenance and prevent decay, the strategy needed to prolong contact with the participants and offer ongoing education and training. An online training module may be an ideal future strategy to facilitate this outcome. Further, the amount of practice could be increased through changes in the design of the workshop, as the short duration (three-and-a-half hours) limited the volume of guided, hands-on practice that the participants received. Ongoing confidence and competence may have been better supported by an extended workshop delivered over a period of days in line with that provided by Simmons-Mackie and colleagues (2007). Similarly, this increased practice of newly acquired skills may have improved confidence immediately following the intervention in the accuracy of assessment when linguistic discourse analysis was used" (Bryant et al 2019, page 51) "Two physiotherapists from two regional sites failed to meet the recommended selection criteria set by the lead sites. Twelve of the 18 (67%) physiotherapists had previously worked in other AMP clinics. Of the 10 sites, six sites trained more than one physiotherapist (Table 2), which enabled the PAR clinic to continue during planned staff leave and support succession planning" (Harding et al 2018, page 102) "some participants working in public health services described

		program participants was particularly useful in recruitment. Bryant et al (2019) suggested that ongoing, online training was required to sustain the use of discourse analysis for dysphagia (O) because confidence in being able to perform the clinical practice needed to be sustained by clinicians, but without this strategy the clinician self-reported indicated decreased confidence to perform the clinical practice (M) and a clinical team that did not have the required expertise to use the clinical practice (C). Bryant et al 2019 - 6 months Harding et al 2018, 2 years Christie et al 2021 - 2 years Terio et al 2019 - 1 year Sutton et al 2018 - not reported	the difficulties of sustaining programs due to low levels of patient recruitment, despite attempts to market CIMT to eligible people in their community: We did advertise it through GP surgeries to see if there were other people who might be interested, but we did not get any response really. We put posters and fliers out across the whole of the region, but we did not actually get any takers that way (Participant 6)."(Christie et al 2021, no page #) "One of the main challenges faced was the recruitment of the clients. This was due to several reasons including high mortality and not getting access to healthcare facilities; this last challenge applied especially to the private profit organizations. Lack of engagement among local colleagues or other medical personnel provided an additional barrier to client recruitment and was reflected in: "We tend to be focused on the now, so when I quickly look and there isn't anything for me now then, I don't get interested, so it's not necessarily our own problem; I think it's a local problem (IT-specialist)". He expressed disappointment at the lack of interest and that people were not paying attention to the relevance of the intervention." (Terio et al 2019, page 8) "The small number of patients enrolled onto ERAS in this speciality was found to affect some staff's ability to differentiate who was an 'ERAS patient' and thus enact the relevant care pathway." (Sutton et al 2018, page 6)
52	When data is relayed to clinicians (S) showing there are no benefits to the evidence-based practice for clinicians or patients (C), then the practice will not continue to be used	Cramm et al (2014) conducted a longitudinal study of 22 Dutch disease-management programs to estimate the predictive role of demonstrated improvements in quality of care (C) on the continued use of the clinical practice up to 2 years following implementation (O). Using multilevel regression analysis, authors reported that quality of chronic care delivery immediately	"This study showed that increased organizational support and system implementation leads to changes in behavior of professionals. The ability of professionals to effectively improve quality of chronic care delivery as a result of the disease management approach is expected to have positively influenced professionals' views on this approach making them more motivated to change their old ways and making the new working method part of their daily routine practice. Unsuccessfully improving quality of care delivery may have

	by organizations (O) because clinicians have a negative attitude about the practice (M).	post-implementation ($p < 0.001$) and quality changes in the first ($p < 0.001$) and second ($p < 0.01$) years predicted the continued use of the clinical practice. Authors proposed that those clinicians that did not see improvements to quality of care through the use of disease-management practices (C) had negative attitudes towards the practice (M), resulting in its discontinuation (O). Cramm and Nieboer 2014 - 1-2 years	resulted in preference for old working habits, with the danger of discontinuation of the new working method within the disease-management approach by professionals." (Cramm et al 2014, page 152)

Chapter 5.
Integration of Manuscripts 1 with Manuscripts 2 and 3

5.1. Objectives of manuscripts 1, 2 and 3

Manuscript 1:

In this manuscript, we aimed to understand under what conditions (context), how (mechanisms) and for what duration an evidence-based rehabilitation practice is sustained (outcome).

Manuscript 2:

In this manuscript, we aimed to describe and document the collaborative sustainability planning process in rehabilitation centers in three rehabilitation sites.

Manuscript 3:

In this manuscript, we aimed to understand how (mechanisms) and in what circumstances (context) and for what duration the MPAI-4 is sustained, or not (outcome) in a single rehabilitation site.

5.2. Integration of manuscript 1 with manuscript 2 and 3

Manuscript 1 provided a synthesis of the causal mechanisms underlying how newly implemented rehabilitation practices are sustained (or not) into a realist program theory. The program theory was used to help guide stakeholders while planning for MPAI-4 sustainability (*manuscript 2*) and was further tested while evaluating MPAI-4 sustainability (*manuscript 3*). Thus, *manuscript 1* was essential in providing a theoretical basis for the practical sustainability steps required to optimize MPAI-4 sustainment and for iterative testing of causal mechanisms to advance the sustainability literature according to recommended practices.

Chapter 6.
Collaborative sustainability planning for the newly implemented Mayo-Portland Adaptability Inventory – version 4 in outpatient stroke rehabilitation: A qualitative description study

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Abstract

Rationale: Evidence suggests that sustainability planning, and the use of a collaborative approach to planning, results in better sustainability outcomes and more relevant knowledge. Yet, both approaches appear to be underutilized. A detailed description of collaborative sustainability planning may encourage the use of these two impactful strategies.

Aims and Objectives: To explore the collaborative sustainability planning process for a single outcome measure in three rehabilitation sites.

Methodology: Within the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) implementation project, we conducted a qualitative description study. We used data from 12 core sustainability planning meetings and 108 follow-up meetings that included a total of 31 clinical and research team participants. Sustainability planning was informed by a MPAI-4-specific implementation guide, and by the results from a realist review of the sustainability of rehabilitation practices and the Clinical Sustainability Assessment Tool. We analyzed qualitative data using thematic content analysis.

Results: Three themes describe the collaborative sustainability planning process: (1) 'collaboration as a driver for sustainability' which captures the active collaboration underpinning sustainability planning; (2) 'co-creation of a sustainability plan to achieve shared objectives' which captures the identified barriers and facilitators, and selected sustainability strategies linked to one of six collaboratively identified shared objectives, and; (3) 'the iterative nature of sustainability planning' which captures the necessity of an agile and responsive sustainability planning process.

Conclusion: Identified strategies may be useful to support (collaborative) sustainment. Future research could investigate the effect of collaborative sustainability planning on sustainability objectives, and the relationship between these objectives.

Keywords: Implementation Science; Program Evaluation; Outcome measurement; Stroke; Rehabilitation; Evidence based practice

Introduction

On average, it takes 17 years for research evidence with demonstrated effectiveness to be regularly integrated into clinical practice (1). This time lag compromises evidence-based practice (EBP) as an approach to clinical decision-making in which up-to-date research evidence, clinical experience and patient preferences are combined (2–4). To reduce the time lag, there have been systematic efforts to implement research evidence in the form of specific EBPs into the clinical milieu (5–10). EBPs are clinical practices which are known to produce the desired outcome within the EBP decision-making process (11). However, conducting a tailored and systematic implementation intervention is not enough – for patients, organizations, and systems to fully benefit from a newly implemented EBP, it needs to be sustained over the long-term (12).

Sustainment refers to the continued implementation of a new practice which includes continued use, benefits, and fit to the clinical workflow, amongst other outcomes (13–15). Sustainment can be left to occur naturally, or can be achieved via a concerted sustainability effort, where "sustainability is the process of managing and supporting the evolution of an intervention within a changing context" (16). The sustainability and sustainment of best practices can be challenging. In our recent realist review aimed at understanding the sustainability of newly implemented rehabilitation EBPs we found that only 54% of EBPs are sustained at least 6 months post-implementation (17).

While newly implemented EBPs should not always be sustained (e.g., when there is a need to replace an outdated practice), in many cases poor sustainment (e.g., reduced or non-use of an EBP) can result in negative consequences including wasted research and implementation funding (18), and a loss of potential improvements in quality of care and patient outcomes (19,20). Furthermore, poor sustainment may result in the loss of morale and a lack of willingness on the part of implementation team members to take part in future practice change projects (19,21,22).

Sustainability planning is a process that can improve sustainment (23–27). For example, authors of a study that aimed to predict the sustainability of community coalitions in healthcare found that sustainability planning was the most influential of all variables tested (27). Sustainability planning includes the identification of barriers and facilitators, and the subsequent selection of targeted sustainability strategies. Sustainability planning may result in modifications

to the EBP itself, and/or the selected implementation and sustainability strategies, so it can be more efficient to plan for implementation and sustainability concurrently (28). Implementation experts have noted that for optimal and ongoing tailoring of sustainability strategies over time, a collaborative approach to sustainability planning in which researchers, clinicians, managers, and other relevant stakeholders work together would be beneficial) (29–32).

Despite the potential benefits of concurrent implementation and sustainability planning this does not commonly take place; only 11% (n=7/61) of included implementation projects in the aforementioned realist review reported sustainability planning along with implementation planning (33–39). Similarly, the authors of only one study included in the realist review reported using a collaborative approach, and they provided few details on their collaborative sustainability planning process (40). Systematic and detailed descriptions of sustainability planning (18,41) and the collaboration underlying the process (42) would guide others in their collaborative sustainability planning practice and contribute towards an evidence base that would allow researchers to better understand how collaborative sustainability planning works. Thus, the aim of this study was to explore the collaborative sustainability planning process for a single EBP in three rehabilitation sites.

Theoretical Approach

An implementation team at each site consisting of researchers, clinicians, managers, knowledge brokers, and IT professionals collaborated using an Integrated Knowledge Translation (IKT) approach (29,43). We endeavoured to maximize the decision-making power amongst all those involved in this project including maintaining open lines of communication and soliciting feedback regularly. We shared core responsibilities: the clinical team reported on the local needs and context, the research team relayed MPAI-4 research evidence and facilitated implementation processes, and IT specialists provided technical and data governance expertise. The use of an IKT approach was facilitated by the strong, existing relationships between many team members (44,45).

Methodology

We conducted a qualitative description study to gain an in-depth understanding of collaborative sustainability planning according to the perspective of those involved (46–48). We emphasized both a literal description of the phenomenon and the meaning that people ascribed to it (47,48). By situating this work within a paradigm of naturalistic inquiry, we committed to understanding sustainability planning in its natural state and to reporting findings by staying close to participants' own words (49).

We obtained ethics approval from the Institutional Review Board of the Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal [MP-50-2022-968 and MP-50-2023-1636]. We followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist (50) (**Appendix A**).

Study Context

The Ministry of Health in the province of Québec, Canada, mandated the use the participation index of the Mayo-Portland Adaptability Inventory – version (MPAI-4) (7). The MPAI-4 is an outcome measure that can be used to assess impairment, activities, and participation of stroke outpatients (51). Though results from a systematic review of the MPAI-4's measurement properties indicate that it can be used to describe and evaluate stroke survivors' outcomes (52), its widespread implementation into clinical practice has required outcome standardization initiatives (53,54) and government mandates (7).

Three sites in separate regional health authorities within one large metropolitan area worked with the research team to implement the MPAI-4 over four years (44). All three sites have an embedded rehabilitation research centre, the Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain [Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal] (CRIR). There are 5-10 full time researchers at each site and knowledge brokers who work to bridge research and clinical milieu.

Amongst their other rehabilitation program offerings, all sites have large stroke rehabilitation programs ranging from subacute inpatients to those enrolled in home-based return-to-work programs. Multidisciplinary teams of 15-45 clinicians serve 200-300 stroke outpatients annually.

Early in the implementation process, the team noted that to follow the mandate and obtain the expected benefits, the MPAI-4 needed to be sustained over the long-term (12). To support sustainment the implementation team at each site undertook a concurrent, collaborative sustainability planning process.

In parallel to the collaborative planning process, we implemented digital infrastructure to support a rehabilitation learning health system as part of the BRILLIANT research program (55). Using this infrastructure, we developed the BRILLIANT platform, a digital health solution that was tailored to local needs and workflows to input MPAI-4 scores and generate automatic clinical and program evaluation reports. This contrasts to the Access Platform, the original digital health solution which was adapted from traumatic brain injury programs and had more limited reporting functionality. Site 1 rejected the Access platform within 6 months of implementation while Site 2 did not proceed past the pilot phase (**Figure 6-1**).

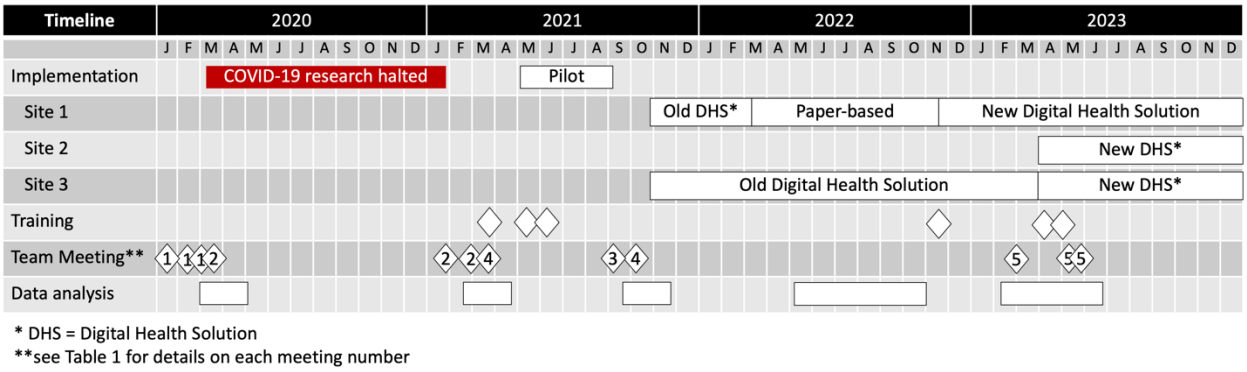

Figure 6-1: MPAI-4 Implementation and Sustainability Planning Timeline

Table 6-1: Description of Core Sustainability Planning Meetings

Meeting	Type	Timing	Description
1	At each site separately	Prior to training and implementation pilot	In a semi-structured meeting based on the INESSS MPAI-4 implementation guide, we discussed the general implementation process, identified implementation and sustainment objectives, and local timelines, and assigned duties.
2	At each site separately	Prior to training and implementation pilot	In a semi-structured meeting based on the INESSS MPAI-4 implementation guide, we selected the implementation strategies needed in the near future (e.g., initial training), and determined how these strategies would be continued over time if needed for sustainment (e.g., booster or orientation training).
3	Cross-site with managers	Near the end of the implementation pilot	In a semi-structured meeting based on the INESSS MPAI-4 implementation guide near the end of the MPAI-4 pilot phase, managers and researchers across sites shared MPAI-4 experiences, especially around workflow integration, clinical team perceptions of the tool and problem-solving around these topics.
4	At each site separately	Approximately 1 month following the implementation pilot	In a semi-structured meeting at Sites 2 and 3 based on the INESSS MPAI-4 implementation guide and the results of the realist review (17) we debriefed following the MPAI-4 pilot phase, updated implementation strategies accordingly and made associated changes to sustainability strategies. Site 1 opted out of this meeting.
5	At each site separately	Approximately 2 months following the implementation of the new BRILLIANT platform for the MPAI-4	In a semi-structured meeting based on the results of the data analysis completed thus far for this study and the results of our realist review (17), we debriefed following the implementation of the new MPAI-4 BRILLIANT platform. We also used the results of the CSAT to refine of the sustainability plan. To gather CSAT data, we invited participants by email to complete the CSAT along with basic demographic questions approximately 1 week prior to this planning meeting with the full team at each site.

Sustainability Planning Process

The implementation team at each site made strategic sustainability planning decisions in three or four, 1–2-hour semi-structured meetings between February 2020 and July 2023. A 1-hour meeting with all managers and researchers across all sites was also held (**Table 6-1; Figure 6-1**).

In addition to these core sustainability planning meetings, we held 108 follow-up meetings across the three sites (0.5-1 hours) to work towards accomplishing objectives set in the core meetings (**Appendix B**). This included developing training sessions and the BRILLIANT platform, communicating timelines and responsibilities, and discussing how to integrate new MPAI-4 research findings.

Guidance for Sustainability Planning

Three sources guided our sustainability planning. The first was the Institut National d'Excellence en Santé et en Services Sociaux [National Institute of Excellence in Health and Social Services] (INESSS) MPAI-4 implementation toolkit. INESSS promotes excellence in health and social services provincially. The toolkit guides the MPAI-4 implementation process, including sustainability (56).

The second was the realist review of sustainability in rehabilitation (17) which provided links between influential barriers and facilitators, and key sustainability strategies, that may be used to achieve specific sustainability outcomes.

Finally, we used the Clinical Sustainability Assessment Tool (CSAT) which is used to assess an organization's capacity to sustain an EBP (57). The CSAT is composed of 35 items divided between seven subscales, on a 7-point Likert scale. During its recent development (n=126) its authors assessed the CSAT's structural validity (RMSEA = 0.084, SRMR = 0.075, CFI = 0.81) and internal consistency (Cronbach's alpha = 0.82-0.94) in varied clinical settings (58). The CSAT helped us identify barriers and prompt sustainability planning at each site (**Appendix C**).

Participants

MPAI-4 implementation team members at each of the three rehabilitation sites participated in this study. Individuals volunteered or were invited to join the MPAI-4 implementation team by the lead researcher and manager at each site because their expertise was

important for implementation success (59). The longstanding professional relationships between researchers, knowledge brokers, and managers helped identify key team members. Team members represented all major clinical and professional groups (i.e., occupational therapists, physiotherapists, speech-language pathologists; clinicians, managers, researchers, IT professionals) (60). All participants received a formal recruitment email and provided written informed consent prior to data collection.

Data Collection

We held sustainability planning meetings in-person at the rehabilitation site or via videoconference. Prior to each meeting the research team developed the semi-structured interview guide and circulated it to the site manager for feedback (**Table 6-1**). We opened each meeting with introductions of new team members, thanked the team for their participation, and verified the meeting objectives.

A research team member experienced in qualitative research moderated each meeting and facilitated collaborative group discussions (RA, SA, AT) while another took research notes and meeting minutes (RA, AT, research assistant). Full implementation meetings were audio-recorded and transcribed verbatim. Due to the focus on execution during the follow-up meetings, these meetings were not audio-recorded. We took notes and made summaries. After each meeting, we circulated meeting minutes, read notes, listened to recordings (full implementation meetings only), and held debriefing meetings.

Data Analysis

We used qualitative content analysis (47,61,62) supported by NVivo 12 (63). RA started by familiarizing herself with the transcripts and summaries of meetings completed by May 2022. Following immersion into the data she completed the initial, inductive coding and first draft of the codebook. RA then identified relationships between the list of codes and collated them into potential themes and subthemes. Throughout this process the codebook underwent iterative revision.

Following the development of the preliminary codes, subthemes, and themes, the codebook was shared with AT for feedback. Iterative updates and reflection by RA and AT continued until the codebook was ready to be applied by an independent reviewer. The independent reviewer applied the codebook to three transcripts according to the analysis process

described above. RA and the reviewer identified and discussed coding discrepancies, then updated the codebook with AT. Once the preliminary codebook was confirmed, RA recoded completed transcripts, and coded the remaining transcripts and meeting notes as data collection was completed.

As RA completed coding, RA and AT discussed and iteratively modified the codes, subthemes and themes before they were finalized. This process enhanced our shared understanding of the of the themes, including by highlighting then addressing any discrepancies.

We enhanced trustworthiness during analysis by following the quality criteria by Lincoln and Guba (i.e., credibility, dependability, confirmability and transferability) (49). Throughout analysis, RA kept a project log to document choices made at critical junctures and establish a pathway for derived findings. Furthermore, RA reflected on how her own experiences and conceptions may be influencing her interpretation of the data (64). She created memos to record her reflexive thinking. For example, her awareness of her perspective that sustainability is a dynamic process helped her contrast viewpoints amongst participants.

Results

There were 31 participants in this study: 9 at Site 1, 12 at Site 2 and 10 at Site 3. Participants changed over time due to staff turnover. At the final meeting at each site, participants (n=19) included 5 researchers, 2 clinicians and 2 managers, 4 care coordinators (i.e., clinician leaders) and 3 knowledge brokers. Complete sociodemographic information is only available for participants who completed the CSAT survey (5/6, 4/5 and 7/8 eligible participants at Sites 1, 2 and 3 respectively). All participants but three identified as women and female (**Table 6-2**).

Description of Collaborative Sustainability Planning

We identified three themes and subthemes describing collaborative sustainability planning: (1) collaboration as a driver for sustainability, (2) the co-created sustainability plan to achieve shared objectives, and (3) the iterative nature of sustainability planning (**Table 6-3**, **Appendix D)**.

Table 6-2: Participant Sociodemographic variables

	Site 1	Site 2	Site 3
Number of team members including turnover	9	12	10
Number of team members at final meeting	6	8	5
Number of CSAT survey participants	5	7	4
Sex (% female)	100	71	75
Gender (% woman)	100	71	75
Perception of MPAI-4 evidence (%)			
Very weak	0%	0%	0%
Weak	20%	29%	0%
Neither weak nor strong	40%	43%	50%
Strong	40%	29%	50%
Very strong	0%	0%	0%
MPAI-4 importance for quality care			
Unimportant			
Somewhat unimportant	0%	0%	0%
Neither important nor unimportant	20%	14%	25%
Somewhat important	40%	71%	25%
Important	40%	14%	50%
	0%	0%	0%
Profession (%)			
Kinesiologist	20	0	0
Occupational Therapist	20	0	50
Physiotherapist	20	29	0
Psychologist	0	15	0
Speech Language Pathologist	0	0	0
Social Worker	0	0	0
Special Education Teacher	0	0	0
Healthcare Administrator	20	15	0
Research	20	42	50
Primary role (%)			
Clinician	20	15	0
Care coordinator	20	29	25
Manager/Administrator	20	15	25
Knowledge Broker	20	15	0
Researcher	20	29	50
Patient	0	0	0

Table 6-3: Theme and subtheme descriptions and exemplar quotes

Theme	Subtheme	Description	Exemplar Quote
Collaboration as a driver of sustainability	Roles and responsibilities of individual members of the implementation team	Self-assigned or designated implementation and sustainability duties of implementation team members. The duties tend to be split according to the authority of an individual's professional role (e.g., managers are responsible for coordination of the clinical side of the project).	I'm thinking about who would be those at the core, who sort of look at the nitty-gritty details of the implementation and then maybe take it back to the teams to validate it and say "is this how we want to do it?". (Researcher, Site 2, Meeting 1)
	Strategies used to optimize collaboration amongst stakeholders	The implementation teams selected and used strategies to optimize the active engagement of the diverse implementation team members. This indirectly enhanced sustainability planning by helping the team speak the same language and providing structure to the collaborative process.	I think it would be interesting if we can do a workflow mapping for the MPAI-4. Because when [the research and IT team] develop a computer system like BRILLIANT we really have to follow the clinical process. The information is needed at the right time with the right questions. So a mapping is a way to visualize this kind of representation in a drawing (Researcher, Site 3, Meeting 3)
	Collaboratively choosing shared sustainability objectives	The implementation teams collaboratively chose the core sustainability objectives for the MPAI-4 implementation project. The team focused on selecting objectives that are relevant to different stakeholders (i.e., clinicians, managers, researchers, patients) so that all key perspectives are included. By planning to address each stakeholder's needs, these stakeholders continue to support and collaborate on the project.	What is important is really to determine what the objectives are…we should learn from what the [TBI teams] already did. But restart with the goal. Okay, let's itemize those goals that are going to be really helpful. That will be a good start rather than trying everything. (Clinician, Site 2, Meeting 1)
	Value of working as a collaborative team	Stakeholders recognize the value that other members of the implementation team bring to the	Because of the [Québec government] we knew we had to implement the

Theme	Subtheme	Description	Exemplar Quote
		table by this being a collaborative project. For example, the necessary resources and connections to make the implementation of the MPAI address all stakeholder concerns requires everyone to be at the table.	MPAI-4, but we thought would we be doing it alone. So, the fact that we are all here is just, it's going to be excellent (Manager, Site 2, Meeting 2)
Co-created sustainability plan to achieve shared objectives	Continue the use of the MPAI-4 for research purposes	By making all the data accessible to researchers within a single platform, researchers could continue to use the MPAI-4 data for research purposes.	Until we collect the data, we can't create the models, we can't do the research projects. (Researcher, Site 2, Meeting 10
	Continue to integrate the MPAI-4 into clinical decision-making	The barriers and facilitators related to clinician's perceptions of the MPAI-4 and necessary technological resources, and the strategies selected to address these including adapting the MPAI-4 and designing a user-centred digital health solution. Ultimately, the clinical-decision making goals are to integrate the MPAI-4 into individual patient planning, post-discharge follow-up and interdisciplinary communication.	I think that the clinicians will continue to recognize that we need a social participation measure to inform them [i.e., the MPAI-4] because they recognize their role in improving that. (Clinician, Site 1, Meeting 2)
	Continue to integrate the MPAI-4 into program evaluation	Managers and administrators seeing the value of the MPAI-4, and using strategies including making the MPAI-4 comparable across sites, and conducting monitoring and feedback of MPAI-4 use can facilitate the integration of the MPAI-4 into program evaluation.	It is important to see if the services are equivalent [across health authorities]. That would be interesting. (Manager, Site 3, Meeting 2)
	Continue to integrate the MPAI-4 into regular routines	The current ministerial mandate to use the MPAI-4, the financial and human support from a larger research program and the lack of an equivalent measure currently being used in practice facilitate the integration of the MPAI-4 into regular clinical routines. Clinician's concerns about the value-add of the MPAI-4 and the view that mandates can change at any moment are barriers. Strategies to	Researcher: Two years from now you say "we are happy", what would that look like for you? Clinician: It's going on in rounds, it's like it's second nature. (Site 1, Meeting 2)

Theme	Subtheme	Description	Exemplar Quote
		help this process include adapting the clinical workflow to the MPAI-4 and conducting a yearly audit of MPAI-4 use.	
	Continue to have the MPAI-4 produce benefits for patients	Throughout the planning process, a core objective was for the MPAI-4 to produce benefits for patients, including by including them and their caregivers in decision-making, and by showing them their progress. However, beyond the creation of data visualization that were designed to show patients based on clinician feedback (user centred design code primarily within clinical decision-making), no planning was done to directly achieve this objective.	I think that everything you do in this hospital is to give benefit to patients. So I think it's kind of weird to have one strategy attached to this. It's the whole thing. That's the ultimate goal of the rest of the subdivided goals. (Manager, Site 1, Meeting 3)
	Support clinician's continued ability to use the MPAI-4	Many strategies were used to support a clinician's knowledge of the MPAI-4 and ability to score patients, interpret the scores and apply their findings to decision-making over time, including creating accessible and re-usable educational materials, and training everyone on the MPAI-4, amongst others. The strategies were facilitated by the support from managers in liberating the clinicians for training time. However, a major barrier to overcome was a lack of continuity in staff due to turnover.	I think the sustainability of using the tool also depends on the continued transfer of knowledge to the clinicians and also more understanding of how [the MPAI-4 is] being used (Manager, Site 2, Meeting 1)
The iterative nature of sustainability planning	Adaptations to stakeholder needs	Modifications to the MPAI-4 and the selected sustainability strategies. Underlying these changes is the goal to match the MPAI-4 to changing stakeholder needs (often the result of a changing practice environment). Built into modifications is the flexibility to adjust to unanticipated future changes. It is thought that adaptation will maintain	The two measurements are very close together [admission and discharge]. They really do not stay long in outpatient rehabilitation…So sometimes [the MPAI-4] doesn't happen when it's too close. (Clinical Coordinator, Site 1, Meeting 3)

Theme	Subtheme	Description	Exemplar Quote
		the fit of the MPAI-4, thus maintaining its acceptability by clinicians.	
	Circumstances leading to major adaptations	The circumstances which caused large modifications to implementation and sustainability planning. For example, expected changes in staffing (e.g., summer vacation season), unexpected events (e.g., COVID-19) and strategies used as part of the implementation process (e.g., an implementation pilot) all led to large changes in implementation planning. Subsequently, corresponding changes had to be made to sustainability planning.	I like the idea of a staggered way because we have different people at different stages or readiness for change, there's lots of stuff going on, we are coming out of this pandemic. If we could pick a few people to do the trial and error who have a bit more tolerance to the difficulties in the beginning versus more… (Manager, Site 2, Meeting 2)
	Early sustainability planning is important	The perception that sustainability needs to be thought of and planned for early on in the implementation process. Implementation choices can affect sustainability and vice versa.	I think that what's important is to bring to your attention the idea of sustainability now, at the beginning, and to make sure that you know that we know how important it is. There's often an impression that a research project dies and then everything just dies. (Researcher, Site 1, Meeting 1)

Theme 1: Collaboration as a driver of sustainability

Team members perceived that active collaboration underpinned sustainability planning, ranging from the individual and collective responsibility for the project to the actions taken to foster collaboration. There are four subthemes: (1) roles and responsibilities of individual members of the implementation team, (2) strategies used to optimize collaboration amongst stakeholders, (3) collaboratively choosing shared sustainability objectives and, (4) the value of working as a collaborative team.

Roles and responsibilities of individual members of the implementation team

Team members reported contributing to sustainability planning based on their knowledge, experience, and interest. For example, an administrator at Site 2 mentioned that they devoted time to this project because of their interest in achieving OM implementation in the stroke outpatient setting per their clinical experience in acute care. Similarly, a care coordinator at Site 2 stated that because of their professional role, they naturally fit into the role of clinical champion. The site manager agreed, noting that the clinical champion "*is the care coordinator by default*" (Meeting 4).

Strategies used to optimize collaboration amongst stakeholders

The implementation teams identified strategies that actively engaged team members in the sustainability planning process, including using a facilitator to streamline collaboration, clinical workflow mapping to provide a common language, and guidance documents to structure the planning process (i.e., INESSS toolkit, realist review results (17) and the CSAT). Participants in all sites highlighted the particular importance of the facilitator, using words like '*essential*', '*point of contact'*, and '*problem-solver'*.

Collaboratively choosing shared sustainability objectives

Managers, researchers, and clinicians emphasized how important it was that they selected shared sustainability objectives. That is, objectives that unite the implementation teams over the long-term and foster engagement. One manager expressed the importance of objectives that are relevant to them as well as those that empower clinicians:

"...that's actually the big thing, [clinical] decision-making. As much as managers need program evaluation, I don't want [the MPAI-4] to just be something that gets done and then goes into a cemetery of data that we pull out a year later. I want it to help the [clinical] team." *Manager, Site 2, Meeting 1*

The value of working as a collaborative team

At all points of the MPAI-4 project, participants acknowledged the value of working as a collaborative team. As one manager notes, without the specialized expertise of all the diverse team members, the MPAI-4 project as currently envisioned would not have been possible:

"We wouldn't have done [the MPAI-4 implementation project] the same way if we hadn't worked with you…We would have done the MPAI-4 on paper to fulfill the government mandate. We wouldn't have been able to interpret the MPAI-4 scores at all." Manager, Site 1, Meeting 3

Theme 2: Co-created sustainability plan to achieve shared objectives

The implementation teams perceived that the sustainability strategies they selected would address barriers or enhance facilitators to achieve the shared sustainability objectives (i.e., outcomes that they wish to achieve). All three sites identified the same six objectives. The subthemes capture participant's descriptions of the sustainability plan for each objective: (1) clinician's continued ability to use the MPAI-4; (2) continued integration of the MPAI-4 into regular care routines; (3) continued use of the MPAI-4 in clinical decision-making; (4) continued use of the MPAI-4 in program evaluation; (5) continued use of the MPAI-4 in research and; (6) the continued benefits of the MPAI for patients.

Clinicians' continued ability to use the MPAI-4

The implementation teams perceived that continued MPAI-4 knowledge and skill development was a required objective. The team highlighted one key barrier (turnover) and facilitator (liberated time for training) and selected relevant sustainability strategies to address these (synthesis of available evidence, ongoing training for everyone, MPAI-4 training in university curriculum). A manager highlighted that ongoing training resources is the essential strategy to achieve this objective, to access even prior to completing initial training:

"The notion of expertise, scoring the data and making sense of the data over time…I think we will have to put it on the agenda soon because we empower people to use the measure, but we will really have to have a resource somewhere." Manager, Site 3, Meeting 2

Continued integration of the MPAI-4 into regular care routines

The implementation teams perceived that the MPAI-4 had to continue to be integrated into regular care routines (i.e., fit to workflow). The team identified several facilitators (i.e., ministerial mandate, embedded within a research program developing a centralized rehabilitation data repository, no equivalent measure currently in use) and two barriers (i.e., changing provincial mandates, lack of relative advantage). Clinical team members expressed that even though mandates encouraged their use of the MPAI-4, the ongoing lack of added value of the measure was a key barrier:

Manager: The recommendations made by the accreditors were to find ways of measuring the results of our interventions…we're lucky to have the MPAI-4.

Clinician: The manager just spoke there saying we're lucky but I think the team wouldn't have understood [their] comment…The rest of us are worried. It's so not representative of what we really do." Site 3, meeting 4

To facilitate the MPAI-4's integration into routine practice, the implementation teams considered three strategies as useful: adapting the clinical workflow to the BRILLIANT platform, modifying the MPAI-4, and providing interactive training opportunities to enhance and promote its added value.

Continued use of the MPAI-4 in clinical decision-making

The implementation teams highlighted that the continued use of the MPAI-4 in clinical decision-making is facilitated by automatic reports within the BRILLIANT platform and positive attitudes towards the MPAI-4. However, clinical teams also expressed negative attitudes towards the MPAI-4, especially due to their perception that using the MPAI-4 is not feasible nor is it sensitive to change. A care coordinator voiced these concerns:

"Honestly, it's the rating scale, that's the number one disadvantage. Of course, with the scale so wide from 25 to 75% we have the feeling that we do not measure change

with that so we don't use that information in decision-making." Care Coordinator, Site 1, Meeting 3

To promote the continued use of the MPAI-4 in clinical decision-making the implementation teams thought that two primary strategies would be particularly useful: user-centered platform design and updates, and research on MPAI-4 psychometrics to understand and address perceived flaws of the measure. The latter was perceived as a separate but interlinked sustainability objective.

Continued use of the MPAI-4 in research

The implementation teams perceived that the continued use of the MPAI-4 in research relies on the integration of the MPAI-4 into regular care routines and easy accessibility of MPAI-4 scores for research purposes. One clinician highlighted both how the clinical team must continue to use the MPAI-4 regularly to be able to conduct research on the measure, and how the resulting research knowledge will be essential to the clinical use of the MPAI-4:

"It's as if until we collect the data, we can't create the models, we can't do the research projects. As long as we don't have the research projects, is it worth collecting data that will be useless? It's like a bit like a chicken or the egg." Clinician, Site 3, Meeting 1

Continued use of the MPAI-4 in program evaluation

Implementation team members perceived that the continued use of the MPAI-4 for program evaluation is facilitated by managers' positive views of the MPAI-4 and its integration into clinicians' care routines. The team thought that two strategies promoted the MPAI-4 use in program evaluation: automatic program, site and intersite evaluation reports, and a similar use of the MPAI-4 across sites so comparisons are meaningful. As one manager describes, they are very interested in applying aggregated MPAI-4 data to illustrate the benefits of stroke rehabilitation:

"[In] a presentation with [the head of the regional health authority] sitting there. I can't just say that people walked a little faster, or you know could lift their arm five more degrees. No one wants to hear that. I need outcomes that people understand." Manager, Site 2, Meeting 1

Continued benefits of the MPAI-4 for patients

The implementation team at all sites expressed that continued benefits of the MPAI-4 for patients had no direct barriers, facilitators or strategies linked to it. One manager summarized their reasoning:

> *"I think that everything you do in this [site] is to give benefit to patients. So, I think it's kind of weird to have strategies attached to this. It's the whole thing. That's the ultimate goal of the rest of the subdivided goals." Manager, Site 1, Meeting 3*

Theme 3: The iterative nature of sustainability planning

The implementation teams perceived that effective sustainability planning is an iterative process that must be agile and responsive. There are three subthemes highlighting the reasons for iterative sustainability planning: (1) adaptations to stakeholder needs, (2) circumstances leading to major adaptations, and (3) sustainability needs to be considered at the same time as implementation.

Adaptations to stakeholder needs

The implementation teams found that adapting to changing local needs throughout the sustainability planning process was essential. For example, at Site 1 the clinical team decided to switch to using the participation subscale only, in order to eliminate overlap with existing measures and reduce administration time - despite drawbacks in losing data from the rest of the measure:

> *"Sometimes we think, if we had entered [abilities and adjustment item scores] we would have seen changes. But I don't think the team is ready to go back to doing the full MPAI-4, it's really longer to do that." Care coordinator, Meeting 3*

Circumstances leading to major adaptations

When implementation teams perceived that the context changed, they discussed and modified the implementation and sustainability plans. For instance, in response to a new data privacy law (65), the implementation teams used a user-centred design process to create the BRILLIANT platform that would align with provincial law yet provide the required

functionality. Although the circumstance was unexpected, participants expressed great satisfaction with the resulting platform, including linking it directly to sustainability:

> *Care Coordinator: "Since we filled things on the new database [BRILLIANT platform], the fact that we have information immediately, it's really wonderful. For me, for sustainability, it was very important to have."*
> *Manager: "It was key."*
> *Meeting 3, Site 3*

Early sustainability planning is important

While it was researchers who prompted the implementation teams to conduct implementation and sustainability planning concurrently, the clinical team members indicated that they saw benefits in the approach. A care coordinator reflected on their experience with concurrent implementation and sustainability planning:

> *"Planning in advance like this is not something we're used to doing in the clinic… to plan and then have strategies to keep motivation and to use the MPAI-4 in a way that makes long-term clinical sense." Care Coordinator, Site 1, Meeting 3*

Discussion

In this qualitative description study we aimed to explore the collaborative sustainability planning process for the MPAI-4 in three rehabilitation sites. The team at each site included researchers, knowledge brokers, clinicians, clinician leaders, managers, and IT professionals working within an IKT approach. We identified three major themes: (1) collaboration as a driver for sustainability; (2) co-creation of a sustainability plan to achieve shared objectives; and (3) sustainability planning as an iterative process.

Guided by sustainability planning recommendations (66–68) and following an IKT approach (29,30,69), the implementation teams planned for MPAI-4 sustainability by collaboratively identifying sustainability barriers, facilitators and outcomes that they wished to achieve (i.e., objectives), then selecting strategies to achieve these objectives. Likely due to some individuals being a member of all implementation teams and the cross-site meeting encouraging information sharing, stakeholders identified the same six objectives at each of the three sites: (1) clinicians' continued ability to use the MPAI-4; (2) continued integration of the MPAI-4 into regular care routines; (3) continued use of the MPAI-4 in clinical decision-making; (4) continued use of the MPAI-4 in program evaluation; (5) continued use of the MPAI-4 in research; and (6)

the continued benefits of the MPAI for patients. Collectively, these objectives addressed all stakeholders' needs in the MPAI-4 project. That is, they are shared objectives that the team has and will continue to unite behind over the long-term (70) because they will continue to result in more usable knowledge and tangible outcomes for all stakeholders (71–73). Participants in this study indicated that identifying shared objectives was essential to the collaborative sustainability planning process. This is consistent with the work of Smith and colleagues, who suggest that insufficient support and/or objective misalignment with stakeholder needs would threaten sustainment (70). As a result, the likelihood of sustaining the shared sustainability objectives may be greater.

In addition to participants identifying shared sustainability objectives, they perceived important relationships between them. The implementation teams highlighted that all other objectives contribute to sustaining patient benefits, which is consistent to cancer care managers' perceptions of sustainability (14). Stakeholders at all sites also suggested that the other five objectives are dependent on clinicians' continued ability to use the MPAI-4, a finding that mirrors the results of our realist review of EBP sustainability in rehabilitation (17). None of the other relationships between objectives highlighted by participants were similar to those discussed in previously published work (e.g., link between continued research and use in clinical decision-making) (14,17). Thus, shared sustainability objectives and the links between them seem to vary between EBPs, care settings (e.g., rehabilitation versus cancer care) or other contextual factors. Implementation teams may benefit from not only identifying their own shared objectives but also the relationships between them to deliver sustainability strategies in the optimal sequence in their project. For instance, after identifying that clinicians' continued ability to use the MPAI-4 was critical to achieving all other objectives, the implementation teams delivered sustainability strategies for this objective before the others. In future research, the identification of relevant sustainability objectives could be further explored, and recurring relationships amongst them tested to guide sustainability planning.

Based on the MPAI-4 implementation adaptations thus far, participants expected contextual factors and their own needs to continue to change over time. Aligned with recent literature (74–76) the implementation teams planned for a range of possible adaptations such as configuring the BRILLIANT platform to make using the participation subscale instead of the full MPAI-4 seamless. We recommend implementation teams make similar plans for likely

adaptations, and echo calls for investigation into the trade-off between adaptation and fidelity (77–79).

Consistent with findings from Song and colleagues (80), implementation team members expressed that sustainability is particularly influenced by local contextual factors and policy-level changes compared to implementation. Multiple participants expressed that local contextual factors (e.g., turnover, site IT processes, etc.) were relatively predictable and could be planned for in advance (e.g., MPAI-4 orientation training, standard operating procedures). In contrast, participants highlighted that policy-level changes such as new laws or changing mandates were unpredictable. While favourable healthcare policies can be an important facilitator for EBP sustainment (81), policy-level factors have historically been underdeveloped and/or underreported. In the recent update to the Consolidated Framework for Implementation Research (CFIR), the authors expanded policy-level factors, including adding the "performance measurement pressure" concept (82). With policy-level factors having a large but previously underdeveloped influence on sustainment, we recommend further investigation. Future research could provide guidance to implementation teams on which policy-level factors may be of influence, which may make them more predictable and easier to plan for as part of implementation projects.

Limitations

Although funding was set aside to involve patient partners and including them may have enhanced MPAI-4 sustainability planning, none were engaged. Similarly, although planned, we were not able to conduct sex and gender-based analysis (83–86) because nearly all participants self-identified as women and female. To preserve anonymity due to small sample sizes we often reported results in aggregate. Including a larger number of sites in future work may enable more analysis and reporting options.

This study took place across multiple sites, but all sites were within the same healthcare system, affiliated with the same research centre, and used the MPAI-4 with the same clientele. The transferability of the results may be limited to similar healthcare contexts (i.e., interdisciplinary rehabilitation programs with strong research affiliations, concerning outcome measures within a public healthcare system).

Finally, this research started just before, then followed, the COVID-19 pandemic. The pandemic prompted a change in the project schedule and clinical priorities, and contributed to stress and burnout amongst healthcare workers (87). This may have made them less engaged in planning for MPAI-4 sustainability, or in making a change in their clinical practice.

Conclusion

This study responded to calls to describe the process of sustainability planning (18,41,88) and IKT (89,90). We identified how the implementation teams collaborated to successfully plan for sustainability, reported the sustainability plan and described the necessity of iterative sustainability planning. These themes highlight the importance of collaborative sustainability planning, especially with the goal to achieve a set of shared objectives. Future research could investigate the links between collaborative sustainability planning and sustainment to provide evidence of the utility of the approach. Implementation teams can be informed by our results when collaboratively creating a sustainability plan to optimize sustainment.

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Conflict of interest statement

The authors declare no conflict of interest.

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Appendix A.

COREQ Checklist

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	p10 line 22
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	title page
Occupation	3	What was their occupation at the time of the study?	title page
Gender	4	Was the researcher male or female?	title page
Experience and training	5	What experience or training did the researcher have?	p10 line 21
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	p10 lines 8-9
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	p10 line 20
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	p12 line6-7
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	pg 7 line 8
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	p10 lines 6-8
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	p10 lines 6-10
Sample size	12	How many participants were in the study?	p12 lines10-12
Non-participation	13	How many people refused to participate or dropped out? Reasons?	p12 lines 10-12
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	p10 lines 16-17
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	pg 10 line 23
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	p12 lines 11-16
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	p10 lines 17-18
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	p9 lines 1-3
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	p11 lines 1-2
Field notes	20	Were field notes made during and/or after the inter view or focus group?	p11 line 2
Duration	21	What was the duration of the inter views or focus group?	p9 lines 1-3
Data saturation	22	Was data saturation discussed?	N/A
Transcripts returned	23	Were transcripts returned to participants for comment and/or	N/A

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	pg 11 lines 15-17
Description of the coding tree	25	Did authors provide a description of the coding tree?	p12 lines 19-22
Derivation of themes	26	Were themes identified in advance or derived from the data?	p11 line 9
Software	27	What software, if applicable, was used to manage the data?	p11 line 7
Participant checking	28	Did participants provide feedback on the findings?	N/A
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	p13-20
Data and findings consistent	30	Was there consistency between the data presented and the findings?	p13-20
Clarity of major themes	31	Were major themes clearly presented in the findings?	p13-20
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	p13-20

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

Appendix B.

Full List of MPAI-4 Meetings

Meetings in bold were recorded and transcribed verbatim. All other meetings were recorded via written summaries only.

#	Date	Hours	Description
1	**19/02/2020**	**2**	**Site 3, full implementation team meeting #1**
2	**21/02/2020**	**1.5**	**Site 1, full implementation team meeting #1**
3	**27/02/2020**	**2**	**Site 2, full implementation team meeting #1**
4	**12/03/2020**	**1.5**	**Site 1, full implementation team meeting #2**
5	06/04/2020	2	Research team meeting, discussion of COVID-19 research halt effects and research study design
6	14/05/2020	1	Research team meeting, discussion of need for more info on MPAI – suggest systematic review
7	28/05/2020	1	Research team meeting, discussion of design for MPAI systematic review of psychometric properties
8	09/07/2020	0.25	Consultation with manager about MPAI systematic review needs
9	13/08/2020	1	Research team meeting, MPAI review of current findings and next steps decisions
10	25/08/2020	1	Consultation with MPAI implementation team on strategies to work on during COVID-19 research shutdown
11	04/11/2020	1	Consultation with MPAI implementation team on prospective reopening to research post-COVID-19 shutdown
12	05/11/2020	1	Research team meeting, MPAI review of current findings and next steps decisions
13	19/11/2020	1	Research team meeting, MPAI review of current findings and next steps decisions
14	14/12/2020	0.5	Site 2, Research team + manager meeting to confirm MPAI implementation project restart and strategy
15	06/01/2021	0.5	Site 1, Research team + manager meeting to confirm MPAI implementation project restart and strategy
16	07/01/2021	0.5	Site 3, Research team + manager meeting to confirm MPAI implementation project restart and strategy
17	**13/01/2021**	**1.5**	**Site 3, full implementation team meeting #2**
18	18/01/2021	1	Site 3, follow-up with manager about deliverables from meeting #2
19	25/01/2021	1	Research team meeting, MPAI review of current findings and next steps decisions
20	28/01/2021	1	Introduction to RedCap, functionalities with IT
21	**10/03/2021**	**1**	**Site 2, full implementation team meeting #2**

22	**11/03/2021**	**1**	**Site 1, full implementation team meeting #3**
23	12/03/2021	0.5	Site 2, follow-up with MPAI systematic review results to questions raised in meeting to help make decision on which populations to use the MPAI with
24	29/03/2021	0.25	Site 1, follow-up about training
25	08/04/2021	1	Research team meeting, MPAI review of current findings and next steps decisions
26	20/04/2021	1	Full research team meeting MPAI implementation project for study design
27	30/04/2021	0.5	Consultation with site managers on feasibility of MPAI implementation study design
28	30/04/2021	0.5	Site 3, consult with manager to tailor training
29	03/05/2021	1.5	MPAI community of practice, TBI and stroke
30	15/05/2021	3	Site 3, MPAI training
31	25/05/2021		Full research team meeting MPAI implementation project updates and next steps
32	26/05/2021	0.25	Site 1, consult with manager to tailor training
33	28/05/2021	0.5	Site 2, consult with manager to tailor training
34	03/06/2021	1	Meeting with TBI MPAI team about Access database (IT)
35	15/06/2021	3	Site 2, MPAI training
36	16/06/2021	3	Site 1, MPAI training
37	17/06/2021	1	Meeting with managers, all sites to discuss next steps and to demonstrate the Access MPAI database
38	30/07/2021	1	Research team meeting, MPAI review of current findings and next steps decisions
39	15/08/2021	1	Meeting with site managers to discuss implementation pilot
40	28/08/2021	0.5	Meeting to TBI MPAI IT team to tailor Access database
41	**07/09/2021**	**1**	**Intersite meeting**
42	15/09/2021	0.5	Meeting to put MPAI on RedCap database (IT)
43	12/10/2021	1	Site 2, post-MPAI pilot meeting with managers to discuss necessary changes (need RedCap before use)
44	**18/10/2021**	**1**	**Site 3, full implementation team meeting #3 (post-pilot)**
45	19/10/2021	0.5	Discuss IT issues across all sites with regional IT group
46	25/10/2021	1	Site 1, post-MPAI pilot meeting with managers to discuss necessary changes (Paper-based while waiting for RedCap)
47	29/10/2021	1	Meeting with USA-based clinician/researchers who implemented the MPAI-4 10 years ago
48	9/11/2021	0.5	Site 3, development of workflow diagram with manager to inform RedCap database development
49	16/11/2021	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
50	09/12/2021	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
51	16/12/2021	1	Site 2, how to restart MPAI implementation (need RedCap)
52	18/01/2022	1.5	MPAI community of practice, TBI and stroke

53	19/01/2022	1	Site 1, meeting with IT to resolve Access issues
54	25/01/2022	0.5	Meeting with MPAI project IT person to develop RedCap database
55	26/01/2022	0.5	Onboard new knowledge broker at site 3 to MPAI project
56	01/02/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
57	03/02/2022	0.5	Site 2, Informal talk + question period on the MPAI based on systematic review results
58	03/02/2022	0.5	Provincial IT meeting – mandate for server to allow for data sharing between health regions
59	09/02/2022	1	Meeting with USA-based clinician/researchers about psychometric properties
60	14/02/2022	0.5	Discuss strengths of different methods of MPAI administration, especially to reach consensus
61	15/02/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
62	24/02/2022	0.5	Provincial IT meeting – mandate for server to allow for data sharing between health regions
63	01/03/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
64	14/03/2022	1	Meeting with MPAI project IT to develop RedCap database
65	15/03/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
66	24/03/2022	1	Provincial and regional IT meeting – mandate for server to allow for data sharing between health regions
67	30/03/2022	1	Share video module scripts with managers at each site and get their written feedback. Follow-up to discuss specific points as necessary.
68	12/04/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
69	21/04/2022	0.25	Provincial IT meeting – progress update and next steps
70	25/04/2022	0.5	MPAI on RedCap demo to research team
71	28/04/2022	1.5	Site 3, RedCap demo and design meeting
72	02/05/2022	1.5	Meeting with IT to discuss and make updates to RedCap based on site 3 feedback
73	05/05/2022	0.5	Provincial IT meeting – progress update and next steps
74	09/05/2022	1.5	Site 1, RedCap demo and design meeting
75	10/05/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
76	11/05/2022	1.5	Site 2, RedCap demo and design meeting
77	12/05/2022	0.5	Provincial IT meeting – progress update and next steps, including mandate and security risks
78	17/05/2022	1.5	Full research team meeting with USA-based clinician/researchers

79	24/05/2022	0.5	Core research team meeting to discuss MPAI project (RA, AT, SA)
80	09/06/2022	1	Presentation the MPAI and it's integration with FIM on request of site 2 to regional committee
81	15/06/2022	1	Full research team meeting, progress update
82	15/06/2022	1	MPAI IT progress meeting, next steps
83	16/06/2022	0.5	Provincial IT meeting – progress update and next steps
84	22/06/2022	2	MPAI community of practice, TBI and stroke
85	23/06/2022	1	Provincial mandate finalization meeting
86	28/06/2022	1	Discussion of MPAI database with TBI, make stroke and TBI databases coherent with one another
87	26/07/2022	0.5	Provincial mandate finalization meeting
88	23/08/2022	1	RedCap final demo and check
89	24//08/2022	1	Site 1, BRILLIANT project update (includes the MPAI)
90	20//09/2022	1	Site 3, BRILLIANT project update (includes the MPAI)
91	13/10/2022	1	MPAI advanced interpretation training planning meeting with research team
92	24/10/2022	0.5	Site 1, MPAI advanced interpretation training planning meeting feedback
93	07/11/2022	1	Full research team meeting advanced interpretation training
94	23/11/2022	2	Site 1, advanced interpretation training session and RedCap demo
95	25/11/2022	1	Site 1, RedCap updates post-training meeting
96	19/01/2023	1	Site 3, MPAI advanced interpretation training planning meeting feedback
97	17/02/2023	0.5	Site 1, RedCap bug fixes
98	24/02/2023	0.5	Advanced interpretation video content development by research team
99	03/03/2023	0.5	Onboard new knowledge broker at site 1 to MPAI project
100	**09/03/2023**	**1**	**Site 1, final full implementation team planning meeting (#4)**
101	06/04/2023	1	Site 3, RedCap test and demo for care coordinators only. Feedback on training objectives
102	13/04/2023	1	Site 3, advanced interpretation training session and RedCap demo
103	13/04/2023	1	Site 2, RedCap test and demo for care coordinators only. Feedback on training objectives for ½ clinical team
104	19/04/2023	1	Site 2, RedCap test and demo for care coordinators only. Feedback on training objectives for ½ clinical team
105	01/05/2023	2	Site 2, advanced interpretation training session and RedCap demo for ½ clinical team
106	04/05/2023	2	Site 2, advanced interpretation training session and RedCap demo for ½ clinical team
107	07/06/2023	1	**Site 3, final full implementation team planning meeting (#4)**
108	17/07/2023	1	**Site 2, final full implementation team planning meeting (#3)**

Appendix C.
CSAT Scores

Differences between domains and item scores correspond to differences in the sustainability plan across sites. Across sites, the lowest scoring domain included outcomes and effectiveness (3.60 (0.75); 3.30 (1.56)), with weaker items concerning evidence of beneficial outcomes of the MPAI-4. In all sites, the strongest domains were bolstered by high scores on items concerning respect and collaboration within the implementation team.

Table C.1: Mean (SD) of CSAT domains and total scale scores at each site

Domain	Site 1 (n=5)	Site 2 (n=4)	Site 3 (n=4)
Engaged staff and leadership	5.00 (0.71)	3.87 (0.64)	4.51 (1.84)
Engaged stakeholders	4.25 (0.40)	3.82 (1.70)	3.50 (2.17)
Monitoring and evaluation	4.60 (0.48)	4.65 (1.14)	5.70 (1.38)
Organizational context and capacity	5.00 (0.22)	4.50 (1.36)	4.92 (1.46)
Workflow integration	5.00 (0.31)	4.70 (1.08)	5.63 (1.33)
Planning and implementation	4.65 (0.20)	4.85 (0.75)	5.33 (2.51)
Outcomes and effectiveness	3.60 (0.75)	3.30 (1.56)	3.68 (1.67)
Total	4.65 (1.40)	4.27 (1.32)	4.79 (1.80)

Appendix D.
Definitions and Exemplary Quotes for Themes, Subthemes and Codes

Theme	Subtheme	Code	Definition	Exemplar Quote
Collaboration as a driver of sustainability			Implementation team members actively collaborated to plan for sustainability, including by taking on implementation and sustainability duties and making key decisions such as choosing implementation and sustainability objectives. Furthermore, the team sought to enhance collaboration underlying planning processes by using strategies that optimized engagement and communication.	
	Roles and responsibilities of individual members of the implementation team		Self-assigned or designated implementation and sustainability duties of implementation team members. The duties tend to be split according to the authority of an individual's professional role (e.g., managers are responsible for coordination of the clinical side of the project).	I'm thinking about who would be those at the core, who sort of look at the nitty-gritty details of the implementation and then maybe take it back to the teams to validate it and say "is this how we want to do it?". (Researcher, Site 2, Meeting 1)
		Role of Information Technology Specialists	Implementation duties of the information technology specialists involved in the MPAI implementation project. Although not decision maker members of the implementation team, their skills were essential to enacting technological components of the implementation and sustainability plans.	I think the [new database], with [IT person] being a godsend, we need to have another GODSENT person because this is it exactly…what happens if something happens to [IT person]? I will die [laughter]. (Manager, Site 1, Meeting 3)
		Role of patient or caregiver partners	The proposed implementation duties of patients or caregivers on the implementation team. No patients or caregivers ultimately joined the implementation teams at any site.	Clinician: Would there be a client partner involved in that? Researcher: Yes, thank you for bringing that up. The answer is yes, we should have one and probably one in each site. So we do

				have patient partners that do work across projects but I think it would be of value for someone who has gone through the system, what do you think? [general agreement from room] (Site 2, Meeting 1)
		Role of the administrators	Implementation duties of the administrative members of the implementation team. Their duties included aligning the MPAI-4 project with their long-term strategic vision to facilitate the integration of the MPAI-4 project into larger initiatives.	I think we all work very closely, with [the other administrators]. I think our next CPA meeting, it's basically the same players…we could talk about where we see it going (Administrator, Site 2, Meeting 2)
		Role of the clinician champions	Implementation duties of the clinical champion members of the implementation team. The clinical champion role was explicitly designated. Duties varied and could be self-assigned or designate. They often included day-to-day support for the MPAI-4 in practice.	Care coordinator: I think the coordinators are going to be the champions, to bring it to the teams. Manager: Yeah, because we got their input, so we know what their ideas are. We will try to integrate those. (Site 3, Meeting 1) The role of the local champion who deals a little bit with the subject of implementation within the stroke program, who plays a bit of a role of facilitator, trainer, clinician who also makes the interaction between the clinical team and the research team and who is supported in her role by myself who plays the role of coordinator of the project (Researcher, Meeting 2, Site 3)
		Role of the intersite implementation team	The duties of the intersite team, especially in contrast to the local implementation teams at each site. The intersite implementation team is composed of managers and administrators with researchers present in an observer or learner role. These meetings tend to focus on issues related to comparing data between the sites at the level of program evaluation.	If each site is ready, they saw their readiness, then they should start. For us across sites, it is important to reflect. What is important for each site and how can we make what we need to the same while allowing each site to go at their own pace? (Researcher, Intersite meeting)

		Role of the knowledge brokers	Implementation duties of individuals in knowledge broker type roles on the implementation team (i.e., clinical research coordinators, professional development coordinators). Their duties relate to their functions as knowledge brokers at their site, including facilitating communication between clinical and research team members, and providing feedback on the feasibility of the research project.	I'm listening to everybody's comments and I understand the clinicians, like I understand the implementation could be challenging. So I'm here to help with that. (Knowledge broker, Meeting 1, Site 2)
		Role of the managers	Implementation duties of the managers on the implementation team. Their duties can be self-assigned or designated, and tend to focus on ensuring clinician concerns are met and focusing on program evaluation.	If we are going to use it as a large team, everyone must know the tool. So at each stage we determined who should be at a given time of formation. That's why the support of managers is super important but I think we're more there. (Manager, Meeting 1, Site 3)
		Role of researchers	Implementation duties of the researcher on the implementation team. The roles can be self-assigned or designated, and tend to focus on the overall management of the implementation project, overseeing the technical portions of the project, and conducting the research project.	Our role as the research team – [researcher] and I are overseeing the process and making sure all the pieces are there from an implementation and a research perspective, and we've got a lot of great people helping us (Researcher, Meeting 2, Site 2)
	Strategies used to optimize collaboration amongst stakeholders		The implementation team selected and used strategies to optimize the active engagement of the diverse implementation team members. This indirectly enhanced sustainability planning by helping the team speak the same language and providing structure to the collaborative process.	I think it would be interesting that we can do a workflow mapping for the MPAI-4. Because when [the research and IT team] develop a computer system like BRILLIANT we really have to follow the clinical process. The information is needed at the right time with the right questions. So a mapping is a way to visualize this kind of representation in a drawing (Researcher, Site 3, Meeting 3)
		Clinical workflow	Mapping the clinical workflow and the MPAI-4's specific place within it	What's important early though is just to determine what our grandes-lignes [major

		mapping to understand the specifics of who, when and how the MPAI-4 will be used	diagrammatically. This mapping includes the timing of MPAI-4 use along a patient's pathway, who will complete the MPAI-4, how consensus will be reached and how and when MPAI-4 scores will be used. This mapping allowed the research team to understand the context of the clinical team and encouraged the clinical team to be explicit in their objectives for the MPAI-4.	lines] are going to be to help the researchers so they understand the differences between the three sites and then we can reflect on it that way. (Manager, Meeting 2, Site 2)
		Conducting planning meetings when needed	Meetings were not planned at regular intervals, but instead scheduled when needed or requested. Meetings also varied in who attended them. All attendees were present at the high-level planning meetings but only those implicated were at hands on meetings to work through those plans.	Should we plan periodic meetings? Or just make sure that we all communicate with each other as needed? Oh, I can already see that everyone prefers the first option (Researcher, Meeting 2, Site 1)
		Having a facilitator to coordinate the MPAI-4 project	The role of the person that coordinates the implementation process for the MPAI-4. This includes facilitating communication amongst team members and coordinating the associated research project. By having a central coordinator, there is a clear chain of communication and management for all team members and the whole team is kept updated.	There will be one overall coordinator across all of the sites who would be sort of the go-to person in making sure everything is running on time and can be, sort of if there's a question that person would go find the answer or they have the answer ready. (Researcher, Site 2, Meeting 2) [The facilitator] is there to say OK what else do you need to link back in with the broader research team if needed, until it becomes its own engine, an MPAI engine if you will, in the team. The idea is that it would remain, that's how we would achieve sustainability. (Researcher, Site 3, Meeting 1)
		Using a specific tool to guide	Use of a sustainability planning tool to structure collaborative sustainability planning. In this case, the clinical sustainability assessment tool was used to help get the	One of the tools we will ask you to look at is the sustainability questionnaire because it touches on the elements that have been identified as being important in a team, or

		sustainability planning	comprehensive and anonymous views of team member's perceptions of their site's ability to sustain the MPAI-4. The results of this tool were integrated into sustainability planning.	in a clinical setting to ensure sustainability of any new project. And so one of the reasons of administering that early on is if we see there's something that is flagged as maybe not being put in place we will say "OK can we work together to put that in place?" so that we are sure that we increase the chances of sustainability. (Researcher, Site 2, Meeting 2)
		Using an implementation guide to structure the implementation process	Being guided systematically through the implementation and sustainability process, and related decision making via an implementation guide. In this case, the specific guide used was the INESSS MPAI-4 implementation toolkit, which structured and prompted implementation team discussions.	Has everybody seen the MPAI implementation toolkit? The trousse? It will really facilitate the discussion. So there, they really outline as you see the history of the MPAI, what groups it was validated in, and broke it up into the different phases. So the objective for today is that we walk through the MPAI, walk through the phases together to see what would it look like here. (Researcher, Site 2, Meeting 2) Clinician: It's like the kit says but... Researcher: It's a good question but I think we can do fast forward. (laughs) Clinician: But the kit says we do it 1 month, 4 months, the implantation is 8 months so.. (Site 3, Meeting 1)
	Collaboratively choosing sustainability objective so team members continue to support the project		The full implementation team collaboratively chose the core sustainability objectives for the MPAI-4 implementation project. The team focused on selecting objectives that are relevant to different stakeholders (i.e., clinicians, managers, researchers, patients) so that all key perspectives are included. By planning to address each stakeholder's needs, these stakeholders continue to support and collaborate on the project.	What is important is really to determine what the objectives are…we should learn from what the [TB teams] already did. But restart with the goal. Okay, let's itemize those goals that are going to be really helpful. That will be a good start rather than trying everything. (Clinician, Site 2, Meeting 1)

		Integrating administrative objectives	Administrators are consulted to understand their goals and priorities, especially in terms of outputs that they would find useful. By ensuring these outputs will be produced, there is support for the MPAI-4 from administrators because the MPAI-4 fits with their goals and priorities.	Yeah and the timing because the other thing is we can have a process but we may say it's good to be done at six weeks post intake, or post start, but that's to kind of maintain those timeframes that we all agree upon because otherwise our data would be all skewed. (Manager, Site 2, Meeting 1) Definitely both of those would be objectives for the implementation of MPAI. I've mentioned it at previous meetings that the challenge of the RAIS milieu is that we don't have an overall measure that can speak to a language to advocate for services…So although clinical it's a good clinical tool and I like that, definitely program evaluation will be something we want as an objective. (Manager, Site 2, Meeting 2)
		Integrating clinical objectives	Clinicians are consulted to understand their goals and priorities, especially in terms of outputs that they would find useful. By ensuring these outputs will be produced, there is support for the MPAI-4 from clinicians because the MPAI-4 fits with their goals and priorities. All members of the implementation team are clinicians in addition to their other designation of researcher, manager etc. In addition to the clinician team members, other individuals could provide their opinion on clinical needs.	I also see the other objective is like when we do the reactivation group and we've always been saying you know, what should we have done before to minimize this risk of reactivation? And this would, we could see what were the indicators that we didn't succeed that integration, their activities, and if we could pick those things up (Clinician, Site 2, Meeting 1) Yes, but as you say, it all depends on the objectives. When you want to implement a tool like that, you have to have clear objectives on which everyone agrees (Care coordinator, Site 3, Meeting 1)

		Integrating research objectives	Researchers are consulted to understand their goals and priorities, especially in terms of outputs that they would find useful. By ensuring these outputs will be produced, there is support for the MPAI-4 from researchers because the MPAI-4 fits with their goals and priorities.	There are meetings with the team at each site to essentially identify the objectives… these decisions are going to belong to the team so that they can adhere to them, but they need to fit [the research team's] goals too (Manager, Site 3, Meeting 2)
	Value of working as a collaborative team		Stakeholders recognize the value that other members of the implementation team bring to the table by this being a collaborative project. For example, the necessary resources and connections to make the implementation of the MPAI address all stakeholder concerns requires everyone to be at the table.	Because of the MSSS we knew we had to implement MPAI-4, but we thought would we be doing it alone? So the fact that we are all here is just, it's going to be excellent (Manager, Site 2, Meeting 2)
Co-created sustainability plan to achieve shared objectives			The sustainability strategies that the implementation team chose to achieve a certain sustainability objective by addressing barriers or enhancing facilitators.	
	Continue the use of the MPAI-4 for research purposes		By making all the data accessible to researchers within a single database, researchers could continue to use the MPAI-4 data for research purposes.	Until we collect the data, we can't create the models, we can't do the research projects. (Researcher, Site 2, Meeting 10
		Objective - continue to use MPAI-4 data in research projects	The MPAI-4 data continues to be accessible for research purposes, especially for research projects in which the results would be meaningful and relevant to the participating rehabilitation centers.	Clinician: Maybe your T2 data would be interesting. That's what I understood was their questioning, can we establish predictors? Are there people in whom they have little idea of the prognosis a little clearer? Researcher: As you say, as long as we have data in the database we can look at that for sure. (Site 3, Meeting 2)
		Strategy - All data should be	All the data that is collected across regions should be within the same database such that	It is sure that the ideal eventually is to have everything in the same place because we in

		accessible to researchers within a single database	all the data can be accessed at once, easing accessibility for research purposes.	the research project we will also look for [administrative] data (Researcher, Site 3, Meeting 1)
	Continue to integrate the MPAI-4 into clinical decision-making		The barriers and facilitators related to clinician's perceptions of the MPAI-4 and necessary technological resources, and the strategies selected to address these including adapting the MPAI-4 and designing a user-centred database. Ultimately, the clinical-decision making goals are to integrate the MPAI-4 into individual patient planning, post-discharge follow-up and interdisciplinary communication.	I think that the clinicians will continue to recognize that we need a social participation measure to inform them [i.e., the MPAI-4] because they recognize their role in improving that. (Clinician, Site 1, Meeting 2)
		Barrier - Clinicians and/or managers perceive that the MPAI-4 has some flaws	Some managers and clinicians have identified what they perceive as drawbacks to the MPAI-4, including to its scoring and interpretation. For example, the rating scale is perceived as imprecise when used to detect the change in a patient. Nor is the MPAI-4 perceived to be able to be interpreted in the same manner when used by a caregiver or patient, versus a clinician.	They're concerned that you know we're scoring, especially when it's the score three which goes, which ranges from 25 to 75%. (Manager, Intersite Meeting) And one of our big questions too and we asked our TCC team is it's a fairly simple pool, it said that it could be filled out by the clients themselves or their proches, but TCC never did that and it sounds like they don't feel it really is something you can give to a client to fill out. (Manager, Site 2, Meeting 1)
		Barrier - Perception that the MPAI-4 is not feasible to use	The MPAI-4 is not considered convenient to use, especially that it will not fit within the time constraints of the clinical workflow.	If it takes 30 minutes to do as a team, it is not realistic in an intervention plan that lasts 30 to spend 30 minutes on the tool. (Clinician, Site 3, Meeting 2) If you are go we start anyway if we do not have the right platform we will wait for your platform. We will stop doing it now because we it takes us 20 minutes more,

				and then more for the final score (Clinician, Site 3, Meeting 3)
		Barrier – Clinicians perceive that the MPAI-4 does not provide a clear advantage over current practice	Clinicians perceive that MPAI-4 scores do not currently have meaningful application, especially in a way that goes beyond that which is available through current clinical practices. There is a need to give clinicians some concrete meaning to scores so that they experience an obvious, direct application of the MPAI-4 in their clinical workflow.	I guess the the one of the buy-ins. I think they need that that feedback loop and by doing electronically they have the feedback and they would 'cause from just from hearing point the another team like TCC how they do it. They do it on paper format. You don't get the total score. (Manager, Intersite Meeting)
		Facilitator - An expectation of expanded benefits from the MPAI-4 in the future	The MPAI-4 data will be used to provide more opportunities for its use in clinical decision making in the future, especially by investigating evaluative and predictive applications of the MPAI-4, and its use in related populations. The expectation of these benefits comes from tentatively planned future work to this effect.	Then I think we know, that it takes data, and then that's what I told the world. Here, you know, we have, we have nothing in the short or medium term with this tool (Manager, Site 3, Meeting 3) We're back to collection. So, if we could do this, if we could start changing the mindset that the numbers that we collect, the work that we put in, the time that we put in, is going to have a big added value for us to help the clients, this would be a win. (Clinician, Site 1, Meeting 1)
		Facilitator - Perception that the MPAI-4 informs clinical decision making	Clinicians perceive that the MPAI-4 can provide valuable information which they can use to inform their clinical decision making.	I think if it's presented as a teaching tool, it's something that you could show to the patient objectively, they like to have objective things to show. It's nice for a clinician to say look you went from here to here. (Knowledge Broker, Site 1, Meeting 2)
		Facilitator - The MPAI-4 is perceived as feasible to use	The MPAI-4 is considered to be convenient to use, including in terms of its simplicity and its ease of integration into the clinical workflow.	The tool is not complicated. You have to get acquainted but clinicians are already used to a lot of tools, so the tool is really not complicated. (Manager, Site 3, Meeting 1)

		Facilitator - The necessary technological resources are available	The necessary technological resources are available, including hardware, software and infrastructure, and human resources, in terms of individuals with technological expertise.	It must not be paper because we do not have the resources to transcribe, it must be electronic. (Manager, Site 3, Meeting 1)
		Facilitator – Clinicians and managers perceive that the MPAI-4 provides a clear advantage over current practice	Based on reviewing and using the MPAI-4, clinicians and managers perceive that the MPAI-4 is comprehensive and uses accessible language. Thus, the MPAI-4 can be relied upon across rehabilitation disciplines to provide a full portrait of a patient and encouraging interdisciplinary communication.	The first basic step is to present the tool to the team and validate that the team sees an added value. It was not clear at the beginning what the team saw as an added value but what we found that made sense was that at the time we had no tools and that's why we developed the Quebec adaptation the MPAI (Researcher, Site 3, Meeting 1) Our IT is not getting the access application on the computers so [the coordinator] has been working very hard with our IT department to get that installed they finally accepted. They said they were going to do it virtually. (Manager, Intersite Meeting)
		Objective - continue to use the MPAI-4 in clinical decision-making	The routine, active and meaningful use of MPAI-4 data in clinical practice, such that it is not becoming a 'cemetery of data'. Objectives include using the MPAI-4 (1) in individual patient planning to describe, evaluate or predict patient outcomes; (2) for post-discharge follow-up and; (3) to provide a common language for interdisciplinary communication.	From the ministerial orientations which are quite good, they mentioned in our phase, beginning and end or rehab, but they also mention the notion of doing a follow-up a year or two after rehab, who might have dropped down and needs a booster of rehab. (Manager, Site 2, Meeting 1) The more people we are around, the more it is likely to be precise but at the same time we tell each other that it is a photo that we take. We take a photo at the beginning and a photo at the end, it may be a little blurry but in general the MPAI-4 presents the portrait of the person quite precisely I

				would tell you. (Clinician, Site 3, Meeting 2)
		Strategy - Conducting user-centered database design	Feedback from the technical team was solicited on how the database (Access or RedCap) could be better designed for ease of use within the clinical workflow. This included logistics such as the location the database can be accessed, database features to lessen administration time and automatic data visualization to inform clinical decision-making.	The idea was for the clinicians to enter directly but the Excel sheet is a bit heavy, so with Brilliant we have the opportunity to maybe program it into an easier, user-friendly interface and then be able to get the score right away (Researcher, Site 2, Meeting 1)
		Strategy - Interactive Training Style	The use of an interactive, case-based training style to engage clinicians in critically thinking about the MPAI-4 and to be more motivated to use it.	I think the training also set you up, it was really that I think consolidated it, it gives them a new impetus to the team to say OK, we were not so in the field. It clarified things, but it gave it back, motivation to the troops to continue. (Manager, Site 1, Meeting 3)
	Continue to integrate the MPAI-4 into program evaluation		Managers and administrators seeing the value of the MPAI-4, and using strategies including making the MPAI-4 comparable across sites, and conducting monitoring and feedback of MPAI-4 use can facilitate the integration of the MPAI-4 into program evaluation.	It is important to see if the services are equivalent [across health authorities]. That would be interesting. (Manager, Site 3, Meeting 2)
		Facilitator - Managers and/or Administrators see the added value of the MPAI-4 for program evaluation	The individuals involved in program evaluation (i.e., primarily managers and administrators; secondarily researchers for limited research purpose) see the benefits of using the MPAI-4 to aid them in their work. For example, by providing concrete data that they can present to regional administrators on rehabilitation impact.	We've wanted to set up something for the measure for external customers for a long time so I was looking forward to it. It's in my annual plan every year. I was there at the beginning of the work. (Manager, Site 3, Meeting 1)
		Objective - integrate the MPAI-4 into	The routine use of MPAI-4 data to evaluate stroke programs and use this information to make program-level decisions including (1)	The desire I have is to have in the whole trajectory if we do it early and we manage to make a double measure, it becomes

		program evaluation	human resourcing; (2) program comparisons (3) rehabilitation intervention comparisons and; (4) justification of outpatient stroke rehabilitation services.	interesting to have a measure at the end of the outcome because it is very poor in rehabilitation I would say in general. When we come to sell our salad or the benefits of our interventions, I think it's going to be a really interesting tool. (Manager, Site 3, Meeting 1) From a management perspective, it will tell me are we actually doing what we're supposed to be doing. (Manager, Site 1, Meeting 2)
		Strategy - Aligning MPAI-4 use across programs to make meaningful comparisons between them	Collecting the MPAI-4 score and selecting relevant sociodemographic information so other stroke and TBI programs that use the MPAI-4 can be meaningfully compared. Managers and administrators are particularly interested in comparisons between programs within their health region or with one nearby. Researchers have an additional interest in comparisons inter-provincially or internationally for research purposes.	If we said that we want to do our first MPAI within six weeks, you are going to measure us, how we implement it. But say [another region] says we're going to do our first MPAI at 12 weeks, as a region we are no longer, like coalescing our data. (Manager, Site 2, Meeting 1) If we are doing that here it would also be good for us just to be aligned with TBI programs then… (Manager, Site 3, Meeting 1)
		Strategy - Monitoring of MPAI-4 use to provide feedback on potential improvements	Detecting the integration of the MPAI-4 into clinical and program evaluation, then sharing this information with the local implementation team. The information is used to further optimize the MPAI-4. For example, if low adherence is detected, that will trigger the selection of strategies to understand why and then address the reason for low adherence.	we have to be sure of, after we get all this data, is who analyzes it. It's great that you're there for 18 months but if we don't give that feedback regularly to the team, they drop out and don't see the added value of doing it and I understand them. (Manager, Site 3, Meeting 1)
		Strategy - The database is designed to	A core function of the database is to provide aggregated, program level information in a format that is readily interpretable by users	I didn't think it was up to us to get out of the data. Personally, I thought it went in the direction, that we were given data, that it

		provide aggregated, program level comparisons	(i.e., primarily managers and administrators, secondarily researchers).	was also combined with the CIO Central West with the downstream, and then that would even have comparison between the institutions. So I didn't think it was up to us to have all the data. (Manager, Site 3, Meeting 3)
	Continue to integrate the MPAI-4 into regular routines		The current ministerial mandate to use the MPAI-4, the financial and human support from a larger research program and the lack of an equivalent measure currently being used in practice facilitate the integration of the MPAI-4 into regular clinical routines. Clinician's concerns about the value-add of the MPAI-4 and the view that mandates can change at any moment are barriers. Strategies to help this process include adapting the clinical workflow to the MPAI-4 and conducting a yearly audit of MPAI-4 use.	Researcher: Two years from now you say "we are happy", what would that look like for you? Clinician: It's going on in rounds, it's like a second nature. (Site 1, Meeting 2)
		Barrier - Clinicians have concerns about the overall value of the MPAI-4	Clinicians may recognize that the MPAI-4 could have some value, but express concerns that this potential value-add is outweighed by the downsides of the measure. This includes concerns with feasibility and their perception of MPAI-4 interpretation.	In a year, you know, there has to be something for the clinician because if not, they're going to drop out, and then they're going to fill it out quickly, and then it's not going to give results that are very significant. (Manager, Intersite Meeting)
		Barrier - Ministerial mandates can change at any moment	There is a perception that the ministry could change their minds about requiring the use of the MPAI-4 at any time. What isn't mandated will be dropped to make time for what is new. Meaning that the MPAI-4 could be dropped at any time.	If the trousse dictates another measure be added, something would need to be dropped to make the time. Whatever isn't mandated that is currently in use would be dropped, for example, if the MPAI doesn't have a mandate anymore. (Clinical Coordinator, Site 1, Meeting 1) It seems I hear a lot of positivity and a lot of hope in it, it's my interpretation of today. There's not too many barriers getting in the way and if the Ministry doesn't decide

				there's a new best thing since sliced bread. (Researcher, Site 1, Meeting 1)
		Facilitator - Integration of the project within a larger research program to support MPAI-4 implementation goals	The MPAI-4 research/implementation project is part of a large research program (i.e., BRILLIANT). Thus, there are additional human, infrastructure and financial supports beyond those directly linked to this individual project. The MPAI-4 project is also expected to align with broader research goals, processes and infrastructure – this is not a standalone research project.	We will develop into this platform where it contains all the information, the information can be readily shared and not only between clinicians, but with patient and family. And all the information follows the client no matter where they are in the healthcare system. So that's BRILLIANT in a nutshell. BRILLIANT gave us the money, they said "here's infrastructure". (Researcher, Site 2, Meeting 1)
		Facilitator - Ministerial mandate to drive portions of MPAI-4 implementation	The mandate from the health ministry to use the participation index of the MPAI-4 in stroke outpatient programs. It is important to note that the mandate is for general use, without specifics in how the data should be interpreted.	I want to say that the MPAI 4, uh, just a reminder that this was something that came from the ministry and so we are trying as a team to make it as meaningful as possible at this time. So we're really working towards doing it the best we can with what we were given to to work with. So we want to make sure that right now the - the interpretation of the MPAI is as good as we can make it. (Researcher, Site 3, Meeting 3) Here it's interesting because it is a directive for the Ministry, so we have to remember that subtlety, which is not quite the subtlety, because it's actually huge. There's a lot, we're not picking and choosing this, it has to be done. (Manager, Site 1, Meeting 2)
		Facilitator - There is no equivalent standardized measure in place	The participating sites currently have nothing or homemade, non-global measures in place to assess global stroke outcomes and participation. While the MPAI-4 may not be perfect, it is better than what is currently in use.	Already this is better than what we have now, which is nothing. (laughs) (Clinician, Site 3, Meeting 1) I think it's really an interesting tool to know if we have an impact on people's social participation. I think that for social

				participation it is a measure that does not exist, that is not used in our team. (Care Coordinator, Site 1, Meeting 2)
		Objective - integrate the MPAI-4 into regular routines	The MPAI being "common, done and used" in routine clinical practice such that it is 'second nature' to clinicians to complete the MPAI-4.	Researcher: If you were to tell somebody "we did a great job with MPAI because today it is…" how would you finish that? Manager: I think integrated into regular routines. Whether it's social work, or A, B, C, D, physio A, B, C, D, if it's just common done and used. (Site 2, Meeting 1) We must not keep it must not lose it must be part of the sustainability of the practice of how we will set up the program reflection on this tool, how we think it says clinical in our daily practice. (Manager, Site 3, Meeting 3)
		Strategy - Changing the regular clinical workflow to incorporate the MPAI-4	Changes to the regular clinical workflow to better integrate the MPAI-4. For example, scheduling new meetings between healthcare professionals or changing the length of patient planning meetings.	Manager: We will see how some teams have implemented it but I know that here at the Institute, they have added 15 minutes to their PII, they have lengthened the meeting. Clinician: Except that here at the [site] they do it as a paper version. If the whole team completed beforehand at the same time to do the preparation of the PII, the 15 minutes decreases. (Site 3, Meeting 2)
		Strategy - Conducting a yearly audit to check MPAI-4 expertise	Check that the MPAI-4 is being used the same way across clinicians and between sites on a regular, yearly basis	So I think the idea of auditing, once a year someone from TCC, audit someone at the same time "did you get the same score" just to make sure we are really… like over time, I know when we are in the beginning phase it's pretty good, but three years from now how do we know our MPAI scores are good? (Manager, Site 2, Meeting 1)
		Strategy - Eliminate	Reducing or stopping the use or delivery of clinical practices that overlap with the MPAI-	Care Coordinator: Yeah because I have as you for the preparation guide you have to

		clinical practices that overlap with the MPAI-4 to streamline the clinical workflow	4 (i.e. de-implementation). By eliminating overlapping practices, the MPAI-4 will be better integrated into the clinical workflow through the collection of novel information and by removing the frustration and added time of recording the same information multiple times.	give out for all clients before the PII, which covers some part of the form. It's like a redundant information we are asking if there's any way to combine the two or complement one of each, so I think that would be-- Manager: And I think that's what we are going to have to absolutely do, so when we are putting something new in, it's not just to add, it's what does it replace? Or what can we combine? Or what do we remove. So that's a very good point. (Site 2, Meeting 1)
		Strategy - Liaise with key stakeholders in the health ministry	Implementation team members with connections in the ministry, or who act in a consultation role in committees related to the MPAI-4 leveraged their network. The goal was to share knowledge with them concerning the MPAI-4 so policy-level changes concerning the MPAI-4 would be favourable over the long-term.	I'm part of a committee with the Ministry where we talk about phase 4, integration and maintenance in the community. The last time, the girl in charge at the Ministry said "we have not yet identified the tools for social participation". I didn't say anything because she wanted to create a sub-committee afterwards but my plan after today's meeting was to write to the Ministry and say listen there are already research projects, a project that is underway that involves several rehabilitation centers and we must not let go of MPAI. (Care Coordinator, Site 1, Meeting 2)
		Strategy - Modify the MPAI-4 to better match the clinical workflow	The MPAI-4 was modified to better match the needs and clinical workflow of the clinical team. This includes modifications in consensus methods and in using only the Participation Index as opposed to the entire measure.	Researcher: Is there anything else that needs to be maybe modified a bit? Care Coordinator: If one day we wanted to do different parts of the MPAI, how would we change that? (Site 1, Meeting 3)
		Strategy - Research on patient use of the MPAI	The intention to conduct research on how to best include patients in the MPAI process. This includes providing a patient reported score and interpreting the MPAI scores.	And is there a correlation between, there's actually when the patients were doing it or the caregivers were doing it, it was matching? Can we do more research on

				that? (Knowledge Broker, Site 1, Meeting 3)
		Strategy - Stroke Community of Practice	Conducting community of practice meetings to learn about how different stroke centres are using and have implemented the MPAI.	I did not have the chance to collaborate with the other sites. There were some meetings before, I saw sometimes the invitations, but then I think it was more about TBI. It may be that there, we would say, I felt less challenged by these discussions there. The TBI group is less relevant to us. But is there anytime to have a discussion with clinicians from other sites to see how they implement the MPAI? It could help to know what all of us do. (Care Coordinator, Site 1, Meeting 3)
	Continue to have the MPAI-4 produce benefits for patients		Throughout the planning process, a core objective was for the MPAI-4 to produce benefits for patients, including by including them and their caregivers in decision-making, and by showing them their progress. However, beyond the creation of data visualization that were designed to show patients based on clinician feedback (user centred design code primarily within clinical decision-making), no planning was done to directly achieve this objective.	I think that everything you do in this hospital is to give benefit to patients. So I think it's kind of weird to have one strategy attached to this. It's the whole thing. That's the ultimate goal of the rest of the subdivided goals. (Manager, Site 1, Meeting 3)
		Objective - the MPAI-4 produces continued benefits for patients	The use of the MPAI-4 shows benefits for patients over time, including (1) getting the patient's and caregiver's voice in decision-making via their use of the measure or using the accessible language to enhance communication and (2) sharing easily interpretable visual information with the patient and caregiver (e.g., MPAI-4 score change over time in a graphic form).	And that notion of shared decision making because I know your other on patient partnership, you know, the teams are good in doing that but this can become a tool, OK if I could only work on five things, what are the five most important areas? Right? It's very concrete for that shared decision making (Manager, Site 2, Meeting 1)

				And I know what they didn't get to yet in TCC and maybe they will is that in this idea that you are sitting with them on admission together filling it out and then you sort of do another, towards the end, if you put it right in the computer, you can press a button and you can show the client right away, the report at the end - Look how much you've improved (Manager, Site 2, Meeting 1)
	Support clinician's continued ability to use the MPAI-4		Many strategies were used to support a clinician's knowledge of the MPAI-4 and ability to score patients, interpret the scores and apply their findings to decision-making over time, including creating accessible and re-usable educational materials, and training everyone on the MPAI-4, amongst others. The strategies were facilitated by the support from managers in liberating the clinicians for training time. However, a major barrier to overcome was a lack of continuity in staff due to turnover.	I think the sustainability of using the tool also depends on the continued transfer of knowledge to the clinicians and also the more understanding of how [the MPAI-4 is] being used (Manager, Site 2, Meeting 1)
		Barrier - Turnover in managers and clinicians	The turnover in staff is thought to break continuity. Both in knowledge of the MPAI-4 and knowledge of the MPAI-4 implementation project.	Manager 1: This Friday is my last, my last. My last day I'm going to be retiring as of then. Manager 2: I will be taking over for [Manager 1]. Researcher: And one more new person? Manager 3: yes, my name is X. I'm replacing [the manager] at [Site 1] (Intersite Meeting)
		Facilitator - Clinicians liberated for training time	Clinicians are given designated time for MPAI-4 training, included for synchronous, in-person training sessions.	What I'm hearing [the manager] say is that she could liberate your gang for x amount of time, you get an expert, we come to the training (Researcher, Site 1, Meeting 2)

		Objective - support clinicians' continued ability to use the MPAI-4	Clinicians' have the knowledge, skill and supports to develop or maintain their consistent scoring and interpretation the MPAI-4 over time.	I think the sustainability of using the tool also depends on the continued use of transfer of connaissances for the clinicians and also the more understanding of how it's being used (Clinician, Site 2, Meeting 1)
		Strategy - Clinical champion(s) oversee day-to-day needs at each site	A designated individual takes responsibility for the MPAI-4's day to day needs at each site. For example, by encouraging the use of the MPAI-4 and answering practical questions such as how to score certain items.	we might want to think about who here has worked with the MPAI, might be a sort of an opinion leader I guess is what we'd call it officially, but somebody who is a répondant, that if somebody has a question, they can go to them quickly and ask and get an answer. (Manager, Site 2, Meeting 1) The role of the local champion who deals a little bit with the subject of implementation within the stroke program, who plays a bit of a role of facilitator, trainer, clinician who also makes the interaction between the clinical team and the research team (Researcher, Site 3, Meeting 2)
		Strategy - Educational resources continue to be available	The high-quality educational resources for clinicians and managers continue to be available by posting all materials on a dedicated website. All training sessions delivered by credible trainers are recorded, edited and uploaded to ensure all the information can be found in one place. This includes information on scoring, interpretation and use of the MPAI-4 in the RedCap database.	Researcher: OK so this is where there could almost be a blog, that's my question, and somebody answers it. That everybody could access. That would be good, it's not only from one site but all the sites Manager: And they could help with training and orientation of new people, FAQ, like you said, but also like a bit of refreshers. (Site 2, Meeting 1) Okay so, the other thing is that for the training modules to be useful to us they cannot be on the website because the therapists, they aren't going to go on the BRILLIANT website. It has to be

				something that is in house, on the intranet, or in the program links. But BRILLIANT, no one is going to go look there. (Manager, Site 1, Meeting 3)
		Strategy - Embedding MPAI-4 training in the formal rehabilitation professional curriculum	Encouraging the MPAI-4 to be taught to university students. This will reduce the orientation incoming students on placement will need, and may provide an ongoing expectation for clinicians to continue to use the MPAI-4.	Manager: Oh speaking of [the university], is the MPAI going to be in the curriculum of the school of OT, PT, social work? Researcher: I mentioned it, and the suggestion was "why don't you do your studying" (lots laughs) (Site 2, Meeting 1)
		Strategy - Maintain a community of practice to share MPAI-4 experiences	Creating and continuing a group to share information, concerns etc. about the MPAI-4, and discuss how sites or individuals overcame challenges with using the MPAI-4.	It would be nice to have the names of all the people at the three sites, so we create sort of a community network and then that way we could also reach out sometimes directly or indirectly with them instead of always going through you as researchers. (Care Coordinator, Site 2, Meeting 2) We can look at that but I think there is a way because there is Sharepoint that is part of MS Teams. The intention of Sharepoint is really to be a community of practice platform so we can look to see if it's something where we can have the history of all discussions and documents. (Researcher, Site 3, Meeting 2)
		Strategy - Synthesizing available knowledge of the MPAI-4	The synthesis of knowledge concerning the MPAI-4. This includes via formal methods such as conducting a systematic review of the literature as well as informal methods of networking and learning from those who have already implemented the MPAI-4.	Researcher: Yes, exactly. And [we] are doing the literature review, just so that we have a concrete answer to that question. Researcher: I want to quickly just say that as part of this literature review, if you want this answer, I can give you this answer in the next day or so because I have the data extracted, so I can tell you who it's been

				used on generally. But the final results will give us a better understanding maybe in the next few months. (Site 2, Meeting 2)
		Strategy - Training everyone on the MPAI-4	Training everyone as opposed to only training the expected 'super-users' (i.e. care coordinators). This is thought to insulate against turnover	If we are going to use it as a large team, everyone must know the tool. (Manager, Site 3, Meeting 1) Yes because there is always a turnover of the team and we can not redo training every time, so yes it would be interesting. (Manager, Site 3, Meeting 2) I want my whole team to be trained, I don't want it to be just a champion. (Manager, Site 1, Meeting 2)
The iterative nature of sustainability planning			Sustainability planning is dynamic requiring iterative adaptation. It is responsive to changes in the implementation context, to the selected implementation strategies and to changing stakeholder needs.	
	Adaptation to stakeholder needs		Modifications to the MPAI-4 and the selected sustainability strategies. Underlying these changes is the goal to match the MPAI-4 to changing stakeholder needs (often the result of a changing practice environment). Built into modifications is the flexibility to adjust to unanticipated future changes. It is thought that adaptation will maintain the fit of the MPAI-4, thus maintaining its acceptability by clinicians.	The two measurements are very close together [admission and discharge]. They really do not stay long in outpatient rehabilitation…So sometimes [the MPAI-4] doesn't happen when it's too close. (Clinician, Site 1, Meeting 3)
		Adaptations to make the MPAI-4 more acceptable to clinicians and managers	Altering the standard protocol when using the MPAI-4 without altering the integrity of the practice itself. For example, adapting the way in which a consensus score is generated but not eliminating the consensus process. Adaptations are driven by the desire to better	For the application and then the implantation, do we really have to follow exactly the kit, the duration, the months? For example, I see here MPAI trial 4 months, do we have to do that? (Manager, Site 3, Meeting 1)

			integrate the MPAI-4 within clinical practice by making it more acceptable.	As [the knowledge broker] says, the two measurements are very close together [admission and discharge]. They really do not stay long outpatient. Then the time between the PII [admission meeting], then the initial, then the PII [meeting] at discharge, it's quite close. So sometimes it doesn't happen when it's too close. (Care Coordinator, Site 1, Meeting 3)
		Matching strategies to each site to complement local needs	Modifying strategies depending on what is needed at each site. Modifications included when those strategies are used (i.e. timeline) and how some strategies were delivered (e.g., training strategies were in-person versus online). All modifications were made based on preferences at the clinical site.	Yes, it's completely flexible. The timeline that we have now is based on [the other sites]. So of course we can adjust it depending on what is feasible [here]. (Researcher, Site 2, Meeting 2) And the other thing, you're looking at the MPAI or we are looking at the MPAI just as its own separate thing. We do a ton of other stuff to include the patients partners, in the PII, we do a million other things. (Manager, Site 1, Meeting 3)
	Circumstances leading to major adaptations		The circumstances which caused large modifications to implementation and sustainability planning. For example, expected changes in staffing (e.g., summer vacation season), unexpected events (e.g., COVID-19) and strategies used as part of the implementation process (e.g., an implementation pilot) all led to large changes in implementation planning. Subsequently, corresponding changes had to be made to sustainability planning.	I like the idea of a staggered way because we have different people at different stages or readiness for change, there's lots of stuff going on, we are coming out of this pandemic. If we could pick a few people to do the trial and error who have a bit more tolerance to the difficulties in the beginning versus more… (Manager, Site 2, Meeting 2)
		Changes resulting from an	Doing small-scale implementation of the MPAI-4 as a testing phase. The results from this phase were then used to inform full	I like the idea of a staggered way because we have different people at different stages or readiness for change, there's lots of stuff

		implementation pilot to inform full MPAI-4 implementation	implementation (and subsequently the sustainability) of the MPAI-4. Modifications following the pilot were made as needed, such as designing and implementing the RedCap database to replace the piloted Access database.	going on, we are coming out of this pandemic that if we could pick a few people to do the trial and error who have a bit more tolerance to the difficulties in the beginning versus more. So like, what did you call it, a step-wise pilot? (Manager, Site 2, Meeting 2)
		Changes resulting from keeping momentum for MPAI-4 implementation	Keeping things developing or happening within the MPAI-4 implementation project such that it becomes less likely to stop. This mindset was applied even when knowing that modifications may be needed in the near future to be tailor to anticipated changes in the local context.	Absolutely, we will try to keep the momentum and maybe even now we can plan the next meeting (Researcher, Site 3, Meeting 1) I would rather keep momentum and stay on proposed timeline. If the other sites are there then we could do it together, if not, then forget them (Manager, Site 1, Meeting 2)
		Expected seasonal changes or differences in the workplace	The usual or expected changes to the workplace that are seen during the summer or in December due to vacations or holidays. These can include reduced staffing due to clinician vacation time. During these times, we could not complete activities such as staff training, piloting the MPAI or even meeting as an implementation team. The timelines were often modified as a result.	I wouldn't stop the project in the summer because there are fewer people. At the clinic level, if you stop something it's difficult to resume so it's really better to do it continuously even if there are fewer patients. There is still a turnover of patients, we welcome anyway, it may not be as fast as the fall but I would leave it in place even in the summer. (Manager, Site 3, Meeting 2)
		Healthcare policy and subsequent process changes due to COVID-19	The healthcare policies that changed due to COVID-19 and that subsequently effected MPAI-4 implementation and sustainability planning. For example, non-COVID-19 related research at the clinical sites was banned for a year during the COVID-19 pandemic, including this implementation project.	We did meet some challenges with the vaccination, the adjustments…in terms of the changes in the team, the offloading, the COVID and then the link with the laboratory here. (Manager, Site 2, Meeting 2) I think timing is going to be important. I would tell you that at the moment with the

				curfew and until the beginning of February with the reinforcements that are asked of us. And we lose clinicians, whether because of Covid positives or because of the reinforcement, I find that to have a good timing we would have to wait a little at least this little month. (Manager, Site 3, Meeting 2)
		Healthcare policy changes and subsequent process changes that are not COVID-19 related	Changes in the healthcare policies or systems of the workplace for reasons other than COVID-19. For example, a provincial policy change mandated increased data sharing across health regions. This unexpected mandate allowed us to leverage provincial IT resources within this project.	Yeah, I think that the readiness of team members is going to depend on this big reorganization that we are supposed to be going through on April 1st, so I don't, you know, I think that has to be taken into consideration, we don't even know … who's doing what, who's belonging to what team… (Care Coordinator, Site 2, Meeting 2) There is still a law that was passed that year we need data transfer agreements that we did not have before, so as soon as we talk about putting together data from several sites, it's under that law (Researcher, Site 2, Meeting 3)
	Sustainability needs to be considered at the same time as implementation		The perception that sustainability needs to be thought of and planned for early on in the implementation process. Implementation choices can affect sustainability and vice versa.	I think that what's important is to bring to your attention the idea of sustainability now, at the beginning, and to make sure that you know that we know how important it is. There's often an impression that a research project dies and then everything just dies. (Researcher, Site 1, Meeting 1)

Chapter 7.
Integration of Manuscripts 2 and 3

7.1. Objectives of manuscripts 2 and 3

Manuscript 1:

In this manuscript, we aimed to understand under what conditions (context), how (mechanisms) and for what duration an evidence-based rehabilitation practice is sustained (outcome).

Manuscript 2:

In this manuscript, we aimed to describe and document the collaborative sustainability planning process at three rehabilitation sites.

Manuscript 3:

In this manuscript, we aimed to understand how (mechanisms) and in what circumstances (context) and for what duration the MPAI-4 is sustained, or not (outcome) at three rehabilitation sites.

7.2. Integration of manuscripts 2 and 3

In *manuscript 1* a realist program theory was developed which explained how newly implemented rehabilitation practices are sustained (or not). This program theory formed the basis of the initial program theory to be tested in the realist evaluation in *manuscript 3*. As part of tailoring the initial program theory to the context of MPAI-4 implementation, we used data from the collaborative MPAI-4 sustainability planning process described in *manuscript 2*. Specifically, the linkages identified by stakeholders between context, strategies and sustainability outcomes informed the initial program theory guiding the realist evaluation that was conducted in *manuscript 3*. By using data from *manuscripts 1* and *2* to inform *manuscript 3*, a cycle of iterative theory tailoring and testing was used between manuscripts in this thesis.

7.3. Alignment between Yin's Case Study Methodology and the Ontology of Pawson and Tilley's Realism

As described in Chapter 1 of this thesis, realists believe that there is an external, objective reality that is independent of what people may believe or understand it to be. This reality is constantly changing. Thus, realists acknowledge that it will take iterative testing to get closer to explaining the objective reality that they believe exists (1,2).

The realist ontology aligns most closely with the ontology underpinning Yin's case study methodology, and thus this was the methodology used in manuscript 3. Yin describes his case study methodology as situated within a "realist perspective" (3) in which the aim is to maintain objectivity via methods to enhance validity and reliability. Thus, Yin's case study approach is strongly post-positivist, in contrast to others (e.g., Stake (4), Merriam (5)) who align with a constructivist epistemology (6). In constructivist case study designs, knowledge generated from the case study process is subjective; this places the emphasis on the researcher to capture the interpreted reality of the case (4,5). Thus, the objective reality of Yin's case study methodology aligns with the objective reality of realist evaluations and was used in manuscript 3.

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Chapter 8.
Sustainability of an outcome measure in outpatient stroke rehabilitation: A realist evaluation

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Abstract

Rationale: Only half of newly implemented evidence-based practices are sustained. Though poor sustainment can lead to negative consequences for clinical teams, organizations, and patients, the causal explanations of sustainment are largely unknown.

Aims and Objectives: We aimed to ascertain how (mechanisms) and in what circumstances (context) a newly implemented outcome measure in rehabilitation was sustained or not (outcome).

Methodology: Informed by an integrated knowledge translation approach, we conducted a realist evaluation using a mixed method, embedded single case study design with data collection up to 18 months following the implementation of the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4), a rehabilitation outcome measure. Quantitative data (survey and patient charts) was analyzed using descriptive statistics, then integrated with qualitative data (interviews with 10 key informants) and analyzed using inductive and deductive retroduction. We integrated the data to develop a case description and ultimately, to refine the program theory to better understand the sustainability of the MPAI-4.

Results: We linked context, mechanisms, and outcomes, and also emphasized sustainability strategies in 18 explanations of how sustainability works. These explanations provide evidence for four overarching patterns: (1) implementation and sustainability phases are interconnected, (2) outcomes build on each other recursively, with patient benefits as the keystone outcome (3)

sustainment is achieved to varying levels across different sustainability outcomes (e.g., high level (e.g., rate of MPAI-4 scoring: 77.7%) to low level (e.g., rate of MPAI-4 application to clinical decision-making: 3.7%) and (4) the work of sustaining the MPAI-4 is shared amongst different stakeholders.

Conclusion: Implementation teams can draw from this program theory to improve the sustainment of outcomes measures while researchers could continue to refine the theory. Continued investigation of sustainability, including diverse and continuous sustainability outcomes, is needed to understand how to maintain improvements in quality of care and patient outcomes.

Keywords: Implementation Science; Program Evaluation; Outcome measurement; Stroke; Rehabilitation; Evidence based practice

Introduction

Each year, approximately one in every 500 people have a stroke in Canada (1,2). Stroke survivors experience impairments such as depression (3), loss of motor function (4) and vision loss (5). These have a negative impact on daily activities such as personal hygiene, and meaningful societal participation such as working or volunteering (6). Stroke rehabilitation interventions aim to improve an individuals' impairment, activity limitations, and participation restrictions (7,8); however, in practice, it can be challenging to optimize rehabilitation outcomes. One way to optimize outcomes is to collect patient outcome data for use in clinical and program evaluation (9).

Clinical evaluation refers to the use of measures to describe, evaluate and predict patient outcomes to aid in diagnosis and personalized treatment planning (10). Program evaluation refers to the aggregation of patient outcome data to assess the rehabilitation program and compare it to similar ones (e.g., benchmarking). Applying program evaluation data can confer benefits to the team (e.g., interdisciplinary communication), organization (e.g., accreditation), and system (e.g., policy development) (11–14). To receive the anticipated, multi-level benefits from using outcome measures data need to be aggregated over the long-term. In other words, the use of measures needs to be sustained (15,16).

Sustainment is defined as the continued implementation of a new practice over the long term and encompasses several outcomes in addition to continued use (17–19). Specifically, outcomes include: (1) continued use, (2) financial viability, (3) continued capacity, (4) continued evolution or adaptation, and (5) continued benefits for individuals, organizations, and/or systems, as identified when combining definitions proposed by authors of syntheses (20,21) and a qualitative description study with healthcare managers (22). Although each outcome is distinct, they are interlinked and influence one another (22–24).

Achieving sustainment is a challenge. Results from systematic reviews suggest that clinical practices are only sustained 40-60% of the time in healthcare broadly (16,25,26). Findings from our recent realist review suggest a similar rate in rehabilitation (54% of the time) (23). While sustainment may not always be appropriate (e.g., a practice is not demonstrating the expected benefits), poor sustainment can often have negative consequences. These can include wasted research funding (27), a loss of potential improvements in quality of care and patient outcomes (28), damage to clinical partner's morale (29) and decreased enthusiasm to be involved

in future implementation projects (28,30,31). Given the prevalence and negative consequences associated with poor sustainment, there is a need to optimize the sustainability of evidence-based practices.

Sustainability is an iterative, ongoing process that involves optimizing the fit between the evidence-based practice, mechanisms (i.e., both the (1) underlying human reasoning and (2) sustainability strategies adding a resource that enhances reasoning (32)) and the context (i.e., triggers or inhibitors to mechanisms) (33–38). By following this process, a sustainability effort aims to achieve positive sustainability outcomes (i.e., sustainment) (39). However, although context, mechanisms, and outcomes are currently well described as separate entities in healthcare implementation (37,40,41) there is a lack of understanding as to how they are linked. Beyond our recent realist review (23) there is no information as to how and in what circumstances a rehabilitation practice is sustained. This has resulted in a lack of guidance concerning the optimal strategy to use in a certain context to achieve a desired outcome. Thus, the aim of this study was to understand how (mechanisms) and in what circumstances (context) a newly implemented outcome measure is sustained, or not (outcome) up to 18 months post-implementation at one rehabilitation site.

Theoretical Approach

We used an integrated knowledge translation (IKT) approach, whereby researchers, managers, care coordinators, clinicians and IT specialists were actively engaged in the project for four years (Figure 1) (42). Each team member provided essential knowledge and expertise (e.g., researchers - best practices in implementation, managers – relayed clinical and administrative needs) and shared decision-making power to strengthen the outputs of this study and the implementation of the outcome measure (43).

Methodology

We conducted a realist evaluation (44,45) according to the Realist and Meta-Review Evidence Synthesis: Evolving Standards (RAMESES) guidelines on the quality and reporting of realist evaluations (46). This realist evaluation was grounded in Pawson and Tilley's realism, in which a stratified reality is independent of what people may believe it to be. However, since

reality is influenced by a constantly changing context, any understanding of reality is based on recurring patterns (i.e., demi-regularities) that take iterative testing to identify (45,47,48).

Adhering to the realist paradigm we sought to explain how the combination of human reasoning and resources from the use of sustainability strategies (mechanism) cause observable events (outcomes) in certain circumstances (context) (49,50). We used the context-mechanism-outcome configuration (CMOC) heuristic to compose explanations, then compiled them into an overarching program theory (45,49,51). The program theory highlighted patterns amongst the CMOCs at the level of the middle range, such that it was specific enough to offer guidance but abstract enough to be transferable to related contexts (52–54). Following recommendations from realist researchers in the field of implementation (51), we explicitly identified the resources concept as linked but separate from the reasoning component of the mechanism (labeled as strategy and mechanism, respectively) (**Appendix A**).

Study Context

In outpatient stroke rehabilitation, the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) can be used to assess impairment, activity limitations, and participation restrictions (55) (**Table 8-1**). In response to a recent government mandate (13), the MPAI-4 was recently implemented in three outpatient stroke rehabilitation sites in the Canadian province of Québec (56). The implementation teams leading this work planned for MPAI-4 sustainment from the outset of the project (24) (**Figure 8-1**).

Table 8-1: Description of the Case

Case feature	Description
Outcome Measure	The Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) can be used to assess global patient outcomes. • Items are organized into three subscales: the ability index (i.e., physical and cognitive abilities), adjustment index (i.e., emotional and behavioural wellbeing) and participation index (i.e., daily activities and community participation) (57). • The MPAI-4 can be completed by clinicians, patients, or caregivers in multiple languages, including English and French amongst others (57,58). • The results of a recent systematic review indicate that while there are gaps in existing evidence, the MPAI-4 and its subscales have strong, high-quality evidence for their use to describe and evaluate stroke outpatients (i.e., sufficient scores for reliability and construct validity) (59). • To interpret the MPAI-4 total and subscale scores, the raw score is converted to a standardized T score (average = 50, SD = 10) against a normative sample (55,60).
Provincial Mandate	In 2018 the participation index of the MPAI-4 was mandated for use in outpatient stroke and traumatic brain injury rehabilitation programs in Québec (56).
Implementation Team	Composed of the research team (researchers, IT specialists, project managers) and the clinical team (managers, care coordinators and clinicians). These groups collaborated over the course of the project to facilitate its success (42). The collaborative team was assembled in 2019.
Implementation and Sustainability planning	Implementation and sustainability planning took place concurrently on this project. That is, the implementation team considered what was needed for adoption of the MPAI-4 and its continuation long-term at the same time, early in the process.
Site Location	Urban area
Program	Outpatient stroke rehabilitation
Available services	Range of general and specialized inpatient and outpatient rehabilitation programs
Number of clinicians	In outpatient stroke rehabilitation, there are approximately 20 multidisciplinary clinicians (e.g., occupational therapists, physiotherapists, etc.).
Number of patients	In outpatient stroke rehabilitation, there are approximately 300 patients per year.
Strength of rehabilitation program	The site has been awarded Stroke Distinction by Accreditation Canada, meaning that they have achieved a superior standard of excellence based on the Canadian Stroke Best Practice Recommendations. As such, the site delivers the highest quality and safest care possible in stroke rehabilitation (61).
Research affiliation	The site also has a strong affiliation with cutting-edge research via an embedded, on-site research centre.
Research program support	There is long-term research funding available to support the MPAI-4 implementation project via the Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies (BRILLIANT) program. Funding is designated for the maintenance of technological resources (i.e., MPAI-4 database).

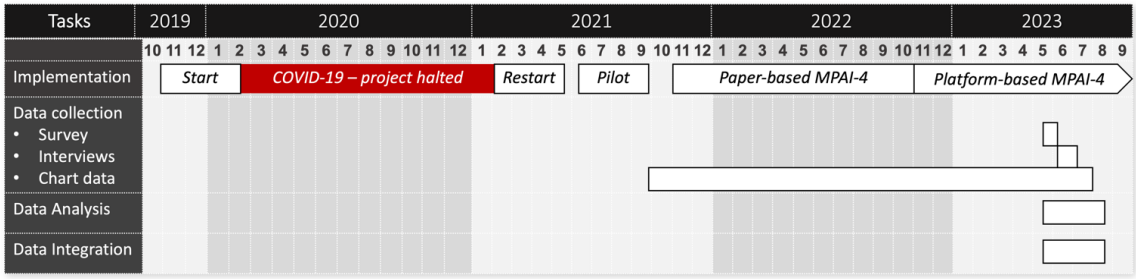

Figure 8-1: Sustainability data collection within the MPAI-4 implementation timeline

Design

We used a mixed method, embedded single case study design (Research Ethics Committee in Rehabilitation and Physical Disability: MP-50-2023-1638) to refine the program theory developed in our earlier realist review (23). To obtain a holistic understanding of the case we used an explanatory sequential mixed methods design, in which qualitative data explained quantitative results and quantitative data prompted lines of questioning in qualitative data collection.

Case study research answers 'why' and 'how' questions (57), particularly while also focusing on the importance of context (57,58). Prior realist evaluations have used single case studies (59,60), including mixed method single case studies, to understand how infection control clinical champions work in a single hospital (61) and the how management influenced the high performance of a hospital operating in Ghana (62).

We selected MPAI-4 sustainability 18 months post-implementation as the case, with clinicians as embedded units. The evaluation timepoint was selected to generate an in-depth understanding of MPAI-4 sustainability (63) beyond the 12 months following initial implementation per expert recommendations (16,17,28) and was selected after talking to key stakeholders to determine if they perceived that they were still implementing processes or they were focusing their efforts on sustainment (Figure 1).

The ministry has mandated that clinicians score patients on the MPAI-4, but how they interpret and apply MPAI-4 scores within their clinical practice is their choice. Thus, the mandate may generate a range of potential sustainability outcomes. The sustainability of the MPAI-4 at the selected rehabilitation site is a critical case where the most relevant data could be collected (63,64). The selected site was the most advanced; at the time of data collection, no

other site had self-identified as sustaining rather than implementing the MPAI-4. Finally, participants at this site had already contributed to our earlier realist review which informs this study (23).

Reflexive Statement

Members of the research team were directly embedded at the site for four years (RA, AT), or in other sites (SA) that were not selected for this study. RA was the project coordinator and a PhD student conducting her research within this project, and AT was an implementation science and health professions education researcher based at this site with previous relationships with the clinical team. RA, AT and SA are clinicians (kinesiologist, occupational therapist and physiotherapist, respectively).

Initial program theory development

We developed the initial program theory from our realist review (23) and related MPAI-4 research projects (24,56,70). As in the realist review, the program theory was informed by Normalization Process Theory (NPT) (71) and the Theory of Planned Behaviour (TPB) (72). These are two theories which are frequently used to explain sustainability (73,74). NPT explains the "social organization of the work (implementation), of making practices routine elements of everyday life (embedding), and of sustaining embedded practices in their social contexts (integration)" (75). The TPB proposes that behavioural intention leads to (sustained) behaviour (72). When combined, these two theories offer a more holistic explanation of sustainability.

Through iterative discussions, research team members embedded at the study site (RA, AT) selected 15 of 52 CMOCs from the realist review that could explain MPAI-4 sustainability. After reviewing results from other MPAI-4 studies at the site (24,56,70), 4 entirely new CMOCs were created. Thus, there were a total of 19 CMOCs in the initial program theory informing this realist evaluation (**Appendix B**).

Study Participants

Eligible participants included research team members (i.e., researchers, project managers, IT specialists) and clinical team members (i.e., managers, care coordinators (clinician leaders), clinicians) who are on the MPAI-4 implementation team or expected to be using the MPAI-4.

Data Collection Methods and Procedures

Data sources included surveys of MPAI-4 use and expertise, clinical data concerning MPAI-4 use from patient charts and semi-structured key informant interviews (**Appendix C**).

Sustainability Outcomes

Quantitative Data Collection

Quantitative data (surveys, patient charts) were primarily used to collect data concerning sustainability outcomes.

Survey

Survey data was collected 18 months post-initial implementation of the MPAI-4. In addition to collecting sociodemographic information, the survey included three components.

The Clinical Sustainability Assessment Tool (CSAT) assesses an organization's capacity to sustain a clinical practice (76). The CSAT has seven subscales, each with 5 items scored on a 7-point Likert scale. It has evidence for its structural validity (RMSEA = 0.084, SRMR = 0.075, CFI = 0.81) and internal consistency (Cronbach's alpha = 0.82-0.94) in clinical contexts (77). We previously used this measure at the site (24).

A Visual Analog Scale (VAS) assesses sustainment intensity (global, scoring, interpretation and application to clinical decision-making), meaning the amount of sustainment on a 0-100 continuum where 0 is no sustainment and 100 is complete sustainment. We designed this VAS based on the VAS for pain intensity (78), because like pain, sustainment is a characteristic with a range of values (79–84). While VAS are considered highly feasible (78), measures of this type have not been used to assess sustainability. There is therefore no psychometric information available for this VAS.

A series of questions based on Kirkpatrick's New World Model (85) to assess learning and self-reported MPAI-4 behaviours on a 5-point Likert scale. We developed and previously used these questions in a study evaluating MPAI-4 training sessions (70). There is no psychometric information available for these questions.

Data from patient charts

From patients admitted to outpatient stroke programs, we collected evidence of scoring eligible patients, score interpretation and application to clinical decision making at admission and discharge from clinical charts from 1-month prior to initial implementation to 18 months post-implementation of the MPAI-4.

Quantitative analysis

Due to a small sample size, we used mean and standard deviation to describe the influential contextual factors (CSAT) and sustainment intensity (VAS), and median and range to describe Kirkpatrick's survey results. Differences between CSAT and VAS scores were determined using Wilcoxon signed rank and paired t-tests, respectively. To describe the use of the MPAI-4 according to patient chart data, we calculated proportions within 6-month time periods. The admission date was used to classify patients into these periods. If MPAI-4 scores were missing from patient files, we assumed that no MPAI-4 was completed. There was no missing data from the survey.

Refining the Initial Program Theory

Qualitative Data Collection

The MPAI-4 implementation team identified diverse key informants who could provide targeted information regarding MPAI-4 sustainability (i.e., researchers, managers, clinicians, etc.; physiotherapists, occupational therapists, etc.). This diversity allowed for rich and varied viewpoints of MPAI-4 sustainability.

We conducted 3 individual interviews with research team members and 2 small-group interviews with 5 clinicians, and a manager and care coordinator, respectively (grouped on request). The interviews ranged from 15-60 minutes. All interviews were semi-structured and designed to test the initial program theory while also allowing for the development of new CMOCs. We used the teacher-learner interviewing technique where both the interviewer and participant switched between these roles to confirm, falsify and modify CMOCs to refine the program theory (86). Each interview was recorded and transcribed verbatim. Once all original and newly developed CMOCs were comprehensively tested and refined, we determined that no more interviews were required (87,88).

Qualitative analysis and data integration

We used deductive retroduction to refine the CMOCs in the initial program theory and inductive retroduction to create new CMOCs (89,90). Using retroduction we made inferences about explanatory patterns (91) facilitated by NVivo 12 (92). We conducted analysis concurrently with subsequent interviews. RA started with familiarization with the interview transcripts, then coded the text to CMOCs. Following consultation on the initial coding with the research team, including confirming the coherence of the CMOCs (49), we formally integrated the codes with the quantitative data. We refined the CMOCs iteratively by integrating data sources and when these were finalized, we looked across all CMOCs for overarching patterns to refine the program theory.

Results

There were 8 survey and 10 interview participants (Table 8-2). Participants worked in varied outpatient stroke rehabilitation programs, and represented diverse professions and primary roles (e.g., clinicians including occupational therapists and physiotherapists, research team members including researchers and project managers, etc.). Clinical team survey and interview participants reported being experienced in their clinical program (mean (SD) years: 17.20 (10.01); 16.00 (2.12)) and in using the MPAI-4 (mean (SD) patients scored on the MPAI-4: 25.88 (23.25); 33.33 (23.24)).

Sustainability Outcomes

Survey scores

As indicated in **Table 8-3**, the highest scoring CSAT domains (mean (SD)) were engaged staff and leadership, and implementation and training, with the strongest items referring to robust collaboration (5.83 (0.98)) and staff receiving ongoing training (6.00 (1.26)). The lowest scoring domain was outcomes and effectiveness (3.70 (1.37)), with the weakest item concerning the relative advantage of the MPAI-4 (3.33 (1.67)).

Clinicians scored their MPAI-4 knowledge as equally high for scoring, interpretation, and application to clinical decision-making ($p > 0.05$). In contrast, MPAI-4 confidence, skill, and especially self-reported behaviour was significantly lower for application than for scoring ($p < 0.05$). MPAI-4 attitudes and commitment results tended to be neutral or slightly negative.

Similarly, on the VAS (mean (SD)) participants indicated global sustainment intensity (61.25 (28.46)) to be like the sustainment in MPAI-4 scoring (63.38 (29.59)) and interpretation (55.38 (31.13)). However, application (31.00 (23.64)) was significantly lower compared to all other VAS scores ($p = 0.01$).

Table 8-2: Participant sociodemographic information

	Survey	Interviews
n	8	10
Age (mean, SD)	44.38 (10.10)	44.20 (5.36)
Sex (% female)	100	90
Gender (% woman)	100	90
Years of experience (mean, SD)*	17.20 (10.01)	16.00 (2.12)
MPAI-4 experience (# patients)*	25.88 (23.25)	33.33 (23.24)
Affiliated rehabilitation program(s) (%)*		
Intensive stroke outpatient rehabilitation	88.0	70
Intensive home-based stroke rehabilitation	12.5	30
Participation-based stroke outpatient rehabilitation	25.0	30
Not applicable	12.5	30
Profession (%)		
Occupational Therapist	50.0	50
Physiotherapist	25.0	10
Speech Language Pathologist	12.5	0
Manager	0	10
Researcher	12.5	10
Project Manager	0	10
IT Specialist	0	10
Primary role (%)		
Clinician	62.5	60
Care Coordinator	12.5	10
Manager	12.5	10
Research team	12.5	30

* Question asked of the clinical team respondents only

Table 8-3: Results of CSAT, VAS and expertise survey questions

Measure	Mean (SD)	Median (range)[1]
Clinical Sustainability Assessment Tool[2] (n=6)		
Engaged staff and leadership	5.57 (1.28)	
Engaged stakeholders	3.90 (1.93)	
Monitoring and evaluation	5.33 (1.32)	
Organizational readiness	5.27 (1.20)	
Workflow integration	4.90 (1.18)	
Implementation and Training	5.47 (1.22)	
Outcomes and effectiveness	3.70 (1.37)	
Total	4.88 (1.53)	
Expertise Questions (n=6)		
MPAI-4 Knowledge		
Score patient		4 (4-5)
Interpret score		4 (4-5)
Apply to goal setting		4 (4-5)
Apply to treatment planning		4 (3-5)
MPAI-4 Attitude		
MPAI-4 applies to only some patients		3.50 (2-5)
MPAI-4 a priority		2.50 (1-3)
Prefer other outcome measures		4.50 (2-5)
MPAI-4 relevant to patient care		3.50 (1-5)
MPAI-4 provides portrait of patient		2.50 (1-5)
MPAI-4 helps develop treatment plan		2.50 (1-3)
MPAI-4 evaluates patient progress		4 (2-4)
MPAI-4 can justify treatment		2.50 (1-4)
MPAI-4 Confidence		
Score patient		4 (3-4)
Interpret score		3.50 (3-5)
Apply to goal setting		3 (2-4)
Apply to treatment planning		3 (2-5)
MPAI-4 Skill		
Score patient		4 (4-5)
Interpret score		4 (3-5)
Apply to goal setting		3 (1-4)*
Apply to treatment planning		3 (1-5)*
Commitment to using the MPAI-4		3 (1-5)

MPAI-4 Behaviour		
Score patient		4 (3-5)
Interpret score		3 (1-5)
Apply to goal setting		1.50 (1-3)*
Apply to treatment planning		1 (1-3)*
Visual Analog Score (n=8)		
Overall sustainment	61.25 (28.46)	
Scoring sustainment	63.38 (29.59)	
Interpretation sustainment	55.38 (31.13)	
Application to clinical decision-making sustainment	31.00 (23.64)**	

[1] 5 = strongly agree, 4=agree, 3=neither agree nor disagree, 2=disagree 1=strongly disagree
[2] 7 = to a very great extent, 1 = to little or no extent
*Significantly different compared to score patient result for that construct, $p < 0.05$ using Wilcoxon signed rank test
**Significantly different from other VAS scores, p=0.01 using paired t-test

Data from patient charts

Compared to the total stroke outpatient population, the use rate of the MPAI-4 was low but consistently improved from 0-18 months post-implementation (8.3-28.1%) (**Table 8-4**). The use rate is expected to be low because of criteria which make a patient ineligible for the MPAI-4. Specifically, these include the absence or delayed formation of a multidisciplinary team (the MPAI-4 is meant to be scored by consensus) and the patient only receiving rehabilitation for a short time (e.g., 2-3 weeks, there is not time to complete non-focussed measures or tests).

Amongst patients scored on the MPAI-4, scoring often matched patient eligibility criteria (75-78.9%). Interpretation improved when the new database was implemented (62.9%) compared to the first year of implementation (36.8-37.5%). A clinician included MPAI-4 scores in their clinical notes to support a treatment decision only once, in this case, to focus on driving training.

Table 8-4: MPAI-4 use according to clinical data from patient charts

	Scored patients*	Scoring was appropriate **, ***	Interpreted***	Applied to decision-making***
Pre-implementation -1-0 months (n=17)	0, 0%	0, 0%	0, 0%	0, 0%
Early implementation phase 0-6 months (n=100)	8, 8.3%	6, 75.0%	3, 37.5%	0, 0%
Implementation phase 6-12 months (n=92)	19, 19.8%	15, 78.9%	7, 36.8%	0, 0%
Sustainability phase 12-18 months (n=109)	27, 28.1%	21, 77.7%	17, 62.9%	1, 3.7%

*as a proportion of the total patient population
**the site determined that scoring would NOT be appropriate if a patient (1) was being seen by a single clinician rather than a multidisciplinary team, (2) the multidisciplinary team was formed after several weeks of rehabilitation had been received from a single clinician already or (3) the patient only received rehabilitation for a very short time (2-3 weeks maximum).
***as a proportion of patients scored rather than of the total patient population

Refined program theory

After empirical testing we retained 14 of 19 CMOCs from the initial program theory and developed 4 new CMOCs. Thus, there are 18 CMOCs in the refined program theory (**Table 8-5, Appendix D).** Looking across all CMOCs we found four major explanatory patterns, which we highlight in the program theory in **Figure 8-2** and presented below via exemplifying CMOCs supported by quantitative results and illustrative quotes.

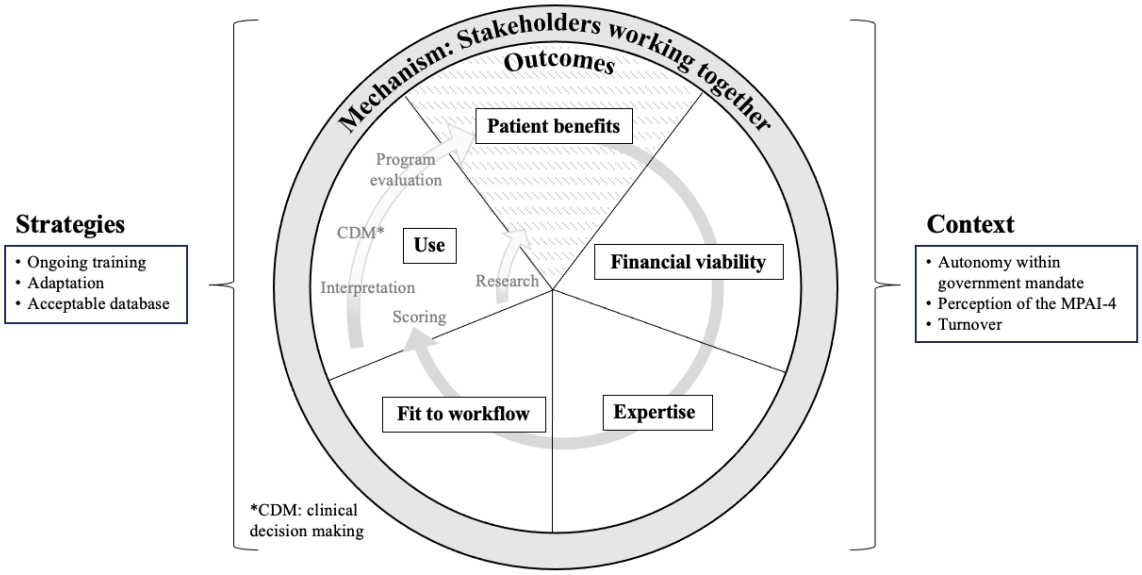

Figure 8-2: Refined program theory of MPAI-4 sustainability

Table 8-5: List of identified CMOCs

#	# in realist review	CMOC	Supporting data
	Outcome: Continued Fit to Workflow		
1	2	If clinicians can choose how to use the MPAI-4 outside of the government mandate (C) and its adaptability is promoted (S), then the clinical and research teams evaluate and modify the clinical team's use of the MPAI-4 (M) resulting in the practice continuing to fit their workflow (O).	Interviews: Clinicians, clinical coordinator, facilitator Clinical data from patient charts
	Outcome: Continued Expertise		
2	Based on 20, 23, 26	Managers provide adequate time to learn how to use the MPAI-4 (C) through ongoing training (S), resulting in clinicians having continued MPAI-4 knowledge and confidence (O) because they can evaluate the worth of the MPAI-4 both individually and as a team (M)	Interviews: Clinicians and researcher Survey Data: VAS, behaviour questions
	Outcome: Continued Clinical Use (Scoring, Limited Interpretation and Not used in Clinical Decision-Making)		
3	Based on 23	when MPAI-4 orientation training is in place (S) to onboard new clinicians by providing them the knowledge they need about the MPAI-4 (C) they will score and interpret the MPAI-4 as described in the training (O) because of the pressure or expectation to use the MPAI-4 in these ways (M)	Interviews: Clinicians Survey Data: VAS, behaviour questions Clinical data from patient charts
4	Based on 1, 30, 35	If clinicians can choose how to use the MPAI-4 outside of the government mandate (C) then they will continue to use the MPAI-4 as implemented (i.e., scoring, limited interpretation) (O) because ongoing training (S) has given clinicians the knowledge and understanding they needed to critically appraise the worth of the MPAI (M).	Interviews: Clinicians, clinical coordinator, manager, researcher Survey Data: VAS, behaviour questions Clinical data from patient charts
5	Based on 3, 19	If there are positive team attitudes towards research evidence (C), then the MPAI-4 will continue to be interpreted (O) when a clinical champion (S) takes ownership of the MPAI-4	Interviews: Clinicians, clinical coordinator,

#	# in realist review	CMOC	Supporting data
		and continuously works to drive the practice forward (M).	manager, researcher, facilitator Survey Data: VAS, behaviour questions Clinical data from patient charts
6	Based on 8, 14 and 33	If clinicians, managers and researchers are committed to the MPAI-4 and there are adequate financial resources (C) the MPAI-4 will continue to be used as implemented (i.e., scoring, limited interpretation) (O) when implementation and evaluation experts complete these supportive tasks (S) such that clinicians can direct their work towards its clinical use only (M)	Interviews: Clinicians, researcher Survey Data: VAS, behaviour questions Clinical data from patient charts
7	39	If implementation team members do not have authority over MPAI-4 mandates (C), MPAI-4 clinical data can be relayed to decision-makers (S) resulting in the continued mandated use of the MPAI-4 (i.e., scoring) (O) because decision-makers would appraise the MPAI-4 and see its value (M).	Interviews: Clinicians, clinical coordinator, researcher, manager Survey Data: VAS, behaviour questions Clinical data from patient charts
8	Based on 16	If the MPAI-4 is mandated (i.e., scoring) (C), but the measure is otherwise adapted and implementation strategies tailored (S), clinicians will increase other uses over time (i.e., interpretation of the MPAI-4) (O) because clinicians and managers perceive greater value/benefits in the MPAI-4 (M).	Interviews: Clinicians, clinical coordinator, researcher, manager Survey Data: VAS, behaviour questions Clinical data from patient charts
9	New (proposed in initial program theory)	As ongoing research provides new interpretations and thus new potential benefits of using the MPAI-4 (C), the database is updated accordingly (S) and subsequently, clinicians and managers redefine and modify	Interviews: Clinicians, clinical coordinator, researcher, manager

#	# in realist review	CMOC	Supporting data
		the MPAI-4 (M) resulting in the continued MPAI-4 use as implemented (i.e., scoring), increased use in interpretation and anticipated increased use in clinical decision-making (O).	Survey Data: VAS, behaviour questions Clinical data from patient charts
10	Based on 27	When an acceptable database is in place (C), then clinical data can be relayed to clinicians (S), resulting in clinicians continuing to use the MPAI-4 as implemented (i.e., scoring, limited interpretation) (O) because they believe that it is right for them to be involved (M).	Interviews: Clinical coordinator, researcher, facilitator Survey Data: VAS, behaviour questions Clinical data from patient charts
11	29	If there is adequate expertise on the clinical team (C), then the MPAI-4 will continue to be used as implemented (i.e., scoring, limited interpretation) (O) when structure sustainability tools are used (S) to prompt researchers and clinical leaders to periodically appraise the worth of the practice (M).	Interviews: Researcher, facilitator Survey Data: VAS, behaviour questions Clinical data from patient charts
12	New	When clinicians continue to score patients on the MPAI-4 (C) and a database provides automatic interpretations (i.e., values, graphs) (S) but clinicians do not believe the interpretations are accurate or precise (M) they will not apply interpretations to their clinical decision-making (O).	Interviews: Clinicians
Outcome: Continued Use in Research			
13	New (proposed in initial program theory)	When patients continue to be scored on the MPAI-4 (C), and the database is designed to facilitate data export for research use (S) then researchers and IT professionals can share the labour of accessing and analyzing MPAI-4 data (M) resulting in the anticipated use of the MPAI-4 in research projects over the long term (O)	Interviews: IT specialist Survey Data: VAS, behaviour questions Clinical data from patient charts
Outcome: Continued Use in Program Evaluation			
14	New (proposed	Program managers perceive the MPAI-4 to be valuable (M) such that they will use it in	Interviews: Manager,

#	# in realist review	CMOC	Supporting data
	in initial program theory)	program evaluation (O) if clinicians continue to score, interpret and apply MPAI-4 information within clinical-decision making (C) supported by interpretations from the database (S).	Researcher, Clinical Coordinator Survey Data: VAS, behaviour questions Clinical data from patient charts
Outcome: Continued Financial Viability			
15	New (proposed in initial program theory)	When building a coalition between research and clinical teams has facilitated resource sharing (S) then there is management support and adequate resources (C) resulting in the evidence-based practice remaining financially viable (O) because the available resources have been allocated appropriately (M).	Interviews: Manager, Researcher, Project Manager
Outcome: Continued Active Collaboration			
16	New	If there is turnover amongst the implementation team (C), orientation training for new team members (S) helps them understand the project, and their specific duties and tasks within it (M) resulting in the team continuing to work together on the project (O).	Interviews: Researcher, Manager
17	New	All team members will continue to collaborate on the project (O) because implementation team members take ownership of the project (M) if the team values the objectives that they are working towards (C) and relationships between team members are based on trust, power-sharing and shared decision-making (S).	Interviews: Researcher, Facilitator
18	New	If implementation stakeholders are engaged in the MPAI-4 project (C), then a facilitator (S) will be able to take ownership of it, and coordinate tasks and duties (M), resulting in team members being organized to collectively contribute to the project's success (O).	Interviews: Researcher, Facilitator, Project Manager

Implementation and sustainability phases are interconnected

Contextual factors, strategies and outcomes that were developed or achieved during implementation are often maintained into the sustainability phase, thus linking the two phases. For example, since the inception of the MPAI-4 project a clinical champion has worked within a context where the clinical team had positive views of research evidence. CMOC 5 proposes that if a clinical team has a positive attitude towards research evidence (C) the clinical champion (S) can take ownership of the project and work to drive it forward (M), resulting in the MPAI-4 continuing to be used as implemented (O):

> *Manager: "At the beginning there was no buy-in, so [the clinical champion] had to work overtime and overdrive."*
>
> *Care Coordinator (Clinical Champion): "I have a team that is not very difficult, people go with the flow, if I ask them to do it, they will do it…I think that this culture of measurement in the [site] is well established."*

The clinical champion worked since the project's inception to support MPAI-4 use in a site receptive to outcome measures. As we would expect from the interaction of the same context, strategy and mechanism, the level of clinical use of the MPAI-4 (i.e., scoring, interpretation and application to decision-making) was maintained or improved from implementation (clinical data from patient charts in **Table 8-4**).

Outcomes build on each other recursively, with patient benefits as the keystone outcome

Several CMOCs build on each other in a recursive process (CMOCs 3, 6, 9, 11, 12, 13 and 14). Thus, an outcome in one CMOC may be the context, strategy, or mechanism in another. For example, in CMOC 14 the context is continued application to clinical decision-making, which is typically an outcome: managers will continue to use the MPAI-4 in program evaluation (O) because they perceive it to be valuable (M) if clinicians apply MPAI-4 information within clinical-decision making (C) supported by interpretations from the database (S). A manager describes how these sustainability outcomes are linked in this CMOC:

> *"I think from a managerial perspective I would want to continue [the MPAI-4] for a couple more years to see. Do I see any benefit in the long run and with time, and if clinically have we found relevance. But after that period of time, a couple of years, I would drop it…if it's not giving me anything. Or if it's giving me data but it's not helping [the clinical team] with patients." Manager*

This manager not only described the links between continued clinical use and program evaluation but also highlights that there must be patient benefits. Participants often described patient benefits as the keystone outcome; anticipated patient benefits drive the initial work towards other outcomes. When benefits are demonstrated within a reasonable timeframe, they strongly influence global sustainment.

Sustainment is achieved at varying levels across different sustainability outcomes

MPAI-4 sustainability outcomes varied, from a high level of sustainment to not sustained at all. For example, reinforced by the provincial mandate, scoring the MPAI-4 was sustained at a high level (VAS mean (SD): 63.38 (29.59); scoring behaviour median (range): 4 (3-5)). CMOC 4 explains this outcome: if clinicians can choose how to use the MPAI-4 outside of the government mandate (C) the clinical team will evaluate its worth (M) when ongoing, interactive training is conducted (S), resulting in the continued use of the components seen as worthwhile (i.e., scoring and to a limited extent, interpretation) (O):

> *Clinician 1: I think the training helped…[but] to me, [the MPAI-4 is] still a waste of time. Okay, I have all these other skills that I use. I don't refer to the MPAI-4 in my reports, I don't show my patients. So, for me there's no reason and there's no added value to using it. It's just because I have to.*
>
> *Moderator: So if the mandate was removed, do you think you would stop sustaining the MPAI-4?*
>
> *Clinician 1: 100% yeah.*

Despite doubts about the value of the MPAI-4, the government mandate was strong enough for clinicians to continuing scoring it. If the mandate is removed and there is no change that would otherwise influence clinicians' perceptions of the MPAI-4 (e.g., new research evidence as in CMOC 9), then it is likely that the MPAI-4 would no longer be scored.

In contrast to scoring, the application of the MPAI-4 to clinical decision-making was sustained at a low level. For example, CMOC 12 explains why using the MPAI-4 in clinical decision-making is rare: when clinicians continue to score patients on the MPAI-4 (C) and a database provides automatic interpretations (i.e., values, graphs) (S) but clinicians are not confident in the interpretations (M) they will not apply them to their decision-making (O):

> *"[The MPAI-4 is] not so precise…Why use it then it's very it's not accurate? How do we interpret the MPAI-4 in this situation?" Clinician 4*

Despite a database providing automatic interpretations, clinicians distrust the MPAI-4 and therefore do not apply its scores to decision-making (VAS and Kirkpatrick's survey scores from **Table 8-3**)). MPAI-4 use in clinical decision-making was neither successfully implemented nor sustained (clinical data from patient charts in **Table 8-4**).

<u>The work of sustaining the MPAI-4 is shared amongst different stakeholders</u>

The sustained work of multiple stakeholder groups and collaboration of the implementation team was required. For example, in CMOC 13 clinicians, researchers and IT specialists are implicated: When clinicians continue to score patients on the MPAI-4 (C), and the database is designed to facilitate data export for research use (S) then researchers and IT specialists can share the labour of accessing and analyzing MPAI-4 data (M) resulting in the MPAI-4's anticipated use in research projects over the long term (O).

> *"We have made the MPAI-4 on the platform so it [is] self-sustainable as it moves forward and the maintenance that is required is quite low…We are trying to make it so that [researchers] can extract the data" IT Specialist*

The continued, active collaboration of the implementation team specifically was so important to this project that three new CMOCs were developed to explain this outcome (CMOCs 16, 17, 18). For example, CMOC 16 indicates that collaboration will continue (O) despite turnover amongst the implementation team (C) when orientation training for new team members (S) helps them understand the project, and their specific duties and tasks within it (M):

> *"We could predict that clinicians move and change, managers come and go, people go on leaves…Researchers, for the most part, are fairly stable for a few years, but students come and go... there's strategies like training that we can put in place to make everything smooth." Researcher*

Turnover was a major barrier to continued work amongst the clinical (CMOC 2,3) and implementation teams (CMOC 16). Ongoing training was always used to address turnover. When doing so, we found that turnover even became a positive contextual feature. For example, CMOC 3 indicates that when MPAI-4 orientation training is in place (S) to onboard new clinicians (C) they will score and interpret the MPAI-4 as described in the training (O) because of the pressure or expectation to use the MPAI-4 in these ways (M):

"For the new people it's just going to be part of the [orientation] toolkit, so I think maybe it'll be sustained like normal work for them. It's hard on us, it's adaptation. We complain about it, but the new people will just kind of go with it." Clinician 1

Discussion

In this realist evaluation we aimed to understand how (mechanism) and in what circumstances (context) the MPAI-4 is sustained in one outpatient stroke rehabilitation site up to 18 months post-implementation. Using a mixed method, embedded single case study design, we identified 18 explanatory statements (i.e., CMOCs). Combining these CMOCs, we developed a refined program theory explaining how the MPAI-4 was sustained.

In the refined program theory we identified four overarching patterns explaining MPAI-4 sustainability. First, we found that implementation and sustainability phases are interconnected. Our findings align with recent literature in which authors conceive these two phases to be overlapping (80,94–96), including our earlier realist review of the sustainability of rehabilitation practices (88). As we discussed in the realist review (88), interconnected sustainability and implementation phases imply that concurrent implementation and sustainability planning could optimize sustainment (89–91). As a result, our MPAI-4 team conducted concurrent planning (24). Although this evaluation indicates that our planning efforts resulted in varied levels of MPAI-4 sustainment (discussed further below), we continue to highly recommend that implementation teams plan for implementation and sustainability concurrently.

Second, sustainability outcomes build on each other recursively. That is, once an outcome is achieved, it can influence other sustainability outcomes in an iterative fashion. Furthermore, the keystone outcome is patient benefits – without perceived patient benefits, sustainment is less likely to be pursued, and without demonstrated benefits long-term sustainability may be unjustified. That is, the implementation team sought to sustain a clinical practice that fits within the patient-centred care model delivered by clinicians (97–99). Thus, our results mirrored those of a sustainability definition developed by clinical managers where patient benefits are emphasized as a key outcome (100). In a healthcare system which is struggling to cope with demand (101), placing efficiency at the forefront of decision-makers minds (102), clinicians and program managers remain primarily concerned with benefits for their patients.

The relationships that we identified between patient benefits and other sustainability outcomes are partly consistent with available evidence. In our realist review (93), the

relationship between outcomes was more linear, with continued use positioned as the ultimately desired outcome. This is perhaps due to the historical views of sustainment as an end result of an implementation process (103–105) and the emphasis on continued use in included articles (106). Other authors have found that some sustainability outcomes are conditional to others (100) and have recommended that sustainability outcomes are repeatedly measured (104); however, their recursive nature has not been previously identified. We have extended the understanding of the relationships between sustainability outcomes to align with the more recent, dynamic view of sustainability in which continuous adaptation is needed to sustain a practice within an everchanging context (103). Future research can continue to build on the relationships identified here, providing guidance to implementation teams who are seeking to sustain their initiatives as the context - and outcomes - change.

Third, sustainment was achieved at varying levels across diverse sustainability outcomes. Some outcomes such as the continued scoring of the MPAI-4 were sustained at a high level whereas others such as applying the MPAI-4 to clinical decision-making were not well sustained. This finding highlights the utility of evaluating and reporting diverse sustainability outcomes (21,84,100) as continuous as opposed to binary variables (i.e., sustained and unsustained) (94). Thus, like other authors (81,107), we highly recommend measuring diverse sustainability outcomes on a continuous scale. We further propose that VAS may provide a feasible and robust way to measure diverse outcomes. VAS results could be used as indicators to prompt team discussion on what outcomes are being achieved and which require further effort. The CMOCs developed in this study could provide an explanatory roadmap that guides team discussion on how to sustain strong outcomes and improve weaker ones. While the VAS used in this study are promising given that results appear to agree with data from clinical charts, psychometric investigation into the use of VAS to measure sustainability (or implementation) outcomes is needed.

Finally, we found that the work of sustaining the MPAI-4 is shared amongst a collaborative team of clinicians, clinician leaders, managers, researchers, IT specialists and project managers. All identified CMOCs indicate that multiple project stakeholders must work collaboratively to achieve a sustainability outcome. These results agree with findings from Jagosh and colleagues' realist review that collaboration between diverse stakeholders increases the team's capacity and outputs (108), and a recent multiple case study of evidence-based

practice sustainability in which authors highlighted that diverse stakeholder engagement is an essential sustainability process (107). Going beyond existing literature, our results directly link collaboration to sustainability outcomes, empirically demonstrating that a collaborative approach (in this case IKT (109)) can benefit sustainment (110,111). Clinical stakeholders made it clear that researchers, IT specialists and project managers could not step away from the project without compromising MPAI-4 sustainment at the time of this study or into the near future (~1 year). However, it is unclear to what extent researchers could disconnect from the project in the future. The use of realist methodologies may be beneficial to further understand the benefits, challenges and links between collaboration and sustainment.

While we did not find any sufficiently robust patterns amongst contexts and strategies to highlight in the program theory, some may be particularly influential. These include the strategies of ongoing training, adaptation and having an acceptable database, and the contexts of turnover, the provincial mandate and the perception of the MPAI-4 itself. All of these have been previously identified as influential for sustainability (93,112,113), including for outcome measures specifically (114). However, mandates and the perception of the MPAI-4 are more commonly cited as facilitators rather than barriers, as found in this project. Further investigation into when and how mandates optimize sustainability, and on the MPAI-4 itself could help address these barriers to sustainment, or conversely, justify the MPAI-4's de-implementation (112,115,116).

Limitations

Investigating a single case precluded comparison of CMOCs between sites, but we compared across stakeholders via the embedded design. Despite data from one site, our middle-range program theory could be transferable to similar contexts (115), such as to understand the sustainability of other rehabilitation outcome measures.

Only one participant identified as neither female nor a woman, thus we could not complete planned sex and gender analysis. While the small sample size and basic descriptive analysis in this study was sufficient to refine the CMOCs, analyses like segmented regression of MPAI-4 use information from patient charts (116,117) could give a deeper understanding of sustainability outcomes, and perhaps indicate when certain strategies or contexts took effect.

The VAS and expertise questions that we used in the survey were not psychometrically tested prior to their use, and represented self-report of sustainability outcomes. To mitigate these limitations we triangulated results with patient chart and/or interview data. There are few pragmatic sustainability measures available (27,82,118,119), of which we did use one (i.e., the CSAT).

Conclusion

In this realist evaluation we refined a program theory informed by our previous work (93) to explain how and in what circumstances the MPAI-4 is sustained in rehabilitation contexts. Implementation teams could apply our results to guide the sustainment of outcome measures in rehabilitation, and perhaps in other clinical fields. Researchers could continue to refine the CMOCs and program theory to better understand how and in what circumstances outcome measures are sustained, especially with the goal to achieve anticipated multi-level benefits.

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Conflict of interest statement

The authors declare no conflict of interest.

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Appendix A.

Definitions of key terms within the manuscript

Table A.1: Definitions of key terms (from the RAMESES training manual (1) unless otherwise stated

Term	Definition
Sustainability	"the continued use of program components at sufficient intensity for the sustained achievement of desirable program goals and population outcomes" (2) "sustainment is an outcome of a sustainability effort" (2)
Sustainment (i.e, sustainability outcomes)	"(1) after a defined period of time, (2) a program, clinical intervention, and/or implementation strategies continue to be delivered and/or (3) individual behavior change (i.e., clinician, patient) is maintained; (4) the program and individual behavior change may evolve or adapt while (5) continuing to produce benefits for individuals/systems" (4) "(1) continued capacity to deliver the innovation, (2) continued delivery of the innovation, and (3) continued receipt of benefits. The key conditions related to (2) and (3), and included: (2a) innovations must continue in the absence of the champion or person/team who introduced it and (3a) adaptation is critical to ensuring relevancy and fit, and thus to delivering the intended benefits" (5) "(1) continued program activities, (2) continued health benefits, (3) capacity built, (4) further development (adaptation) and (5) cost recovery" (6)
Context	The conditions and circumstances that trigger mechanisms.
Mechanism	The opportunity created by implementation resources (e.g. strategies), and resulting human reasoning and decisions that cause an outcome to occur.
Outcome	The desired products and/or observed products of an intervention.
Strategy	The actions, methods or activities that are used to either 1) provide resources and/or encourage individuals to reason or make decisions to achieve a certain outcome or 2) alter the context to trigger a mechanism to achieve a certain outcome
CMOC	Context-mechanism-outcome configuration. In realist reviews, causation is described in form of CMOCs where particular features of context (C) activate specific mechanisms (M) that generate certain outcomes (O). In this review, strategies (S) are made explicit as part of the CMOC.
Program Theory	A plausible and sensible explanation of how an intervention is supposed to work according to the patterns seen across individual CMOCs.
Domain Theory	A formal theory that has previous been applied in the field of research in which the review is being carried out (i.e. implementation science).
Middle Range Theory	A theory at a level of abstraction in which it is detailed enough and 'close enough to the data' that testable hypotheses can be derived from it, but abstracted enough to apply to other, similar situations as well.
Theory of	A middle range theory developed by Ajzen that states that behavioural intention

Planned Behaviour	leads to that behaviour or action. Three mechanisms are proposed to influence behavioural intention: attitudes, subjective norms and perceived behavioural control. The latter also acts on behaviour directly (7).
Normalization Process Theory	A middle range theory developed by May and Finch which proposes different types of work that people do explain the implementation and sustainability of processes in social contexts. These types of work include coherence or sense making, cognitive participation or engagement, collective action and reflexive monitoring (8)

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Appendix B.

Table CMOCs divided by construct, and in sentence and narrative formats

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
2	Outside of being required to use the MPAI-4, clinicians have autonomy over how to integrate it into their workflow	Adapted the MPAI-4 (e.g., use Participation index only, when the measure is scored)	Clinicians work together to evaluate and modify their use of the MPAI-4	Continued fit to workflow	Outside of being required to use one subscale of the MPAI-4, clinicians have autonomy over how to integrate it into their workflow (C), so the practice remains relevant to them and continues to fit their workflow (O) because of the work clinicians do together to evaluate and modify their use of the MPAI-4 (M) when its adaptability was and continues to be promoted (S).	In 2018, the ministry of health and social services of Québec mandated the use of one subscale of the MPAI-4 – the participation subscale – for use in acquired brain injury rehabilitation programs, this includes outpatient stroke rehabilitation programs. This mandate only specifies that patients must be scored on the participation subscale. No requirements as to the interpretation or application of these scores for clinical, program or provincial-level decision making were given. Thus, clinicians do not have autonomy over scoring patients on the MPAI-4, but they can choose when to score patients, and how to interpret and apply these scores within their clinical decision-making (C) [**sustainability planning manuscript data**]. By having autonomy over these choices and the ability to adapt how the MPAI-4 is used during implementation and throughout sustainability (S), clinicians can evaluate and modify how they use the MPAI as individuals and as a clinical team (M). For example, the MPAI-4 was originally implemented at the rehabilitation site as the full measure. However, after using the MPAI-4 in this format for a year, the clinicians found that the measure overlapped with other, existing measures and that the time the full MPAI-4 took to complete was not acceptable in their workflow. They started using only the participation subscale at this point [**clinical data from patient charts**]. Since this time, some clinicians and the care coordinator have expressed that

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
						perhaps some of the change seen in clients is occurring on the other subscales of the MPAI-4. Since adaptation continues to be possible, if the value of doing the full MPAI-4 measure outweighs the cons (e.g., time), then in the future the clinical team or individual clinicians may use the full MPAI-4 measure once again [**informal discussion pre-evaluation with Kim and Julie, confirm in interviews**]. In any case, the result is that clinicians continue to be able to integrate the MPAI-4 into their workflow, in accordance with their expertise as clinicians and the patient's values (O).
N1	The time it takes to use the MPAI-4 is acceptable to clinicians and managers	MPAI-4 database is continuously updated to optimize it's use	Clinicians judge the value of the practice to be worth their time	Continued fit to workflow	The time it takes to use the MPAI-4 is acceptable to clinicians and managers (C), when a database is continuously updated to optimize it's use (S) resulting in the continued fit to clinician's workflow (O) because clinicians judge the value of the practice to be worth their time	The MPAI-4 takes about 20-30 minutes to do when starting out, and around 10-15 minutes once practiced at it. Similarly, the participation subscale takes 15 minutes at the beginning and no more than 5 minutes once used to it. The MPAI-4 should be filled out by at least 2 clinicians who arrive at the final score by consensus. Thus, the total working hours required to complete the MPAI-4 is not inconsiderable (at least 30min at admission and 30min at discharge) (C) [**sustainability planning manuscript data**]. A key component of the development of the MPAI-4 database was reducing the time it took to score and interpret the MPAI-4. The database continues to undergo development for further optimization in pursuit of these goals (S). An optimized database encourages clinicians to judge using the MPAI-4 as worth their time – the practice is seen as valuable enough to outweigh the time spent using the measure versus providing direct patient care (M) [**confirm via interviews, currently assumed**]. The result is that the scoring, interpretation and application of the MPAI-4 continues to fit the clinician's workflow (O) [**confirm via interviews, currently assumed].**

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
20 + 26	Managers indicate that the MPAI is an expected part of clinical duties, and this leads them to provide clinicians adequate time to learn how to use the MPAI-4	Ongoing training provides learning opportunities	Clinicians are confident in their ability to use the MPAI-4 + Clinicians understand their specific tasks and responsibilities related to the use of the MPAI	Continued MPAI-4 expertise	Especially if there is turnover, ongoing training is needed (S) to signal that the evidence-based practice is an expected part of clinical duties (C) so that clinicians continue to feel confident in their ability to perform the practice and understand their specifics tasks and responsibilities related to the MPAI-4 (M), resulting in continued expertise amongst clinicians (O).	Management support for the MPAI-4 has been consistently excellent. The manager and care coordinator have indicated and shown through their actions that the MPAI-4 is an expected part of clinical duties, including providing clinicians adequate time and support to learn how to use the MPAI-4 (C) via release time to participate in ongoing training workshops and integrating the asynchronous training materials (e.g., webinars, infographics, etc) into orientation and booster training (S) [**sustainability planning manuscript data**]. This has led to clinicians continuing to have the knowledge and confidence to score, interpret and apply MPAI-4 scores to clinical decision-making 4 (O) because they understand their specific tasks and responsibilities related to the use of the MPAI-4 (M) [**survey data**, **interview data].**
23	Organizational turnover of clinical staff	Ongoing training provides learning opportunities	Peer pressure for clinicians to use the MPAI-4	Continued MPAI-4 expertise	If there is turnover in clinicians but the necessary expertise for the MPAI-4 is still present on the clinical team (C)	There has been considerable turnover and staff shortages at the rehabilitation site. The manager on this project was on leave for 1 year in the middle of MPAI-4 implementation. Due to reassignments and other pressures during the pandemic, the clinical team has seen numerous individuals retire or move to other positions. The team is contending with staff shortages in most professions. As the manager has stated, they have the money to hire new clinical staff to

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					since ongoing training in conducted (S), then clinicians will continue to have MPAI-4 expertise (O) because there is peer pressure or expectation for them to use it (M).	address these gaps, but very few people are available to hire. The Canadian healthcare ecosystem more widely is currently experiencing perhaps the largest workforce shortage in its history (C) **[sustainability planning manuscript data].** To address the learning needs of the new staff that have recently joined the team, as well as preparing to orient the expected new clinical staff, ongoing training workshops and asynchronous training materials (e.g., webinars, infographics, etc) were provided (S). This led to continued expertise to score, interpret and apply MPAI-4 scores to clinical decision making (O) because there was peer pressure and expectation for clinicians to use the MPAI-4 (M). [**confirm in surveys and interviews**]
1 + 30	Outside of being required to use the MPAI-4, clinicians have autonomy over how to integrate it into their workflow	Ongoing training	Clinicians and/or managers value the MPAI-4 + Clinicians feel confident in their ability to use the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	If clinicians have autonomy over how to integrate the MPAI-4 into their workflow even though they do not have a choice in using it due to a government mandate (C), when ongoing training is conducted (S) clinicians will value the MPAI-4 and maintain confidence in their ability to use	In 2018, the ministry of health and social services of Québec mandated the use of one subscale of the MPAI-4 – the participation subscale – for use in acquired brain injury rehabilitation programs, this includes outpatient stroke rehabilitation programs. This mandate only specifies that patients must be scored on the participation subscale. No requirements as to the interpretation or application of these scores for clinical, program or provincial-level decision making were given. Thus, clinicians do not have autonomy over scoring patients on the MPAI-4, but they can choose when to score patients, and how to interpret and apply these scores within their clinical decision-making (C) [**sustainability planning manuscript data**]. By having autonomy over these choices and being provided information on the different ways in which the MPAI-4 can be scored, interpreted and applied during ongoing training (including workshops and asynchronous online methods like webinars and FAQs) (S), clinicians continue to value the MPAI-4 and are confident in their ability to use it in

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					it (M), resulting in its continued use (O).	their clinical work (M). This results in clinicians continuing to score, interpret and apply MPAI-4 results in their clinical decision-making.
4	Key stakeholders in the organization are committed to using the MPAI-4, creating a positive atmosphere	Ongoing, collaboratively developed interprofessional training strategy	Clinicians can divide the labour of using the MPAI-4 amongst the team + Individual and collective appraisal of the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	When key stakeholders in the organization are committed to using the MPAI-4, they create a positive atmosphere (C) within which an ongoing, collaboratively developed interprofessional training strategy can be used (S) that will result in the continued clinical use of the MPAI-4 (O) because clinicians individually and collectively evaluate the strengths and weaknesses of the MPAI-4, then divide the labour of the MPAI-4	Key stakeholders including the manager and care coordinator in the role of clinical champion are committed to using the MPAI-4. These key individuals influence the attitudes and perceptions surrounding the MPAI-4 in a constructive way, helping create a positive atmosphere concerning the measure (C). It is in this committed and constructive atmosphere that the research team led ongoing, collaboratively developed interprofessional training workshops. These workshops were explicitly theory-informed with the goal to deliver a safe space for clinicians learn and critique the MPAI-4 (S). The clinicians then individually appraised the strengths and weaknesses of the MPAI-4, followed by collective appraisal and division of labour to use the MPAI-4 as part of the group discussions during the training. Discussions on the strengths and weaknesses of the MPAI-4 and the division of labour to do it continued following the workshops (M) [**MPAI-4 training evaluation data**]. As a result, the clinicians continued to score, interpret and apply the MPAI-4 to clinical decision-making [**sustainability evaluation data**]

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					amongst themselves.	
3 + 19	Positive workplace atmosphere concerning the importance of using research evidence in general + MPAI-4 aligns with organizational priorities and has become an expected part of clinical duties	Clinical champions for the MPAI-4	Positive influence on colleagues to use the MPAI-4 + Clinical champions took ownership of the MPAI-4, and are continuously working to drive it forward	Continued use clinically • Scoring • Interpretation • Application of results	Positive workplace atmosphere concerning the importance of using research evidence in general and the MPAI-4 aligning with organizational priorities lead the MPAI-4 to become an expected part of clinical duties (C), that a clinical champion can support (S) by taking ownership of the MPAI-4 and continuously working to positively influence MPAI-4 attitudes (M) such that the MPAI-4 continues to be used (O)	The rehabilitation centre has a strong record of research involvement and the use of the most up to date, evidence-based practices. This is evidence of a positive workplace atmosphere concerning the importance of integrating research in general. At the same time, the MPAI-4 aligns with organizational priorities, as it is a priority for the site to be in compliance with the provincial mandate on the use of the MPAI-4. Collectively, these circumstances lead the MPAI-4 to become an expected part of clinical duties (C). A single clinical champion for the MPAI-4 at the site was very well positioned on the team, in a leadership role already and a long-time member of the clinical team (S) [**sustainability planning manuscript]**. The clinical champion took ownership of the MPAI-4, continuously working to drive the practice forward. They were instrumental in expressing that the MPAI-4 was an expected part of clinical duties in a positive way (M) **[ask clinicians during interviews]**. This work by the clinical champion resulted in the continued scoring, interpretation, and application of the MPAI-4 by clinicians [**ask during interviews] (O).**

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
14 + 8	Clinicians, managers and researchers committed to the use of the MPAI-4	A collaborative team of clinicians, managers and researchers is developed and maintained	Team members including clinicians, managers and researchers encouraged to clinicians belief that they can usefully be involved and take ownership of the MPAI-4 + Clinicians have positive attitudes and continue to be confident in their ability to use the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	Clinicians, managers and researchers committed to the MPAI-4 (C) can lead to its continued clinical use (O) when a collaborative team composed of these key stakeholders (S) influences clinicians' belief that they can usefully be involved and take ownership of the MPAI-4 (M)	Clinicians, managers and researchers are committed to the MPAI-4. This includes an acceptable level of belief in the strength of the measure and the acknowledgement of the necessity of using the MPAI-4 due to the provincial mandate (C). When this group of committed individuals forms a collaborative team to work towards MPAI-4 adoption and sustained use, the inclusion of the key stakeholders with the right expertise and in the right positions on the clinical team (S) [**sustainability planning data]** will lead to the clinicians having a positive attitude and confidence in using the MPAI-4 [**survey results, interview results**] and believing that they can usefully be involved in using the MPAI-4, such that that take ownership of it (M) [**ask clinicians in interviews]**. As a result, the clinicians continue to score,interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
33	Adequate financial resources	Implementation advisor or a data expert to relieve the research or implementation burden on clinical teams	Clinicians believe that they can usefully be involved and take ownership of using the MPAI-4 + The labour of sustaining the	Continued use clinically. • Scoring • Interpretation • Application of results	If there are adequate financial resources (C), implementation and evaluation experts can relieve the clinical team of these tasks (S), resulting in the continued clinical	There are adequate financial resources available to sustain the use of the MPAI-4 over the relatively long-term. The MPAI-4 project was largely supported by research grants, to develop infrastructure such as the database and set up servers that could handle patient data, to provide funding for a research/implementation coordinator, IT professionals and researchers for the project, who all provided their expertise to the endeavour (C) [**MPAI implementation data].**Having this non-clinical expertise on the team meant that the clinical team did not need to be burdened with these tasks that they did not necessarily have the expertise nor the

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
			MPAI-4 is divided amongst the implementation team members		use of the MPAI-4 (O) because the clinical team believes that they can usefully be involved and take ownership of using the MPAI-4, and divide the clinical tasks related to the MPAI-4 amongst themselves.	time for (S) [**interviews with all**]. The labour of sustaining the MPAI-4 was divided amongst the diverse members of the implementation team, such that clinicians are left with the duty of using the MPAI-4 in their clinical practice. Having their duties fall within their realm of expertise led them to believe that they are right to be involved in using the MPAI-4 (M) [**interviews with clinicians].** As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
39	Stakeholders do not have authority over MPAI-4 mandates by the province	Clinical data on patients for whom the MPAI was used is relayed to individuals in the ministry who make priority decisions	Individuals making prioritization decisions would appraise the MPAI-4 and see its value	Continued use clinically • Scoring • Interpretation • Application of results	Stakeholders do not have authority over MPAI-4 mandates by the province (C), so the benefits of the MPAI-4 according to actual clinical data was relayed to individuals making priority decisions (S) resulting in the continued clinical use of the MPAI-4 (O) because individuals making prioritization	The provincial mandate to use the MPAI-4 was not made or influenced by any stakeholders on the implementation team for this project. No team members have authority over this mandate. However, there are some members of the MPAI-4 implementation team who have connections to relevant individuals within the ministry of health and social services, who have some say over the MPAI-4 mandate and general practice requirements for stroke rehabilitation (C) [**implementation and sustainability planning data**]. The experiences of using the MPAI-4, the perception of its benefits and the potential for clinical data on patient outcomes for use at the provincial level were all relayed to contacts within the Ministry of health and social services who are perceived by team members to have some decision-making power over the MPAI mandate (S) [**sustainability planning data**]. It is thought by members of the implementation team that by communicating the strengths and opportunities associated with the MPAI-4, individuals making decisions on the MPAI-4 mandate would appraise the MPAI-4 and see its value (M) [**can only get**

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					decisions would appraise the MPAI-4 and see its value (M).	**perceptions on this, ask Julie**]. As a result, the clinicians continue to score,interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
12	Management support and sufficient non-financial resources for the MPAI-4	Building and cultivating relationships led to resource sharing amongst research and clinical teams	Clinical and research teams divide the labour of using the MPAI-4 amongst the team	Continued use clinically • Scoring • Interpretation • Application of results	When building and cultivating relationships building a coalition facilitated resource sharing (S) then there is management support and sufficient non-financial resources for the evidence-based practice (C), resulting in the continued clinical use of the practice (O) because the human resource needs of the clinical practice can be divided between stakeholders who are working together to	Building and cultivating relationships relationships led to resource sharing amongst research and clinical teams. Resource sharing between the research and clinical teams in terms of human and physical resources has been essential to the success of the MPAI-4. By essential resources being provided by the research team (e.g., IT, implementation expertise) (S), there was management support for the project, including a willingness to share their own resources (e.g., release time for clinicians, use of physical spaces at the site). This led to sufficient non-financial resources for the MPAI-4 (C) [**sustainability planning data**]. In this way, the different members of the implementation team divided the labour of using the MPIA-4 amongst themselves, making the workload manageable for everyone involved and tailoring each individuals duties to their skillset and position (M) [**sustainability planning data, confirm in interviews**]. As a result, the clinicians continue to score,interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					operationalize the practice (M). *this CMOC is VERY similar to 33, they are really embedded within one another in the MPAI-4 project.	
16 + 25	The MPAI-4 is an expected part of clinical duties + Clinicians see benefits to using the MPAI-4	Adapted the MPAI-4 and tailored MPAI-4 sustainment plan	Clinicians can divide the labour of using the MPAI-4 to fit the workflow of the team + Positive attitude towards the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	When the MPAI-4 is an expected part of duties due to the benefits it has for the rehabilitation site, clinicians and/or patients (C), then the MPAI-4 will continue to be used clinically (O) when the MPAI-4 is adapted and implementation strategies are tailored to the rehabilitation site (S) because the labour has been adequately divided to fit the workflow of the clinical team and clinicians have a	The rehabilitation site has made the MPAI-4 an expected part of clinical duties. At the beginning, this expectation was purely based on the mandate for its use from the province (C). Following the tailoring of implementation strategies including developing, launching a new database, delivering an advanced interpretation training session and promoting the adaptability of the MPAI-4 (i.e., using the participation subscale only) (S), clinicians began to experience benefits to using the MPAI-4 (C) [**ask clinicians in interviews]**. Clinicians have leveraged these strategies and adaptations to make informed decisions as to what labour each individual is expected to undertake to fit the MPAI-4 to the workflow of the team. For example, who is expected to score the MPAI-4 via consensus when there are more than 2 clinicians working with a single patient. Furthermore, this division of labour and the benefits experienced from the MPAI have given created more positive attitudes towards the practice (M) [**ask clinicians in interviews]**. As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					positive attitude towards the MPAI-4 (M)	
35	MPAI-4 is perceived to be beneficial for patients by clinicians	Local consensus discussion	clinicians have worked together to evaluate the value of MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	If the MPAI-4 is perceived to be beneficial by clinicians (C), then they will continue to use it (O) because the clinicians have worked together to evaluate the MPAI-4's value (M) during local consensus discussions (S).	Both informal discussions during the course of day-to-day clinical work and a more structured discussion during an ongoing training session (S) have provided clinicians the opportunity to work together to evaluate the worth of the MPAI-4 (M). Although not perfect, overall the MPAI-4 is considered to be beneficial by clinicians (C). As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
N2	Ongoing research will provide new interpretations of the MPAI-4 and thus new potential benefits to using the MPAI-4	Ongoing database updates to reflect new evidence of the MPAI-4 and possible MPAI-4 interpretations	Clinicians and managers continue to redefine and modify how the MPAI-4 is used in alignment with the evidence that is being collected and associated database features	Continued use clinically • Scoring • Interpretation • Application of results	As ongoing research provides new interpretations of the MPAI-4 and thus new benefits to its use (C), the database is updated to reflect this new evidence and possible MPAI-4 interpretations (S) and subsequently, clinicians and	Research continues to be conducted on the MPAI-4, with the intent to optimize interpretation and use of the measure according to stated clinical and program level needs (C). As new interpretations become known, the database continues to be updated to integrate this new evidence of the MPAI-4, especially in terms of automatic calculations and interpretations. For example, new information concerning items acting as red flags came to light during our development of the database. In response, we went through an iterative cycle to develop the updates to the database then launched the changes (S) [**sustainability planning data**]. Subsequently, clinicians and managers went through a cycle of redefining and modifying how the MPAI-4 is used in alignment with the new evidence and associated database features. They had to determine how the new

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					managers redefine and modify the MPAI-4 (M) resulting in its continued clinical use (O)	interpretations would fit into their workflow and decision-making (M) [**ask all in interviews]**. As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
27 + 18	Acceptable database in place + MPAI-4 aligns with organizational priorities	Clinical data on patient outcomes relayed to clinicians	Clinicians believe that it is right for them to use the MPAI-4 + Understand the value and importance of the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	When an adequate database is in place and the MPAI-4 aligns with organizational priorities (C), then clinical data can be relayed to clinicians concerning their patients (S), resulting in clinicians continuing to use the MPAI-4 (O) because they believe that it is right for them to be involved since the MPAI-4 provides valuable and important information (M).	The MPAI-4 project began with a database adapted from a similar MPAI-4 implementation project in TBI rehabilitation in the province. Despite the implementation team's best efforts, the adapted database was not acceptable to the clinical teams. The new database was developed according to a user-centred design to ensure it was acceptable to users and its functionalities aligned with organizational priorities (C). It was recognized that for the MPAI-4 to be successful, the actual users of the measure (i.e., clinicians) needed to have their priorities be met. Namely, they required automatic calculations and interpretations of the MPAI-4 in easy-to-use formats that matched their clinical workflows. An iterative cycle of database development was used to optimize the clinical data that clinicians receive about their patients within the database (S) [**sustainability planning data**]. The valuable information that clinicians receive from the MPAI-4 via the database led to the clinicians believing it was right for them to use the MPAI-4 (M) **[ask clinicians during interviews**]. As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
29	adequate expertise on the clinical team for the MPAI-4	use tools to assess sustainability readiness, barriers and facilitators, and use the assessment information to tailor strategies and promote adaptability	The implementation team works together to periodically appraise the value of the MPAI-4	Continued use clinically • Scoring • Interpretation • Application of results	If there is adequate expertise on the clinical team for the MPAI-4 (C), then it will continue to used by clinicians (O) because the implementation team will have worked together to periodically appraise the worth of the practice (M) when they use tools to assess sustainability readiness, barriers and facilitators, and use the assessment information to tailor strategies and promote adaptability (S).	The clinical team continues to have adequate expertise in using the MPAI-4, and thus are able to think critically about the measurement tool (C). Prompted by the use of the Clinical Sustainability Assessment Tool (CSAT), the implementation team, composed of both research and clinical team members (S), appraised the value of the MPAI-4 as a clinical practice to be sustained. During this process, both the positives (e.g., fit to workflow) and the negatives (e.g., lack of patient benefits information as it must be accumulated over time) were discussed openly and weighed (M). As a result, on the recommendation of the implementation team, especially the clinical team members, clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
N3	Patients continue to be scored on the MPAI-4	Database designed to facilitate data export of patient data for research use	Researchers and IT divide the labour of accessing and analyzing MPAI data	Continue to use MPAI-4 data in research projects	When patients continue to be scored on the MPAI-4 (C), and the database is designed to	Patients continue to be scored on the MPAI-4 at the rehabilitation site – scoring has continued consistently from initial implementation using the old database in November 2021, through using a paper-based format starting in Winter 2022 through to January 2023 and finally when the new database became available in January 2023 (C)

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					facilitate data export for research use (S) then researchers and IT professionals can divide the labour of accessing and analyzing MPAI-4 data (M) resulting in the MPAI-4 continuing to be used in research projects (O)	[**sustainability planning data and patient charts]**. When the new database was developed, the design included the ability to easily export the data for research use across all participating sites. Thus, there is one large dataset rather than data scattered amongst participating sites. This streamlines data export - data export takes only a couple minutes and the export is already formatted to be easily imported to common statistical software (S) [**sustainability planning data]**. The setup of the database means that researchers and IT professionals can easily divide the labour of accessing and analyzing the MPAI-4 data (M) **[sustainability planning data]**. As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]
N4	Clinicians continue to score patients on the MPAI-4 (C)	Database designed to facilitate interpretation (S)	Clinicians divide the labour of using the MPAI-4 (M)	Patients benefit from the MPAI-4 *may be too early for this outcome, per comments by Kim in March	When clinicians continue to score patients on the MPAI-4 (C) and the database is designed to conduct calculations and provide graphics that facilitate interpretation (S), then clinicians divide the remaining labour of interpreting and applying the MPAI-4 to inform	Patients continue to be scored on the MPAI-4 at the rehabilitation site – scoring has continued consistently from initial implementation using the old database in November 2021, through using a paper-based format starting in Winter 2022 through to January 2023 and finally when the new database became available in January 2023 (C) [**sustainability planning data and patient charts]**. When the new database was developed, it was designed to facilitate MPAI-4 interpretation at the individual patient level first and foremost. For example, this included automatic T score calculations and associated interpretation of the clients limitations, and visuals such as the patient's scores versus the average scores of patients in the program (S) [**sustainability planning data]**. Clinicians are able to divide the labour of using the MPAI-4 between themselves and the database – the database does the arduous calculations and matches them to the interpretations.

#	**Context** Environment	**Strategy** Action the team took	**Mechanism** Why strategy works	**Outcome** Result	**CMOC in sentence format**	**Full CMOC narrative**
					clinical decisions amongst themselves (M) resulting in patients receiving continued benefits from the use of the MPAI-4 (O) *May be too early for this outcome, based on Kim's comments in March	Clinicians can focus on the interpretations themselves and take the time to consider how they may integrate that information into their decision-making (M) [**sustainability planning data + ask clinicians interviews].** As a result of MPAI-4 informed clinical decisions and treatment planning, patients receive benefits from the MPAI-4 (O) [**ask all in interviews, patient chart data]**.
11	Adequate resources and management support	Building and cultivating relationships led to resource sharing amongst research and clinical teams	Available resources are allocated appropriately	Financial viability	When building a coalition has facilitated resource sharing (S) then there is management support and adequate resources (C) resulting in the evidence-based practice remaining financially viable (O) because the available resources have been allocated appropriately (M).	The MPAI-4 project continues to be funded by a large, multimillion dollar infrastructure grant which covers the architecture, servers and other software needs of the project for a period of up to seven years. There are recurring, yearly costs to maintain servers and update the database. Building and cultivating relationships led to resource sharing amongst research and clinical teams (S). Sharing these financial resources with the clinical teams delivers adequate resources for the project which in turn encourages management support of the work (C). Resources can then be allocated judiciously amongst the needs of the project, ultimately resulting in the MPAI-4 remaining financially viable (O).

Appendix C.

Data Collection for each construct of interest

Construct	Quantitative Inquiry			Qualitative Inquiry
	Measures	**Measure Properties**	**Score and interpretation**	
Process (context, mechanisms, strategies)				
Context	Organizational level - CSAT average scores by item/subscale, by centre Clinician level – CSAT individual scores by item/subscale, (especially change over time)	Newly developed using a literature review and expert consultation via concept mapping. Assesses the individual or organizational capacity to sustain a clinical practice. Items concern influential contextual features. Structural validity (RMSEA = 0.084, SRMR = 0.075, CFI = 0.81) and internal consistency (Cronbach's alpha = 0.82-0.94) were assessed in a small pilot (n=126). Approximately 10 minutes to complete the 35-item measure. 85% of participants rated the CSAT as easy to use.	0-6 total score and subscale scores. Some indication of ceiling effects but not explicitly assessed.	Clinician level – Key informant interviews Document reviews Observation Organizational level – Key informant interviews (especially managers)
Strategies (including adaptations to MPAI-4 or implementation strategies)	Organizational level – traffic to educational materials hosted online at implementation to 12 months (i.e. implementation phase) and within sustainability phase (12-20 months)	N/A	Count	
Mechanisms (resources and reasoning)	N/A	N/A	N/A	

Construct	Quantitative Inquiry			Qualitative Inquiry
	Measures	**Measure Properties**	**Score and interpretation**	
Outcomes				
Benefits				
Benefits (clinician and organizational levels)	N/A	N/A	N/A	Clinician level – key informant interviews Organization level – key informant interviews (especially managers)
Use of the evidence-based practice				
MPAI-4 is used at admission/at discharge	Organizational level: Clinical chart audit - MPAI-4 use in eligible patients at implementation to 12 months (i.e. implementation phase) and within sustainability phase (12-20 months).	N/A	Binary (Y/N); Proportion (%) by clinician and by site	Organizational level – key informant interviews
MPAI-4 is used for rehabilitation planning	Organizational level: Clinical chart audit – when MPAI-4 is used, the number of instances there is evidence that scores informed the treatment plan during implementation to 12 months (i.e. implementation phase) and within sustainability phase (12-20 months).	N/A	Binary (Y/N); Proportion (%) by clinician and by site	Clinician level (patient planning) - key informant interviews Organizational level (program planning) – key informant interviews
Expertise				
Knowledge, skill and training needs (clinician	Informed by MPAI-4 training evaluation data collection	N/A	Descriptive statistics	key informant interviews

Construct	Quantitative Inquiry			Qualitative Inquiry
	Measures	**Measure Properties**	**Score and interpretation**	
level)				
Fit/Alignment				
Fit to the workflow or organization	N/A	N/A	N/A	Clinician and organizational level – key informant interviews
Global Sustainability Outcome				
Global sustainability score	Organizational level – VAS Clinician level - VAS	A VAS measures a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured (172,173), such as sustainment (57,62,66,108). VAS are considered highly feasible. None have previously been used to assess sustainability.	Horizontal 100mm line, with the left end labelled 'no sustainment' and the right end labelled 'complete sustainment'.	Clinician and organizational level – key informant interviews

Appendix D.

Data Collection for each construct of interest

Refined CMOCs

CMOCs from initial program theory : 7
CMOCs from initial program theory with small adaptations: 7
New CMOCs : 4
Total CMOCs: 18

Table D.1: CMOCs divided by construct, and in sentence and narrative formats

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
1	Realist review CMOC 2	If clinicians can choose how to use the MPAI-4 outside of the government mandate (C) and its adaptability is promoted (S), then the clinical and research teams evaluate and modify the clinical team's use of the MPAI-4 (M) resulting in	In 2018, the ministry of health and social services of Québec mandated the use of one subscale of the MPAI-4 – the participation subscale – for use in acquired brain injury rehabilitation programs, this includes outpatient stroke rehabilitation programs. This mandate only specifies that patients must be scored on the participation subscale. No requirements as to the interpretation or application of these scores for clinical, program or provincial-level decision making were given. Thus, clinicians do not have autonomy over scoring patients on the MPAI-4, but they can choose when to score patients, and how to interpret and apply these scores within their clinical decision-making (C) [**sustainability planning manuscript data and interviews conducted for this manuscript**]. By having autonomy over these choices	"Well, by not doing part A and B, it really reduced the scoring time, now it takes no more than 5 minutes. Then, I tried different ways to use [the MPAI-4], sometimes I try to use it first because usually, when I do [an interdisciplinary team meeting], I want to know what lifestyle habit is affected by stroke. Then after that I did the MPAI-4 and then I said to myself, 'well now I repeat some things'. It made try to start with the MPAI-4 instead…In fact when I do it this way, it doesn't really interrupt and my workflow is still quite fluid." **Clinical Coordinator** "As the obligation is only to use Part C [the Participation subscale], I liked when they

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		the practice continuing to fit their workflow (O).	and the ability to adapt how the MPAI-4 is used during implementation and throughout sustainability (S), clinical leaders consulted with researchers to evaluate and modify when and how they use the MPAI the clinical team would use the MPAI-4 (M). For example, the MPAI-4 was originally implemented at the rehabilitation site as the full measure. However, after using the MPAI-4 in this format for a year, clinicians found that the measure overlapped with other, existing measures and that the time the full MPAI-4 took to complete was not acceptable in their workflow. After consulting with the research team and finding that the evidence supports the use of the participation index only and this action would align with the ministry mandate, the clinical team started using the participation subscale only [**sustainability planning manuscript data and interviews conducted for this manuscript; clinical data from patient charts**]. Since this time, some clinicians and the care coordinator have expressed that perhaps some of the change seen in clients is occurring on the other subscales of the MPAI-4. Since adaptation continues to be possible, if the value of doing the full MPAI-4 measure outweighs the cons (e.g., time), then in the future the clinical team or individual clinicians may use the full MPAI-4 measure once again [**interviews**]. In any case, the result is that clinicians continue to be able to integrate the MPAI-4 into their workflow, in accordance with their expertise as clinicians and the patient's values (O) [**interviews**].	reduced to that portion, we are just at Part C now. I think it is good for us in team meetings to be able to fill out this form because before, it was too much, because we already make everyone do their own assessment. To add the full MPAI-4 in meeting, I think it was too slow, we repeated the same information." **Clinician 2** "I think especially expressed within the sustainability planning or underpinning sustainability planning was that concept of there are lots of things you can plan for in advance that we know we would need for sustainable we need and there are other things we cannot plan for, but we have to just try to make everything as adaptable or modifiable as possible within the parameters of still work within the core evidence of the MPAI. And understanding we have to kind of stick to how the practice is supposed to be delivered." **Facilitator**
2	Realist review CMOC	Managers provide adequate time to learn how to use	There has been considerable turnover and staff shortages at the rehabilitation site. The manager on this project was on leave for 1 year in the middle of MPAI-4	"I think [additional, in-person training] helped. I like that we were in groups and trying to score the situations you have given us. But what it also

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
	20, 23, 26	the MPAI-4 (C) through ongoing training (S), resulting in clinicians having continued MPAI-4 knowledge and confidence (O) because they can evaluate the worth of the MPAI-4 both individually and as a team (M)	implementation. Due to reassignments and other pressures during the pandemic, the clinical team has seen numerous individuals retire or move to other positions. The team is contending with staff shortages in most professions. As the manager has stated, they have the money to hire new clinical staff to address these gaps, but very few people are available to hire. The Canadian healthcare ecosystem more widely is currently experiencing perhaps the largest workforce shortage in its history **[sustainability planning manuscript data].** Despite this challenging environment, Management support for the MPAI-4 has been consistently excellent. The manager and care coordinator have indicated and shown through their actions that the MPAI-4 is an expected part of clinical duties, including providing clinicians adequate time and support to learn how to use the MPAI-4 (C) via release time to participate in ongoing training workshops and integrating the asynchronous training materials (e.g., webinars, infographics, etc.) into orientation and booster training (S) [**sustainability planning manuscript data**]. This has given clinicians the ability to critically appraise the MPAI-4 individually and as a group (M) **[interviews]**. In this way, clinicians continue to have the knowledge and confidence to score, and to a lesser extent, to interpret the MPAI-4. The MPAI-4 is not used in clinical decision-making (O) [**survey data**, **interview data].**) [**interview data].**	showed was that different teams had different numbers and they were all right. You know, they all have a good justification for it" **Clinician 1** In fact, before having the training, I think that personally I was always wondering how to score [the MPAI-4}…it was not clear what score we should give. We often went back to the manual. **Clinician 4** "There is a lot of confusion before having the training in scoring because we were looking for a single answer, which is something we are used to. I think the training made it possible to clarify that it was not that, it was a tool that was not as precise. But after that, there was still frustration. Why use it then it's very it's not accurate? How to interpret the MPAI in this situation?" **Clinician 4** **Clinician 4:** "I don't know if to have online training that could be done. It's easier that new employees have to listen to online training. Maybe that's a simpler way…" **Clinician 3**: "But since it is, it's very gray, really that in person would be better…there has to be a little discussion around the tool to make it more understandable." **Clinician 4:** "It is true that it helps a person indeed."

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
				"I remember being flabbergasted - remember, we did the training - to know that some people just despise the thing. Oh my gosh, you know, like it was really important to know that. And it wasn't a judgement. I mean, I'm a clinician, I was an OT for years. You know, I have a lot of a lot of respect and admiration for clinical acumen and so with the for the clinicians to say, look, I'm not crazy about this measure" **Researcher** **Expertise question results**
3	Realist review CMOC 23	If the necessary expertise for the MPAI-4 is maintained on the clinical team (C) since ongoing training in conducted (S), then clinicians will continue to use the MPAI-4 as the clinical team does (i.e., scoring and limited interpretation) (O) because there is peer pressure for	There has been considerable turnover and staff shortages at the rehabilitation site. The manager on this project was on leave for 1 year in the middle of MPAI-4 implementation. Due to reassignments and other pressures during the pandemic, the clinical team has seen numerous individuals retire or move to other positions. The team is contending with staff shortages in most professions. As the manager has stated, they have the money to hire new clinical staff to address these gaps, but very few people are available to hire. The Canadian healthcare ecosystem more widely is currently experiencing perhaps the largest workforce shortage in its history (C) **[sustainability planning manuscript data].** To address the learning needs of the new staff that have recently joined the team, as well as preparing to orient the expected new clinical staff, ongoing, in-person training workshops and asynchronous training materials (e.g., webinars, infographics, etc.) were provided (S). When	"The new people are just going to be part of the toolkit, so I think maybe it'll be sustained like work. It's hard on us, it's adaptation. We complain about it, but then the new people will just kind of go on with it." **Clinician 1** "I think it's going to be going to continue just because we're when we have to do something, we do it, we're when we have to do it. I think we're good drivers, and then we do it, even if we don't agree. And I think that even if a new clinical coordinator, let's say, because it's [the clinical coordinator] who does it in rounds with the team, I think it would follow. You know, the, we'd keep doing it because we have to." **Clinician 4** **Expertise questions - behaviour results**

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		them to use it in these ways (M).	MPAI-4 orientation materials were given to new clinicians as part of a package with all other material relevant to their new jobs, the MPAI-4 is simply viewed as another practice amongst many that are expected of them in their new clinical workplace. In other words, there was pressure from the organization and their colleagues to use the MPAI-4 (M) [**interviews, MPAI-4 training evaluation manuscript data].** This led to the scoring of patients and, to a lesser extent, the interpretation of the MPAI-4 amongst the new clinicians, and thus, the continued use of the MPAI-4 by the clinical team as a whole (O) [**interviews, survey data, patient chart data]**	**VAS score results** **Patient chart results**
4	Realist review CMOC 1, 30, 35	If clinicians can choose how to use the MPAI-4 outside of the government mandate (C) then they will continue to use the MPAI-4 as implemented (i.e., scoring, limited interpretation) (O) because ongoing training (S) has given clinicians the knowledge and understanding they needed to	In 2018, the ministry of health and social services of Québec mandated the use of one subscale of the MPAI-4 – the participation subscale – for use in acquired brain injury rehabilitation programs, this includes outpatient stroke rehabilitation programs. This mandate only specifies that patients must be scored on the participation subscale. No requirements as to the interpretation or application of these scores for clinical, program or provincial-level decision making were given. Thus, clinicians do not have autonomy over scoring patients on the MPAI-4, but they can choose when to score patients, and how to interpret and apply these scores within their clinical decision-making (C) [**sustainability planning manuscript data and interviews conducted for this manuscript**]. Ongoing training workshops and integrating the asynchronous training materials (e.g., webinars, infographics, etc.) into orientation and booster training have given clinicians a solid knowledge and	"I think I think it's a tool that we were told to use by the ministry. I don't think it's a tool that we would necessarily have picked as a first choice." **Manager** "As clinicians we're all taught in our formal education and what we're told to do in practice is to really think critically about what we're doing and make our own autonomous decisions based on what's in front of you. And definitely having that time during the training to have a critical discussion and really use our own individual brains as well as discuss as a collective to, you know, figure it out, I think it was very important." **Clinician 5** "So that's a part of sustainability. If it hadn't been for the fact that we had to put in the MPAI-

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		critically appraise the worth of the MPAI (M).	understanding of the MPAI-4 (S) [**sustainability planning manuscript data**]. Clinicians are then able to appraise the MPAI-4 individually and as a group, including assigning value to the MPAI-4 (M). Following this critical appraisal, clinicians have continued to score, and to a lesser extent, to interpret the MPAI-4. However, they do not trust the scores enough for them to be applied to their decision-making (O) [**survey data**, **interview data].**	4 [due to the government mandate] I would have tanked the project right on the spot [following earlier, non-interactive training]. When you came and you gave that presentation and we went through the cases and we had the discussion, that's when I found much more buy-in from clinicians. Because now they're going 'now somebody has bothered to come and to explain and to have a discussion and to have a debate'. And they challenged you, and it was OK. And it actually went very well. They like challenging people. But it was it was appreciated from the clinicians that they felt like, OK, now we're actually talking about the MPAI-4 and now we can have the clinical discussion and decide how to use it." **Manager** **Manager:** The importance of the FIM, if they're not understanding the importance of doing the MPAI, they don't agree with it. **Clinical Coordinator:** No, that's right. Yeah, it's like OK, you just have to do it "For us, we've been doing these things and then they just, force the MPAI on us, but like it was fine before. So yeah, like, why are you fixing something that's not broken, right?" **Clinician 1** "There is a lot of confusion before having the training in scoring because we were looking for

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
				a single answer, which is something we are used to. I think the training made it possible to clarify that it was not that, it was a tool that was not as precise. But after that, there was still frustration. Why use it then it's very it's not accurate? How to interpret the MPAI in this situation?" **Clinician 4** **Clinician 3:** There was that tool that was created. Ergos never bought into it, but the government said, you have to use it. This is what's prescribed by the government and we never did because like the MPAI-4, it was too hard to score. I'm gonna give a four, and I'm gonna reassess it. And I might give a 5. So people are not using it. It is not accurate. **Moderator:** Yeah, it's harder when you can't just choose an answer, it takes more mental capacity, work, to score. **Clinician 5**: "It may be a bit of that. But it also doesn't reflect the customer's performance...I also think that we do not see the usefulness of the MPAI-4." "why are people disliking it? Is the measure so problematic? Or is it that it was mandated top down? You know what's really standing behind all the problems" **Researcher**

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
				Clinician 1: “Its something new, right? So it's like we were so used to doing these different steps and then it's like an extra thing that we're still incorporating. So it's still the last thing that we'll do.” **Clinician 3:** “There is no structure, not that It is not our interventions, the discussion, our intervention plan. It doesn't, so for your questions, is it done? No. No, it's more of a tool that closes the end of our rounds.” “The 25 to 75% [range], it's still hard for me to wrap my head around it, even after the training. But it’s easier to get to a consensus now. So, I think the training helped with that. But if [the rating scale] was separated into two different intervals, it'd probably be more acceptable as a tool. [agreement from the room] **Clinician 1** **Clinician 1:** “I think since they reduced the length of the MPAI, it's less annoying. They used to be every time, you should say we have to do the MPAI and it was like all the sections I was just like 20 minutes trying to figure out a number that's not going to change my life. But now that since it's just participation, it's less long, so it's less of a like a burden, but to me, it's still a waste of time. OK, I have all these other skills that I use, I don't like refer to the MPAI in my reports, I don't show my patients. So for me there's no, like there's no reason and there's no

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				added value to using it. It's just because I have to. And I'll do it because I have to. **Researcher:** "Right. So if the mandate was removed, for example, do you think you would stop sustaining the MPAI? **Clinician 1:** 100% yeah. "It is not sensitive for patients who are more sedentary and older and there, their social participation is poorly evaluated, I find with the MPAI that you are worker, what we say more your car and social Life. Thats is a large portion of our patients." **Clinician 3** "I just started to making them think about it. It's light, shorter, and then that's a green or red flag. Ok, this person I expect longer as length of stay…, but I don't know, I don't know because the MPAI…But this works as long as you're confident in the score. I'm not sure the team has confidence in the score**. Clinical Coordinator** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
5	Realist review CMOC 3 and 19	If there are positive team attitudes towards research evidence	The rehabilitation centre has a strong record of research involvement and the use of the most up to date, evidence-based practices. This is evidence of a positive workplace atmosphere concerning the importance of integrating	"If there was like an MPAI-4 initial and final, written on the page that we have to fill out [during the interdisciplinary meeting], maybe then it would be sustained overtime if there's a

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		(C), then the MPAI-4 will continue to be interpreted (O) when a clinical champion (S) takes ownership of the MPAI-4 and continuously works to drive the practice forward (M).	research in general, however the atmosphere isn't quite as strong for outcome measures amongst clinicians. At the same time, the MPAI-4 aligns with organizational priorities, as it is a priority for the site to be in compliance with the provincial mandate on the use of the MPAI-4. Collectively, these circumstances lead the MPAI-4 to become an expected part of clinical duties (C). A single clinical champion for the MPAI-4 at the site was very well positioned on the team, in a leadership role (clinical coordinator) and a long-time member of the clinical team (S) [**sustainability planning manuscript]**. The clinical champion took ownership of the MPAI-4, continuously working to drive the practice forward. Despite ongoing reservations concerning the MPAI-4, they were instrumental in expressing that the MPAI-4 was an expected part of clinical duties in a positive way (M) **[interviews]**. This work by the clinical champion resulted in the continued scoring and limited interpretation of the MPAI-4 by clinicians. Furthermore, clinicians take their lead concerning the non-use of the MPAI-4 in clinical decision-making [**interviews, surveys, patient charts] (O).**	new [clinical champion], because then they will remember. [the clinical champion] if she leaves, it would be a problem." **Clinician 1** "At the beginning there was no buy-in, so [the clinical champion] had to work overtime and overdrive to get the buy in, which I don't think should have been shouldered by her. I mean, I did a little bit, but it was mostly [the clinical champion] who did it." **Manager** "I've not experienced big, big challenges. I don't have much resistance…I think that this culture of measurement in the hospital is well established. People who have been trained on the FIM, which helps them know what it is to do the MPAI-4." **Clinical Coordinator** "We do have a clinical champion at JRH. And it's also one individual that is a linchpin, let's say type person, a gatekeeper, a source of a lot of knowledge about the practice, and helps institutionalized it make it routine... In particular, its use - more for interpretation and potential for clinical decision making, more so than just the scoring use." **Project Facilitator** "So, it's supported because it does not depend on us. It depends on our clinical coordinator. For each patient, we use it right now." **Clinician 3**

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				Moderator: "Yeah especially you [the clinical coordinator/clinical champion]. You definitely took on a lot, yeah." **Clinical Coordinator:** Yes, but I'm not an expert either, that's for sure. **Moderator:** "Yeah, but you are very much, I would maybe give you the term like gatekeeper of the MPAI." **Manager:** "100%." **Clinical Coordinator**: "Yes people 'go with the flow'. In fact it wasn't that bad, it was the technical problems at the beginning that really affected, at least me, my motivation." **Moderator:** "Yes, this project took a very long time for a lot of reasons outside of our control…I imagine with the paper-based MPAI that was a lot of work. **Clinical Coordinator**: "Yes, but not [the local IT] which took a year! We're waiting for a year... Yeah, fact that it is, it's all this period there to do it by paper, we had no interpretation, fact that you know. For me, it was heavy. That's when we start playing with the data, and then we start seeing, what can we do with it? But before, yes, to just fill it to fill it…that was hard" **Researcher:** Like there isn't another participation measure.

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				Clinician 5: No, no outcome measures, but we're still doing it still, yes. **Researcher:** Yes, you're doing it in terms of that's a goal of your rehabilitation. [agreement from the room] **Clinician 5:** So, we're still addressing it. With our patients and that's the most important thing for the patient, OK, not the tool or the outcome measure. **Clinician 5:** We prefer to observe it in reality. **Clinician 1:** Yes and we are capable of seeing the social improvement. **Clinician 5:** Yes, that's right. We prefer to observe it. "I think that there is this culture of measurement that in the hospital, which is well established. it makes you know, people who have been trained at the FIM makes them know what it is to do the MPAI." **Clinical Coordinator** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
6	Realist review CMOC	If clinicians, managers and researchers are committed to the	Clinicians, managers and researchers are moderately committed to the MPAI-4. This includes an acceptable though not a high level of belief in the strength of the measure and the acknowledgement of the necessity of	"Buy in from the managers was important, right. Because we know that they have quite a bit of authority. To me, it was also important to know the extent to which they had garnered, you know

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	8, 14 and 33	MPAI-4 and there are adequate financial resources (C) the MPAI-4 will continue to be used as implemented (i.e., scoring, limited interpretation) (O) when implementation and evaluation experts complete these supportive tasks (S) such that clinicians can direct their work towards its clinical use only (M).	using the MPAI-4 due to the provincial mandate (C). When this group of committed individuals formed a collaborative team to work towards MPAI-4 sustained use, they included key stakeholders with the right expertise and in the right positions on the clinical team. For example, the clinical champion was already a member of the clinical team with a leadership position (S) [**sustainability planning data, interviews].** This leads to the clinicians having a positive attitude and confidence in using the MPAI-4 [**survey results, interviews**] and believing that their use of the MPAI-4 is worthwhile in terms of scoring the MPAI-4 and, to a lesser extent, interpreting the MPAI-4 (M) [**interviews]**. As a result, the clinicians continue to score and interpret (limited) the MPAI-4. However, they do not apply the MPAI-4 to their clinical decision-making (O) [**interviews, patient chart results**]	the willingness and the motivation of the clinicians, even though they were sort of mandated to use it. You know, had it just become like they've just resigned themselves to it or did something happen between the manager and [clinical coordinator], and the clinicians? That was a good positive process to say, OK, it might be problematic on all these levels, but look at all the good that it can do. So, if it can do some good, maybe we'll continue to use it over time and make sure it's sustained" **Researcher** "So, it's supported because it does not depend on us. It depends on our clinical coordinator. For each patient, we use it right now." **Clinician 3** "We always use [the MPAI-4] with [the clinical coordinator]. Yeah, she puts it in, but I never go back to see it. I think we have that, you know, sorry, because we don't, we don't have our individual computers we and we do have still a lot of like writing white paper and we have like our own like papers that we used to keep with us. So we're seeing so many patients that we don't often go to the computer. So I think that's one of the obstacles of being able to see the database all the time and stops us from going to check it. I think we've got access, but I never thought about going to see it." **Clinician 1**

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				"I think the important word here is trust. So I think that if the sites trust us. They know that if they run into a glitch or there's an obstacle they can come back to us. They were allies. So for me, the collaborative process is very, very important in sustainability and if, if it's not sustained, I'm not suggesting that's because we didn't have a good collaboration, there might be other things, but we might then, together, collaboratively have a discussion and say well, this may or may not work out for us long term, but I think having a good strong relationship and a trusting relationship between, I mean that's what I've learned over the years with our clinical partners is like imperative when you're implementing things" **Researcher** "for me the trust is huge for sustainability, and I've learned that over the years, you know, it's essential in a lot of professional relationships. And I think in the sustainability of a new practice that we've worked so hard to implement, at some point the relationship between the different players had to have had a huge impact." **Researcher** **"**We always use [the MPAI-4] with [the clinical coordinator]. Yeah, she puts it in, but I never go back to see it. I think we have that, you know, sorry, because we don't, we don't have our individual computers we and we do have still a

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				lot of like writing white paper and we have like our own like papers that we used to keep with us. So we're seeing so many patients that we don't often go to the computer. So I think that's one of the obstacles of being able to see the database all the time and stops us from going to check it. I think we've got access, but I never thought about going to see it." **Clinician 1** "I would hope that I wouldn't necessarily be involved with the continuous evaluation of its sustainability. But hopefully we've put enough processes in place that they would be able to self-sustain. And you know, reach out to us if anything changed with respect to use of the MPAI that would warrant it - that may have an impact on it's sustained use." **Researcher** "In terms of finances, we have money set aside in brilliant to cover three years and then after three years we have money coming in from other projects, other funds. So, there's no problem with maintaining the database access for sure from in terms of money, in terms of managing the database, [the principal investigator] is hiring for a developer and we are also engaging with a database architect who's going to be helping us make sure all the databases is working together. So that all the data makes sense. They're all linked together properly" **Project Manager**

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				"We have no financial resources, so we have to just reuse what we have and redirect what we have again, which is why if [the MPAI-4] not a relevant project over time it's going to get dropped. Because I can pay her to do other things, so there has to be a relevance." **Manager** "We always use [the MPAI-4] with [the clinical coordinator]. Yeah, she puts it in, but I never go back to see it. I think we have that, you know, sorry, because we don't, we don't have our individual computers we and we do have still a lot of like writing white paper and we have like our own like papers that we used to keep with us. So we're seeing so many patients that we don't often go to the computer. So I think that's one of the obstacles of being able to see the database all the time and stops us from going to check it. I think we've got access, but I never thought about going to see it." **Clinician 1** "It was very important for us to know you know what financial or physical resources were available. I could speak for the [site] to make sure that it'll be sustained." **Researcher** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**

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7	Realist review CMOC 39	If implementation team members do not have authority over MPAI-4 mandates (C), MPAI-4 clinical data can be relayed to decision-makers (S) resulting in the continued mandated use of the MPAI-4 (i.e., scoring) (O) because decision-makers would appraise the MPAI-4 and see its value (M).	The provincial mandate to use the MPAI-4 was not made or influenced by any stakeholders on the implementation team for this project. No team members have authority over this mandate. However, there are some members of the MPAI-4 implementation team who have connections to relevant individuals within the ministry of health and social services, who have some say over the MPAI-4 mandate and general practice requirements for stroke rehabilitation (C) [**implementation and sustainability planning data**]. The experiences of using the MPAI-4, the perception of its benefits and the potential for clinical data on patient outcomes for use at the provincial level were all relayed to contacts within the Ministry of health and social services who are perceived by team members to have some decision-making power over the MPAI mandate (S) [**sustainability planning data**]. It is thought by members of the implementation team that by communicating the strengths and opportunities associated with the MPAI-4, individuals making decisions on the MPAI-4 mandate would appraise the MPAI-4 and see its value (M) [**would like to do this but have no contact with ministry, where does this leave us with this CMOC??**]**.** As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]	"Are there going to be more of these ministerial mandates? You know? Can the organizations push back against the MPAI? There's things like that that are more the political and systems level that I'd be really interested in following like over the next 3-4 years, just keeping in touch with the managers at the JRH for example and saying anything new from the ministry? Or they just put, you know, put their hands up and say you guys continue. So I'd love to see what's happening at that level because I think most of the power of the decision making lies there unfortunately, and then clinicians are said well told, well, you know, use it." **Researcher** "I think I think it's a tool that we were told to use by the ministry. I don't think it's a tool that we would necessarily have picked as a first choice." **Manager** **Clinical Coordinator:** "In fact, before the pandemic, there was a committee called the Community Home Reintegration Committee. **Manager: "**Oh yeah, you have no contact now." **Clinical Coordinator:** "It is true that it is with the department, then we were certain people designated to work together. The department wanted us to start working on this committee, they set up the MPAI-4 and then I was to arrive to say hey, we want to do a research project. We

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				only had 2 meetings, then that stopped. Since the pandemic everything has stopped. **Manager:** "Ya, nothing. I think all of the ministry committees, our regional committee, they're all done. They've never been resurrected after the pandemic. So we're pushing, but we have no contact." "I do not know, I would tend to knock on the door of research and then say can you offer me other tools and then we make a choice. Is it the best choice? On, it's true that I, I'm not sure it's the best choice." **Manager** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
8	Realist review CMOC 16	If the MPAI-4 is mandated (i.e., scoring) (C), but the measure is otherwise adapted and implementation strategies tailored (S), clinicians will increase other uses over time (i.e., interpretation of	The rehabilitation site has made the MPAI-4 an expected part of clinical duties. At the beginning, this expectation was purely based on the mandate for its use from the province (C). Following the tailoring of implementation strategies including developing, launching a new database, delivering an advanced interpretation training session and promoting the adaptability of the MPAI-4 (i.e., using the participation subscale only) (S) [**interviews]**, clinicians and managers began to perceive that the practice was worthwhile, in some respects (M**) [interviews].** As a result, the clinicians continue to score and, on a limited but increasing basis, interpret the MPAI-4. The clinicians do not apply the MPAI-4 to their clinical	**"**even though they were sort of mandated to use it, you know was had had it just become like they've just resigned themselves or did something happen between the managers and the clinicians? That was a good positive process to say, OK, it might be problematic on all these levels, but look at all the good that it can do. So if it can do some good, maybe we'll be continue, we'll continue to be, we'll continue to use it over time and make sure it's sustained, right" **Researcher**

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		the MPAI-4) (O) because clinicians and managers perceive greater value/benefits in the MPAI-4 (M).	decision-making but continued adaptations may achieve this aim in the future (O) [**interviews, surveys, patient charts]**	"that by not doing part A and B, it really reduced the quotation time, there it takes no more than 5 Min. I tried different ways to use it, sometimes I try to use it first because usually, when I do a PII, I want to know what lifestyle habit is affected by stroke then after that I did the MPAI and then I said to myself, Well there I repeat some things, made that sometimes I try to start with my MPAI as a fact that I already have in mind what is the habits of affected life, a few are missing. In fact when I do it this way, it doesn't really interrupt, and then it's still quite fluid." **Clinical Coordinator** **Clinician 3:** "Absolutely, so for [some] patients, the measure doesn't show a progression but you scored them very low…so I still have a problem with scale. But at least it not as long as it used to be." **Clinician 1**: "Yeah, at least there's that." "I personally have a hard time seeing, and again I'm the manager, how it's going to impact on decision making for a clinician at that particular moment. If it's just light or moderate because they're not treating the light. They're really treating "He wants to do this, this is his problem". I have a hard time understanding. But it could just be me. How can the MPAI impact decision making?" **Manager**

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				For social participation, we have no [other] measure…it is really the score of this patient in the MPAI, that's all, that's it... It's a nice addition. Also, that we do as a team makes it that we all talk about it together. **Clinician 4** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
9	New, proposed in the initial program theory	As ongoing research provides new interpretations of the MPAI-4 and thus new benefits to its use (C), the database have reflected this new evidence and possible MPAI-4 interpretations (S) and subsequently, clinicians and managers redefine and modify the MPAI-4 (M) resulting in its clinical use for scoring and interpretation (on	Research continues to be conducted on the MPAI-4, with the intent to optimize interpretation and use of the measure according to stated clinical and program level needs (C). As new interpretations become known, the database continues to be updated to integrate this new evidence of the MPAI-4, especially in terms of automatic calculations and interpretations. For example, new information concerning items acting as red flags came to light during our development of the database. In response, we went through an iterative cycle to develop the updates to the database then launched the changes (S) [**sustainability planning data, interviews]**. Subsequently, clinicians and managers went through a cycle of redefining and modifying how the MPAI-4 is used in alignment with the new evidence and associated database features. They had to determine how the new interpretations would fit into their workflow and decision-making (M) [**interviews]**. As a result, the clinicians continue to score and to a lesser extent, interpret the MPAI-4. It is our hope that over time, we can continue to see increases in MPAI-4 interpretation and see some use	"For me, the MPAI is an outcome measure. It's part of best practice. And I would like to spend more time thinking about how they're engaging with the results of the measure or, you know, reasoning and decision making" **Researcher** "Research takes so much longer to do and to evaluate relative to the constantly changing needs of the clinical sites. And if we can't keep up with each other, there's a huge problem and that worries me for sustainability" **Researcher** "it's incredibly frustrating that there's so much logistical garbage that has to be done, in the name of the ethics, which I understand and respect tremendously, but it trickles down to implementation and sustainability. It does. They're not divorced." **Researcher** [We need] to work more the wording because you know the leisure box and occupation, if they

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		a more limited basis).	of the MPAI-4 in clinical decision-making (O) [**interviews, patient chart results, surveys**]	could be detailed differently…The main worry is that inactivity is 'involved in activities with the role less than 3 hours per week'. How can that work for us? You're scoring four at the beginning, they will score 4 when they die!" **Clinician 3** "So we have we have I think we have a database that's already set up, so that's good and we have access of everybody has access. So these are all good things that happen. What still needs to work as the SOP so the SOP is about how to communicate with the clinicians with the end users, how to escalate? How to report bugs and all of those operational details that we need to kind of have more details around to make it a more sustainable solution" **Project Manager** **Manager:** "So I think. I think where we are now short term it's functional where I potentially see hiccups down the road is let's say there's an update to the MPAI or a new version or that has to be changed. That's where we're going to get stuck. That's where we're really going to get stuck… let's say you were still here and you were looking at it over time, then you know in three years when you call me up and say "there's a new version, let me come in. Let me do a training. Let me do -" Or if there is papers that come out and how to interpret it? We're not going to hear about it."

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				Researcher: "It's my hope is because it's part of BRILLIANT, so its part of a larger project and that is going on for a long time, that the MPAI project will benefit from that. There's things you know still rolling with that or just starting with that, that there's a people attached to those projects who will be, you know, are involved in them really in project. On a larger scale, it will take on the kind of back end you know, like little things that will come up overtime from projects that then finish within that portfolio." "In theory the knowledge translation for all projects has to go on over time. So when we talk about sustainability, it's both ways. We sustain it clinically and research has to sustain it also. It's not just us." **Manager** "If there were more research would we use more? Yes...I think that if let's say there for example the MPAI had a lot of research, we are confident in the score we give to patients…But right now we do not share [the MPAI score with patients] because we are not confident of the score we gave…We are not going to share something that for us does not make sense with the patient, because we are not even confident of the rating we give." **Clinician 3** **Expertise questions - behaviour results**

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				VAS score results **Patient chart results**
10	Realist review CMOC 27	When an acceptable database is in place (C), then clinical data can be relayed to clinicians (S), resulting in clinicians continuing to use the MPAI-4 as implemented (i.e., scoring, limited interpretation) (O) because they believe that it is right for them to be involved (M).	The MPAI-4 project began with a database adapted from a similar MPAI-4 implementation project in TBI rehabilitation in the province. Despite the implementation team's best efforts, the adapted database was not acceptable to the clinical teams. The new database was developed according to a user-centred design to ensure it was acceptable to users and its functionalities aligned with organizational priorities (C). It was recognized that for the MPAI-4 to be successful, the actual users of the measure (i.e., clinicians) needed to have their priorities be met. Namely, they required automatic calculations and interpretations of the MPAI-4 in easy-to-use formats that matched their clinical workflows. An iterative cycle of database development was used to optimize the clinical data that clinicians receive about their patients within the database (S) [**sustainability planning data, interviews**]. The valuable information that clinicians receive from the MPAI-4 via the database led to the clinicians believing it was right for them to use the MPAI-4, in particular scoring and interpreting it (on a limited basis) (M) **[interviews**]. As a result, the clinicians continue to score and, on a limited basis, interpret the MPAI-4. The clinicians do not apply the MPAI-4 to their clinical decision-making but continued adaptations may achieve this aim in the future (O) [**interviews, surveys, patient charts]**	**Researcher: "**So you find that the database now is acceptable? It is what you need, or is there things that are still missing? I know that there are some small updates to make." **Clinical Coordinator:** "Yes" **Researcher** "Yeah, it's good? It's what you need?" **Clinical Coordinator:** Yes, absolutely "I mean [the new database] and all that you're trying to implement something in 2023, you know and it's like it's 1983. You know and it's frustrating cause it's complex enough to implement, maintain, sustain, something in authentic practice environments, with all the moving parts, and you'd hope at least that technology would make your life easier and it's made our lives more difficult. So, it's been a huge lesson learned for me. And you know, I'm not a tech expert. And I'm not a digital health person like [other researchers are]. But what a lesson it's been to say, Oh my God. You know what a wrench it's thrown into the process, you know." **Researcher** **Expertise questions - behaviour results** **VAS score results**

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				Patient chart results
11	Realist review CMOC 29	If there is adequate expertise on the clinical team (C), then the MPAI-4 will continue to be used as implemented (i.e., scoring, limited interpretation) (O) when structure sustainability tools are used (S) to prompt researchers and clinical leaders to periodically appraise the worth of the practice (M).	The clinical team continues to have adequate expertise in using the MPAI-4, enabling them to think critically about the measurement tool (C). Clinical team representatives on the implementation team can then contribute real-world knowledge to discussions in which clinicians and researchers come together to appraise the MPAI-4's worth. For example, weighing the positives (e.g., fit to workflow) and the negatives (e.g., lack of patient benefits information as it must be accumulated over time) (M). These discussions in which all viewpoints are elicited are often prompted by structured tools such as the Clinical Sustainability Assessment Tool (CSAT) (S) [**sustainability planning interviews]**. As a result, on the recommendation of the implementation team, clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**interviews, patient charts, surveys**]	"if some of the issues of the barriers to sustained use of the MPAI are readily fixable, you know that we can work with the sites to address them." **Researcher** "you want to make sure that it lasts, right? It's not just like a honeymoon period. So I think that it's important to do the implementation of the MPAI, to evaluate the implementation outcomes and then see what may or may not stand in the way of its sustainability." **Researcher** "I like things that give some structure to a process, something that we can fall back on, something that can be recorded. So my vote would be to continue to use those tools and those processes. Because I think they're useful and I like things to be organized and for there to be some order. But also to use them nimbly." **Researcher** "they're reflective tools too, right? They're ways to see what are we doing and how are we doing and what outcomes and to get us to have a conversation to exchange. I mean tools don't make decisions." **Researcher** "any information that we gather from any tool or any process I think should be food for

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
				conversation should nourish discussions and reflection on how we can we do things differently or do things more effectively" **Researcher** **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
12	New	When clinicians continue to score patients on the MPAI-4 (C) and a database provides automatic interpretations (i.e., values, graphs) (S) but clinicians do not believe the interpretations are accurate or precise (M) they will not apply interpretations to their clinical decision-making (O).	Patients continue to be scored on the MPAI-4 at the rehabilitation site – scoring has continued consistently from initial implementation using the old database in November 2021, through using a paper-based format starting in Winter 2022 through to January 2023 and finally when the new database became available in January 2023 (C) [**sustainability planning data and patient charts]**. When the new database was developed, it was designed to facilitate MPAI-4 interpretation at the individual patient level first and foremost. For example, this included automatic T score calculations and associated interpretation of the clients limitations, and visuals such as the patient's scores versus the average scores of patients in the program (S) [**sustainability planning data]**. Clinicians are able to divide the labour of using the MPAI-4 between themselves and the database – the database does the arduous calculations and matches them to the interpretations. Clinicians can focus on the interpretations themselves and could take the time to consider how they may integrate that information into their decision-making (M) [**sustainability planning data, interviews].** As a result, patients receive the anticipated	"What I like, for example, it is when at discharge we do the MPAI, then there, it's fun. It is often that the clinical coordinator will tell us that the patient has a robust change or a slight change in social participation. It makes it that you know how the patient did...it's fun to see the most at discharge." **Clinician 2** "I found in some cases where we knew there was not much progress, and then we had to give leave. Some people still feel guilty for letting go of a patient who has not progressed. But when we see with the MPAI shows no change, it validates a little that we have a position." **Clinician 5** "We always use it with [the clinical coordinator'. Yeah, she puts it in, but I never go back to see it…I think we've got access, but I never thought about going to see it. [the clinical coordinator] is kind of the gatekeeper for it." **Clinician 1**

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
			benefits from using the MPAI-4 at the individual, patient level only rarely, as the MPAI-4 information is only integrated into decision-making in a very few specific instances. For example, when clinicians feel its too early to discharge a patient since they have not progressed enough. The MPAI-4 can confirm that they have not progressed (O) [**interviews, patient chart data evidence in clinical decision-making (?)**].	
13	New	When patients continue to be scored on the MPAI-4 (C), and the database is designed to facilitate data export for research use (S) then researchers and IT professionals can divide the labour of accessing and analyzing MPAI-4 data (M) resulting in the MPAI-4's likelihood that the MPAI-4 will be used in research projects over the long term (O)	Patients continue to be scored on the MPAI-4 at the rehabilitation site – scoring has continued consistently from initial implementation using the old database in November 2021, through using a paper-based format starting in Winter 2022 through to January 2023 and finally when the new database became available in January 2023 (C) [**sustainability planning data and patient charts**]. When the new database was developed, the design included the ability to easily export the data for research use across all participating sites. Thus, there is one large dataset rather than data scattered amongst participating sites. This streamlines data export - data export takes only a couple minutes and the export is already formatted to be easily imported to common statistical software (S) [**sustainability planning data**]. The setup of the database means that researchers and IT professionals can easily divide the labour of accessing and analyzing the MPAI-4 data (M) **[sustainability planning data]**. As a result, researchers continue to use the MPAI-4 data in research projects (O).	"we have made the MPAI on the platform so it has started to be self-sustainable as it moves forward or the maintenance that is required is quite low" **IT specialist** **Moderator**: How do you see that task in terms of the sustained use of the MPAI for research purposes over time and your responsibility and your, I don't know how you see how easy it would be to sustain that responsibility? **IT specialist:** Umm, that responsibility is quite narrow and it's quite streamlined. And again in that sense, because it's mainly looking at access policies and how are how is the research team accessing clinical data. **IT specialist:** As research projects change and then needs change, the data that is needed will also change and so I think that would be a case by case basis evaluation. **Moderator:** OK. But it sounds like it's going to be relatively simple for everyone involved.

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
				IT specialist: Yeah, we are trying to make it so that you yourself can extract the data at a point we don't need to be included in that. Then again, unless there is a this role access behavior that we need to define, and that's where you'll be interacting with us in, in the sense that, OK, we need this data for X reasons. And based on this, define another role that would say yes in this case is this person can be assigned this role and based on that rule they can extract X&Y data it. **Expertise questions - behaviour results** **VAS score results** **Patient chart results**
14	New	Program managers perceive the MPAI-4 to be valuable (M) such that they will use it in program evaluation (O) if clinicians continue to score, interpret and apply MPAI-4 information within clinical-decision making (C) supported by	Clinicians are continuing to use the MPAI-4 in their clinical practice. Scoring in particular is done consistently while interpretation is completed on a more limited basis (C) [**interviews, patient charts, surveys]**. The implementation of the MPAI-4 is similar across the sites, meaning that it is scored at around the same time, and the opportunity for interpretation and its integration into clinical decision-making is similar (S) [**sustainability planning interviews, interviews]**. This has led to the MPAI-4 being perceived as relevant by managers, both in terms of them perceiving it to their clinical team and as relevant to their ability to evaluate and compare their program to others (M) [**interviews]**. While enough data has not yet accumulated for program evaluation to take place, there is an anticipated or expected use of the MPAI-4 for program evaluation, in	**Manager: "**I think from a managerial perspective I would want to continue it for a couple of years to see. Do I see any benefit in the long run and with time? Have we found relevance clinically? But after that period of time, couple of years, if the answer is no, I would I would drop it. **Researcher: "**Yeah, if it's not giving anything?" **Manager:** "100%. If it's not giving me anything or if it's giving me data but it's not helping [the clinicians] because at the end of the day I have other points of reference. I have other data that I collect and I was perfectly fine without [the MPAI-4]. I will continue to be fine without it. So if it clinically shows nothing, then no, I'm not

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		interpretations from the database (S).	particular for comparing sites to one another (O) **[interviews]**.	gonna take it - we aren't going to be working for nothing. **Clinical Coordinator:** "Well, I think that if we had the choice, I think we should work with clinicians to find a tool that measures social participation. I think its a concept which is important, I think, it's relevant for that. It's like a global rating of what we do." **Manager:** "To me there's a benefit if all the sites are doing it. And then there's actual data because it just becomes us doing it, then there's even less of a benefit to doing it. **Researcher:** "So a lot of it too for you from the managerial standpoint, is that comparison or having something to the other sites?" **Manager & Clinical Coordinator:** "Yes." "From an administrative perspective, I see no benefit in doing it at this point. So I'm basing myself on when [the clinical coordinator] says that clinically she likes having the score or that maybe we can use it...But for me, for me, like it hasn't changed my life and I have nothing from it yet. Right, we're not there yet, so for me, it's not there administratively. Clinically is another thing." **Manager**
11	New	When building a coalition between research and clinical teams has	The MPAI-4 project continues to be funded by a large, multimillion dollar infrastructure grant which covers the architecture, servers and other software needs of the project for a period of up to seven years. There are	"We have no financial resources, so we have to just reuse what we have and redirect what we have." **Manager**

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		facilitated resource sharing (S) then there is management support and adequate resources (C) resulting in the evidence-based practice remaining financially viable (O) because the available resources have been allocated appropriately (M).	recurring, yearly costs to maintain servers and update the database. Building and cultivating relationships led to resource sharing amongst research and clinical teams (S). Sharing these financial resources with the clinical teams delivers adequate resources for the project which in turn encourages management support of the work (C). Resources can then be allocated judiciously amongst the needs of the project, ultimately resulting in the MPAI-4 remaining financially viable (O).	"In terms of finances, we have money set aside in brilliant to cover three years and then after three years we have money coming in from other projects, other funds. So, there's no problem with maintaining the database access for sure from in terms of money, in terms of managing the database, [The principal investigator] is hiring for a developer and we are also engaging with a database architect who's going to be helping us make sure all the databases is working together. So that all the data makes sense. They're all linked together properly" **Project Manager** "From a project management position, [the principal investigator] is hiring for another research assistant and another post doc. So, there is gonna be hopefully an influx of people coming in between now and the fall, and I'm hoping that one of those people is going to be assigned the MPAI. So overlap with you as you're exiting and that person entering the project." **Project Manager**
16	New	If there is turnover amongst the implementation team (C), orientation training for new team members (S)	There was considerable turnover amongst implementation team members over the course of the project thus far, and more is expected into the future. For example, the manager went on leave for 1 year in the middle of the project. The local and provincial IT specialists, project facilitator, clinical research coordinator (i.e., knowledge broker) and project manager changed multiple times throughout the project (C). For the new implementation	**"**having this turnover at the manager level over the past few years especially has been hard on us and it's going to get worse because people are going to be going out soon. It's going to get a lot worse.**" Manager** "I think what's important is to put it to pre-empt stuff and not be reactive. You know what we've learned that people, we've learned with our very

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		helps them understand the project, and their specific duties and tasks within it (M) resulting in the team continuing to work together on the project (O).	team members to understand the value of the MPAI-4 project and their specific tasks and duties within it (M), we used an orientation strategy for new implementation team members. Specifically, we developed a set of 'ongoing training materials' which quickly introduced the practical and research components of the project. Then, the facilitator met with the new team member for about 30 minutes to answer their questions one-on-one (S). Using this strategy resulted implementation team members actively contributing to the project and working to drive it forward (O).	sort of participatory kind of research that people change, systems change, organizations change, researchers change, students change. So, we know that change is inevitable." **Researcher** "I think that there should be processes and we've learned that if you wait for it to happen. That's way more problematic than to say OK, You know, if [the principal researcher] leaves or [the facilitator] leaves or someone leaves or [the manager] is no longer the manager, do we have a Plan B? And Plan C?" **Researcher** "we could predict the clinicians move and change managers come and go, people go on leaves, right? We can predict that summer periods are of a bit, you know, crazy time. Researchers, for the most part, are fairly stable for a few years, but students come and go, so those, so you see, there's things we know. And we've learned from experience and from research that there's things we can put in place to make everything smooth." **Researcher**
17	New	All team members will continue to collaborate on the	Each team member of the collaborative team was selected because they could bring valuable expertise, local knowledge and/or were in an important clinical or research leadership position that needed to be aligned	**Researcher:** "you forged the relationship with them and then the extent to which it's going to trickle into into long-term sustainability after

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		project (O) because implementation team members take ownership of the project (M) if the team values the objectives that they are working towards (C) and relationships between team members are based on trust, power-sharing and shared decision-making (S).	with the project. Each of these individuals saw the value and/or need for the project for them because the team came together to develop unifying outcomes, which were the co-developed objectives for the project that would address the needs of all stakeholders (C). The development of unifying objectives was possible because relationships based on trust, power-sharing and shared decision-making were built and maintained over the course of the project and beyond, as objectives were not selected once and stagnant after that. Shared decision-making needed to be undertaken over time (S). By creating this environment all team members took ownership of the project and their specific role within it (M). As a result, all team members leveraged their expertise, local knowledge and/or leadership position to its fullest extent to drive the project forward towards all unifying objectives (O) **[sustainability planning interviews, interviews].**	you leave I don't know. But it seems to be an important ingredient." **Facilitator:** "I agree. I'm also very unsure of how this will develop when I am no longer there"
18	New	If implementation stakeholders are engaged in the project (C), then a facilitator (S) will be able to take ownership for the project and coordinate tasks (M), resulting in team members being organized to collectively	Implementation stakeholders are engaged in the project due to the value and/or need they see this project addressing for them. In particular, they see value in working towards the unifying objectives (C). In this context, a facilitator for the project is able to work closely with all stakeholders towards meaningful goals (S). The facilitator took ownership of the project and work to continuously drive it forward by coordinating tasks and duties amongst varied stakeholders. For example, by bringing together IT specialists and researchers to develop the new database based on the needs expressed by clinicians. Then, once drafted, bringing IT specialists and clinicians together directly to work together to	**Researcher:** "you forged the relationship with them and then the extent to which it's going to trickle into into long-term sustainability after you leave I don't know. But it seems to be an important ingredient." **Facilitator:** "I agree. I'm also very unsure of how this will develop when I am no longer there" **Project Manager:** "I think the previous one I was taking care of, MPAI was [redacted]. And I don't think there was a good relationship building there. So that so for me like it's only it I

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
		contribute to the project's success.	finalize the database (M). This resulted in team members being organized to collectively contribute to the project, according to their knowledge, expertise and their professional role (O) **[sustainability planning interviews, interviews].**	only was able to give attention to the MPAI when you came along because it was, I had a better working relationship with you than I had with [redacted] for reasons that I didn't really never explored. So I think I would have been able to give more attention to MPAI had the relationship with them been stronger you know. But since I think we have a great relationship together and CSR and we're being backed by [multiple researchers] and the rest of the team. I think we were able to move forward with it, painfully, but we did."

Table D.2: Tested but rejected CMOCs

#	Origin	CMOC in sentence format	Full CMOC narrative	Supporting data collected for this manuscript
	New	The time it takes to use the MPAI-4 is acceptable to clinicians and managers (C), when a database is continuously updated to optimize it's use (S) resulting in the continued fit to clinician's workflow (O) because clinicians judge the value of the practice to be worth their time	The MPAI-4 takes about 20-30 minutes to do when starting out, and around 10-15 minutes once practiced at it. Similarly, the participation subscale takes 15 minutes at the beginning and no more than 5 minutes once used to it. The MPAI-4 should be filled out by at least 2 clinicians who arrive at the final score by consensus. Thus, the total working hours required to complete the MPAI-4 is not inconsiderable (up to 30min at admission and 30min at discharge) (C) [sustainability planning manuscript data]. A key component of the development of the MPAI-4 database was reducing the time it took to score and interpret the MPAI-4. The database continues to undergo development for further optimization in pursuit of these goals (S). An optimized database encourages clinicians to judge using the MPAI-4 as worth their time – the practice is seen as valuable enough to outweigh the time spent using the measure versus providing direct patient care (M) [**rejected in interviews**]. The result is that the scoring, interpretation and application of the MPAI-4 continues to fit the clinician's workflow (O) [**rejected in interviews]**	This CMOC was rejected because there is no apparent link between time it takes to use the MPAI and the database for clinicians. In fact, clinicians at the site do not use the database directly, the clinical coordinator is the gatekeeper/main user. The time it took to do the MPAI via paper-based/Access database only seemed to effect the clinical coordinator. Even then, the larger time effect was from using the participation index only.
	New	When key stakeholders in the organization are committed to using the MPAI-4, they create a positive atmosphere (C) within which an ongoing, collaboratively developed interprofessional training strategy can be used (S) that will	Key stakeholders including the manager and care coordinator in the role of clinical champion are committed to using the MPAI-4. These key individuals influence the attitudes and perceptions surrounding the MPAI-4 in a constructive way, helping create a positive atmosphere concerning the measure (C). It is in this committed and constructive atmosphere that the research team led ongoing, collaboratively developed interprofessional training workshops. These workshops were explicitly theory-informed with the goal to deliver a safe space for clinicians learn and critique the MPAI-4 (S). The clinicians then individually appraised the strengths and weaknesses of the MPAI-4, followed by collective appraisal and division of labour to use the MPAI-4 as part of the group discussions	

		result in the continued clinical use of the MPAI-4 (O) because clinicians individually and collectively evaluate the strengths and weaknesses of the MPAI-4, then divide the labour of the MPAI-4 amongst themselves.	during the training. Discussions on the strengths and weaknesses of the MPAI-4 and the division of labour to do it continued following the workshops (M) [MPAI-4 training evaluation data]. As a result, the clinicians continued to score, interpret and apply the MPAI-4 to clinical decision-making [sustainability evaluation data]	
)	CMOC 12	When building and cultivating relationships building a coalition facilitated resource sharing (S) then there is management support and sufficient non-financial resources for the evidence-based practice (C), resulting in the continued clinical use of the practice (O) because the human resource needs of the clinical practice can be divided between stakeholders who are working together to operationalize the practice (M).	Building and cultivating trusting relationships led to resource sharing amongst research and clinical teams. Resource sharing between the research and clinical teams in terms of human and physical resources has been essential to the success of the MPAI-4. By essential resources being provided by the research team (e.g., IT, implementation expertise) (S), there was management support for the project, including a willingness to share their own resources (e.g., release time for clinicians, use of physical spaces at the site). This led to sufficient non-financial resources for the MPAI-4 (C) [**sustainability planning data**]. In this way, the different members of the implementation team divided the labour of using the MPIA-4 amongst themselves, making the workload manageable for everyone involved and tailoring each individuals duties to their skillset and position (M) [**sustainability planning data, interviews**]. As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]	Ideas from this captured in CMOC 33 – other components listed here are not core CMOC components comparatively
	Realist review CMOC 35	If the MPAI-4 is perceived to be beneficial by clinicians (C), then they will continue to use it (O) because the clinicians have worked together to evaluate the MPAI-4's value (M) during	Both informal discussions during the course of day-to-day clinical work and a more structured discussion during an ongoing training session (S) have provided clinicians the opportunity to work together to evaluate the worth of the MPAI-4 (M). Although not perfect, overall the MPAI-4 is considered to be beneficial by clinicians (C). As a result, the clinicians continue to score, interpret and apply the MPAI-4 to their clinical decision making (O) [**ask clinicians in interviews, patient chart results**]	**Rejected because it either fit into another CMOC, or ideas on connections of relevance but into new CMOC**

		local consensus discussions (S).		

Chapter 9.
Integration of Manuscripts 2 and 3 with Manuscript 4

9.1. Objectives of Manuscripts 2, 3 and 4

Manuscript 2:

In this manuscript, we aimed to describe and document the collaborative sustainability planning process at three rehabilitation sites.

Manuscript 3:

In this manuscript, we aimed to understand how (mechanisms) and in what circumstances (context) and for what duration the MPAI-4 is sustained, or not (outcome) at three rehabilitation sites.

Manuscript 4:

In this manuscript, we aimed to develop a tailored, theory-informed advanced training session for the MPAI-4, and evaluate its impacts on clinicians' reaction, learning and intent to use the MPAI-4.

9.2. Integration of Manuscripts 2, 3 and 4

In *manuscript 4*, a tailored, theory-informed advanced training session for the MPAI-4 was developed, delivered, and evaluated. The design and delivery of the training session was based on needs identified during the MPAI-4 implementation and sustainability planning process, of which the latter is described in *manuscript 2*. The training session influenced the sustainment of the MPAI-4, as described in *manuscript 3*.

Chapter 10.
Development and Evaluation of Tailored, Theory-informed Training to support the implementation of an outcome measure: an explanatory sequential mixed method study

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Abstract

Purpose: To describe the development of a tailored, theory-informed training session supporting the uptake of an outcome measure, and evaluate its impact on clinician reaction, learning, and behavioural intent.

Materials and Methods: We developed a theory-informed training session using an integrated knowledge translation approach. To evaluate the training, we used a mixed method explanatory sequential design informed by the New World Kirkpatrick Model (reaction, learning, behavioural intent) composed of three surveys followed by interviews. We analyzed survey data using cumulative link mixed models, and interviews using directed content analysis.

Results: We delivered training sessions for 80 clinicians, (surveys (n=51), interviews (n=6)). Odds ratios indicate that post-training individuals were more likely to rate themselves higher than pre-training on most outcomes. Interview data further elucidated survey results indicating that: 1) there were positive reactions to the training session, and positive learning and behavioural impacts, 2) participant negative attitudes and commitment were due to perceived limitations in the measure and, 3) training impacts were affected by contextual factors such as a provincial mandate for the outcome measure.

Conclusion: Implementation teams could adapt our training design process to their context. Further research to understand how educational strategies work would produce more robust guidance.

Introduction

Rehabilitation clinicians are expected to deliver high-quality care to their patients. This includes direct patient care and the use of outcome measures (OMs) to inform intervention selection and assess their impact (1,2). Ultimately, using OMs can lead to enhancements in care processes and patient outcomes (3,4). However, research shows that OMs are underused in rehabilitation settings (2,5–7). Common barriers include a lack of knowledge and skill to use the measures, and having the necessary technology in place (e.g., digital platforms) to facilitate use (8,9). These barriers are difficult to overcome despite clinicians (2), managers and policymakers (10,11) acknowledging the benefits of OMs. Tailored interventions targeting patients, clinicians, organizations, and systems are often required to optimally integrate OMs into practice (12,13).

One type of intervention that has successfully increased the uptake of OMs amongst clinicians are educational strategies such as workshops, or educational materials (14,15). A systematic review of OMs implemented by rehabilitation clinicians indicated that OM uptake increased immediately following the use of an educational strategy in 9 of 10 included articles (16). Educational strategies can also have long-term impact; for instance, Moore and colleagues found that three gait assessment measures were used four years following a multicomponent educational strategy (17). Thus, there is evidence to suggest that educational strategies are fundamental to implementing and sustaining the use of OMs in rehabilitation. However, it is currently unclear how and under what circumstances these strategies work (16). The effect of this evidence gap is twofold: first, identifying the active ingredients of educational strategies is difficult (17–19). leading to a lack of guidance on how to adapt strategies to new contexts; and second, not knowing how the educational strategies work has made it impossible to synthesize existing evidence into practical recommendations (16).

In implementation studies aimed at enhancing the use of direct rehabilitation care practices (e.g., pain self-management (20–22), upper limb exercise (23)), authors addressed the two limitations raised above by using theory (e.g., self-determination theory (SDT) (24), behaviour change techniques (BCTs) (25), etc.). Theory guided the development, adaptation, and evaluation of the educational strategy, was useful in explaining the impact of the chosen strategy, and helped identify the strategy's active ingredients and fit within the larger implementation project (26). The authors of the aforementioned systematic review suggest: 1) using theory in

these ways; 2) using a collaborative approach with learners to enhance the relevance of the educational strategy (27,28), and 3) thoroughly describing educational strategies (16).

Although authors of recent rehabilitation OM implementation studies have adhered to some of these recommendations (i.e., collaborative approach (17), tailored to the local context (17,29), well described theory-informed design (30)), we were unable to find any that adhered to all recommendations. The present study addresses these gaps. Specifically, across three sites we aimed to:

1. Develop a tailored, theory-informed training session in support of the implementation of a single OM.
2. Evaluate the session's impact on clinician reaction, learning, and intent to start or continue to use the OM.

Theoretical Approach

We used an integrated knowledge translation (IKT) approach whereby an implementation team comprised of researchers, managers, and clinicians collaborated throughout the project to facilitate its success (31,32). Collaboration required a meaningful partnership between team members characterized by knowledge exchange and mutual learning built on trust, respect, and power sharing (28,33–37). The IKT approach was facilitated by existing relationships between team members.

Study Context

In response to a ministerial mandate, the collaborative team implemented the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4), an OM used in stroke outpatient rehabilitation programs in three different sites in Québec (38) (Table 10-1) The MPAI-4 assesses impairments, activity limitations and participation (39). To interpret MPAI-4 scores, the raw score is converted to a standardized T score (average = 50, SD = 10) against a reference sample (40,41). The MPAI-4 was previously implemented in the same sites within traumatic brain injury programs using a less tailored approach and a relatively basic digital platform (40).

As one part of the MPAI-4 multicomponent implementation intervention in stroke, we used diverse educational strategies including a project coordinator with MPAI-4 expertise, clinical champions, online educational materials, and an initial and advanced training session (42) (**Figure 10-1**). The development of an advanced training session is the focus of this

manuscript, where training was highlighted as an appropriate strategy when we mapped barriers and facilitators to the Consolidated Framework for Implementation Research version 2 (CFIR 2.0) (43) (described elsewhere (44)). Specifically, we found that clinicians needed additional knowledge and skills, and positive attitudes towards the MPAI-4 to apply the interpretations provided by the newly developed digital platform to their clinical-decision making (e.g., T score conversions, graphs).

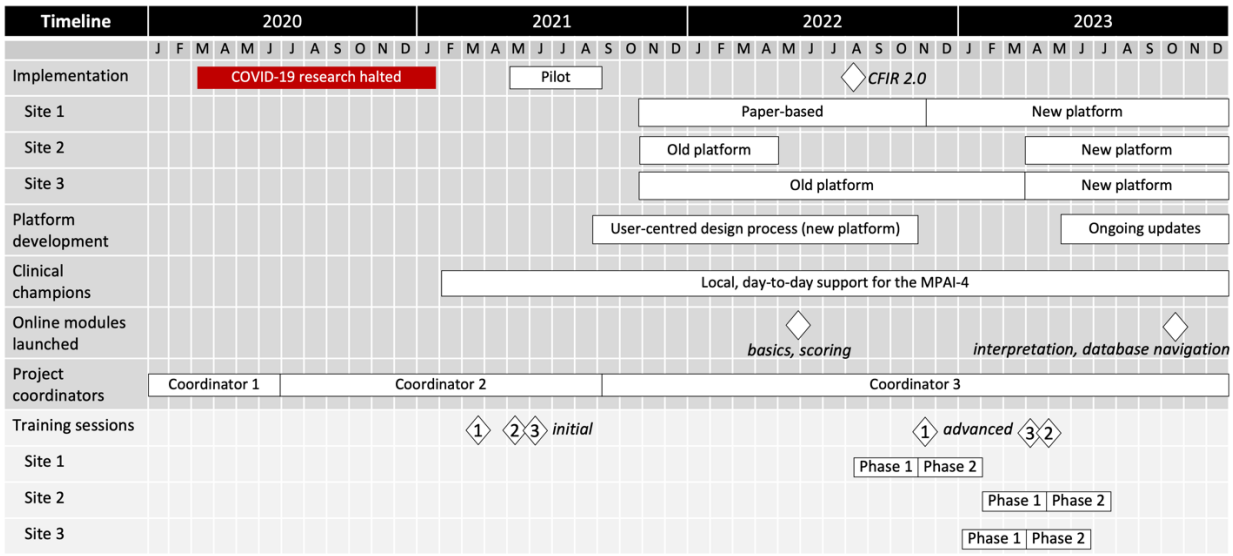

Figure 10-1: Training Sessions Situated within the larger MPAI-4 Implementation Project

Table 10-1: Description of the study context

Contextual factor	Description
Outcome Measure	The Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) can be used to assess global patient outcomes. • Items are organized into three subscales: the ability index (i.e., physical and cognitive abilities), adjustment index (i.e., emotional and behavioural wellbeing) and participation index (i.e., daily activities and community participation) (39). • The MPAI-4 can be completed by clinicians, patients, or caregivers in multiple languages, including English and French amongst others (39,40). • The results of a recent systematic review indicate that while there are gaps in existing evidence, the MPAI-4 and its subscales have strong, high-quality evidence for their use to describe and evaluate stroke outpatients (i.e., sufficient scores for reliability and construct validity) (41). • To interpret the MPAI-4 total and subscale scores, the raw score is converted to a standardized T score (average = 50, SD = 10) against a normative sample (42,43).
Provincial Mandate	In 2018 the participation index of the MPAI-4 was mandated for use in outpatient stroke and traumatic brain injury rehabilitation programs in Québec (38).
Implementation Team	Composed of the research team (researchers, IT specialists, project managers) and the clinical team (managers, care coordinators (clinician leaders) and clinicians). These groups collaborated over the course of the project to facilitate its success (31). The collaborative team was assembled in 2019.
Site Location	Each site is within a different regional health authority, but in the same urban, metropolitan area.
Program	Outpatient stroke rehabilitation
Available services	Range of general and specialized inpatient and outpatient rehabilitation programs
Number of clinicians	In outpatient stroke rehabilitation, there are 15-40 multidisciplinary clinicians at each site.
Number of patients	In outpatient stroke rehabilitation, there are 100-300 patients per year.
Research affiliation	All sites have a strong affiliation with cutting-edge research via an embedded, on-site research centre. Supports exist to encourage collaboration, including knowledge brokers who work to bridge research and clinical milieu.

Research program support	There is long-term research funding available to support the MPAI-4 implementation project via the Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies (BRILLIANT) program. Funding is designated for digital infrastructure to support a rehabilitation learning health system as part of the BRILLIANT research program (44), including the development and maintenance of technological resources (i.e., digital health solution, the MPAI-4 BRILLIANT platform).
Overall Implementation Intervention	The MPAI implementation intervention included multiple components. The main components are introduced in Figure 10-1 and include: 1. New platform for the MPAI-4 The BRILLIANT platform for the MPAI-4 was developed using a user-centred design. This digital health solution was tailored to local needs and workflows to input MPAI-4 scores and generate automatic clinical and program evaluation reports. 2. Clinical Champions A clinical champion was designated at each site to provide local, daily support in the use of the MPAI-4 and the accompanying platform. They also functioned as a key point of contact with the research team. 3. Online Modules The online modules included short videos, case scenarios, infographics and frequently asked questions. Basic information on the MPAI-4 and it's scoring were developed first, followed by information on interpretation and application to clinical decision-making, and navigation of the MPAI-4 platform. 4. Project coordinators The project coordinators for the MPAI-4 implementation project served as MPAI-4 experts and points of contact for the project. They facilitated communication, led meetings and developed and delivered training with support from the larger research team. 5. Training sessions An initial training session prior to the MPAI-4 pilot were delivered at each site, and primarily focused on basic MPAI-4 information and scoring. And advanced training session was delivered prior to the implementation of the new MPAI-4 platform at each site, and focused on MPAI-4 interpretation and application to clinical decision-making as supported by the new platform.

Guiding Theories and Frameworks

SDT (24) and BCTs (25) link the training session's content and delivery to its anticipated impacts. SDT states that behaviour change is achieved when three basic psychological needs are met: autonomy, connectivity, and competence (24). Consistent with the work of other authors in implementation science, (45–48) we aimed to change MPAI-4 behaviour by optimizing these psychological needs via BCTs (25). BCTs are a taxonomy of strategies that are connected to barriers (25). For example, the BCT of 'instruction on how to perform a behaviour' can overcome a knowledge barrier (49), as demonstrated in the implementation of a biopsychosocial approach to physiotherapists' practice (50). Using SDT and BCTs together guides the development of training session while providing enough flexibility to adapt the training between sites (49).

The New World Kirkpatrick Model (NWKM)(51) can help inform training session objectives and evaluation. This model defines four levels of impact – reaction, learning (knowledge, attitudes, confidence, commitment, skill), behaviour (operationalized as behavioural intent in this study), and results. This work was informed by the first three levels only, since 'results' requires collecting data on MPAI-4 benefits which was beyond the scope of this study.

Methodology

This was a two-phase study (**Figure 10-2**). In phase 1 we collaboratively designed and delivered a training session tailored to local needs (objective 1). In phase 2 we used a mixed method explanatory sequential design consisting of a series of three surveys followed by an interview to evaluate the training session (objective 2). Ethics approval was obtained from the Research Ethics Board for Rehabilitation and Physical Disability in the Integrated Center for University Health and Social Services of the South-Central Island of Montréal [MP-50-2022-968].

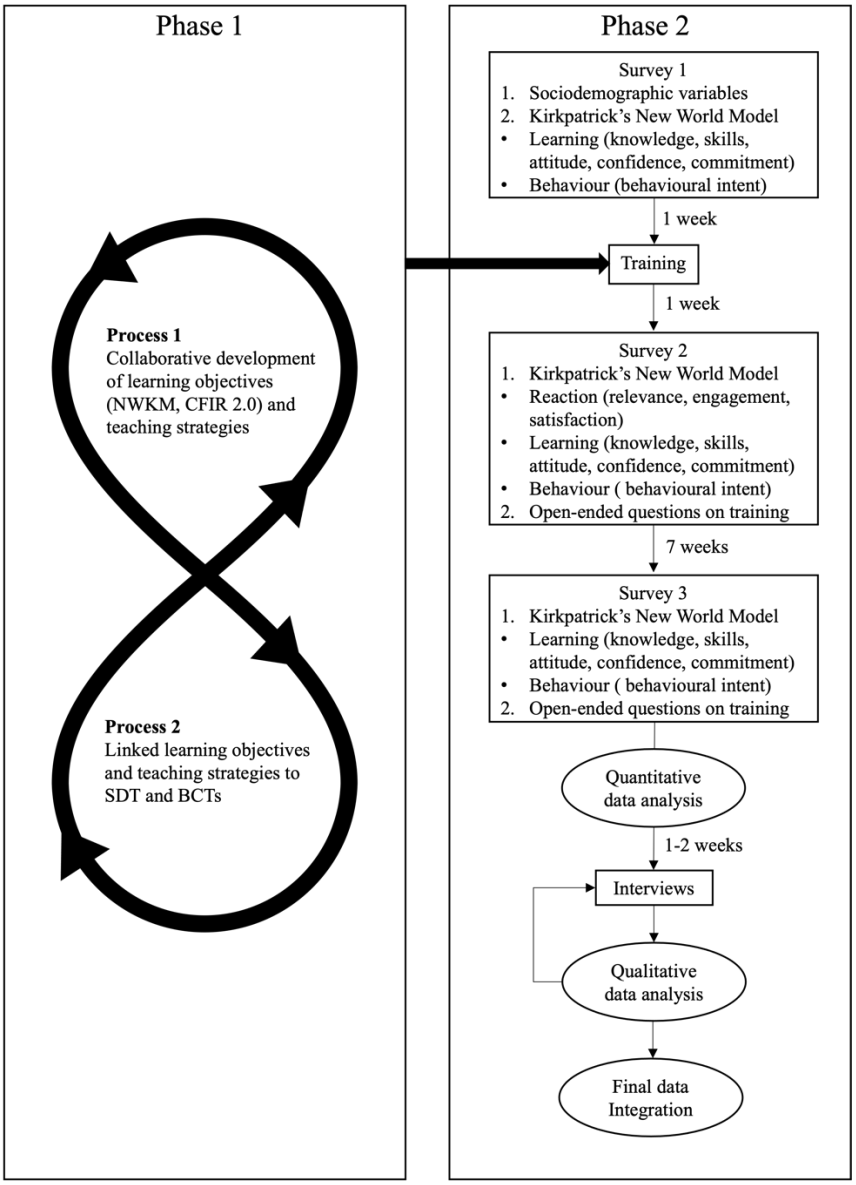

Figure 10-2: Two phase methodology

Phase 1: Tailored, theory-informed training session

Participants

At each site, participants included the research team (i.e., the MPAI-4 implementation project's principal investigators (AT, SA, CA), the project coordinator/trainer (RA) and research trainees (DRA, AM)) and the clinical team (i.e., manager and clinical champion).

Training Session Development

We collaboratively developed a unique training session for each site. By following a tailored, theory-informed process, we anticipated positive clinician reactions and learning, which we expected would lead to increased use of the MPAI-4. We iteratively undertook two processes to develop the training session.

First, the research team drafted potential learning objectives and corresponding training strategies informed by identified CFIR 2.0 barriers (i.e., MPAI-4 knowledge, attitudes, and skills (44)) and NWKM. The manager and clinical champions at each site provided feedback on the objectives and strategies via email and videoconferencing. This process continued until the training content and mode of delivery was agreed upon.

Second, the research team simultaneously linked learning objectives and teaching strategies to BCTs (52) and SDT (24). We identified the underpinning behavioural change constructs between learning objectives and teaching strategies (e.g., BCT: instruction on how to perform a behaviour is linked to SDT: competence) (see Table 10-2, Appendix A for further examples). Furthermore, we explicitly acknowledged our training philosophy to work in partnership with clinicians, value their skill development and their ability to make autonomous decisions, and offer a collegial training environment.

Phase 2: Training Session Evaluation

Participants and Recruitment

Eligible participants were all clinicians who attended the MPAI-4 training session (N=80). We invited clinicians by email to complete the surveys and recruited a convenience sample of 1-3 clinicians at each site to participate in an individual semi-structured interview in either English or French.

Quantitative Phase

Data Collection

Due to the lack of an existing measure that was fit for purpose, we developed the survey questions based on the NWKM (51) and a similar survey used to evaluate training for patient-reported OMs (29). The surveys included a total of 31 questions: on reaction

(n= 4), learning (knowledge, attitudes, confidence, commitment, and skill; n=21), and behavioural intent (n=4) and 2 open-ended questions concerning further training needs (Appendix B). Responses to survey questions were made on a 5-point Likert agree-disagree or construct-based scale (e.g., completely-not at all confident). We piloted the questions with three clinicians for clarity. We administered the survey by email 1-week pre-training, 1-week post-training and 8-weeks post-training.

Data Analysis

We calculated the median and range for reaction survey questions (administered 1-week post-training only). We tested the likelihood that an individual would rate themselves higher on each of the 25 learning and behavioural intent survey questions following the training session using a cumulative link mixed model (CLMM) as implemented in the R (53) package ordinal (54). For an ordinal response variable Y with J number of ordered categories, the most common parameterization is where the outcome of interest is 'Y less than or equal to *j*' (54). Unlike repeated measures ANOVA, mixed models such as CLMM directly handle missing data and dropouts in longitudinal designs with a maximum likelihood estimation by retaining all the participants who have data at any time point.

All analysis were performed using R (version 4.3.1) (53). Three models were fitted for each survey question:

Model 1 (base model): site+time)

Model 2: site+time+number of MPAI-4 clients per clinician

Model 3: site+time+number of MPAI-4 clients per clinician+clinical experience (years)

For the survey questions with significant odds ratios (ORs) at 1-week and 8-weeks post-training in model 1, model 1 was compared to models 2 and 3 using a likelihood ratio test via the R ANOVA function. All models included a random effect (participants). Although tested as a nested random effect, site was ultimately included in the model as a fixed effect.

We tested the assumption of proportional odds (the effect of an independent variable is constant for each increase in *j*) (54) using Brant's test as implemented in the R package gofcat. In the absence of a method to test the assumption in the CLMM model,

we conducted Brant's test by fitting a cumulative link model (CLM) with the smooth-effect-on-response penalty (SERP) by averaging each individual's survey responses across timepoints.

A simulation based post-hoc power analysis confirmed that the sample size was sufficient for 80% power to detect a high Cohen's d effect size (i.e., > 0.8; odds ratio (OR) > 4) at a type I alpha of 0.05 between pre-training, and 1-week and 8-weeks post-training.

Qualitative Phase

Data Collection

We conducted 30-minute interviews via videoconference 1-2 weeks following the completion of the last survey. RA began each interview welcoming of all perspectives before following a NWKM-informed semi-structured interview guide. The interview guide was reviewed by the research team, then tailored based on survey results for each site (Appendix C). Additionally, we asked questions to understand the impact of the advanced training session in the context of the entire MPAI-4 implementation project. Each interview was audio-recorded and transcribed verbatim, French quotes were translated for reporting only.

Data Analysis

We used directed content analysis (55,56) in NVivo 12 (57) to code interview and survey text to the NWKM. We developed an operational definition for each theme (e.g., reaction) and subtheme (e.g., relevance) by adapting the conceptual definitions in NWKM to this study. While we primarily coded deductively, we inductively created new codes to capture findings outside of the NWKM.

Coding started with RA familiarizing herself with the audio, transcripts, and open-ended survey question text. Then, RA and DRA independently coded the first transcript. They discussed discrepancies and updated the codebook as needed before RA coded the remaining transcripts. Once all the text was coded, RA looked for differences between participants and sites.

We applied Lincoln and Guba's principles of trustworthiness throughout (i.e., credibility, transferability, dependability, and confirmability) (58). While coding RA and

DRA reflected on how their experiences and perspectives may influence their data interpretation. RA used project logs, wrote reflective memos, and regularly debriefed with additional members of the research team (AT, DRA, AM) to resolve coding discrepancies, establish clear pathways for derived findings, and discuss alternative lines of inquiry and explanations for results (58).

Data integration

Guided by Creswell (59), we integrated data from surveys and interviews within each NWKM construct. Thus, for each construct quantitative survey results accompany a narrative explanation from the qualitative interviews and open-ended survey question data. Mixing this data helped us confirm or challenge the quantitative results and supported a contextualized understanding of the training session's impact.

Results

Phase 1: Tailored, theory-informed training session

The training session at each of the three sites differed in the number of trainees, length, mode of delivery, and content (Table 10-2, Appendix A)

Phase 2: Training Session Evaluation

Quantitative Results

Participant Characteristics

Of 80 potential participants, 51 completed survey 1 (63% response rate), 44 completed survey 2 (55%), and 24 completed survey 3 (30%) (see Table 10-3 for participant characteristics).

Reaction to the training session

At least 70% of participants at each site agreed or strongly agreed that the training session was relevant, engaging, and satisfying (Figure 10-3). Only Site 3 participants reported negative reactions (minimum response of disagree). Between 14% and 27% of participants per site requested additional training.

Table 10-2: Training sessions at each site

	Site 1	Site 2	Site 3	Teaching Strategies
What	In-person interpretation training (15 learners)	In-person interpretation training x2 (14 learners and 26 learners)	In-person interpretation training (25 learners)	
Length	2 hours	2 hours	1 hour	
How	Brief overview then full case scenario, interactive	Online training modules pre-requisite to attendance Brief overview then case-based discussion and interactive session	Brief overview then case-based discussion and interactive session using MPAI-4 data from the centre	
Learning objectives *(linked BCT; SDT)*	#1 Review the timeline of the MPAI-4 implementation project *(1.6 Discrepancy between current behavior and goal; Autonomy & Connectivity)*	#1 Review the timeline of the MPAI-4 implementation project *(1.6 Discrepancy between current behavior and goal; Autonomy & Connectivity)*	#1 Review the timeline of the MPAI-4 implementation project *(1.6 Discrepancy between current behavior and goal; Autonomy & Connectivity)*	Introduction by senior research team member, including overview of MPAI-4 implementation project timeline and provincial mandate
	#2 Describe the evidence-based use of the participation index in outpatient stroke rehabilitation *(4.1 Instruction on how to perform a behaviour; Competence and 5.3 Information about social and environmental consequences; Connectivity. 9.1 Credible source; Connectivity)*	#2 Describe the evidence-based use of the MPAI-4 in outpatient stroke rehabilitation *(4.1 Instruction on how to perform a behaviour; Competence. 5.3 Information about social and environmental consequences; Connectivity. 9.1 Credible source; Connectivity)*	#2 Describe the evidence-based use of the MPAI-4 in outpatient stroke rehabilitation *(4.1 Instruction on how to perform a behaviour; Competence and 5.3 Information about social and environmental consequences; Connectivity. 9.1 Credible source; Connectivity)*	RA didactically shares results of the MPAI-4 systematic review (58), including recommendations for the clinical use of the MPAI-4 or participation index for outpatient stroke rehabilitation specifically, based on current evidence

#3a Understand scoring on each item of the participation index #3b Navigate the platform and input scores for a patient at admission on the participation index #3c Navigate the platform and interpret the results (graph, change score and severity score at discharge,) after scoring a patient at admission on the participation Index and identify how the scores may inform decision-making (*see objectives #4a and #4b*)			RA leads patient case scenario in a small group activity format. Each group scores the patient at admission then discuss item scoring as full group. A consensus score is reached. RA demonstrates how to navigate the platform to input the consensus score and access results. She facilitates discussion on how to interpret the admission scores.
#4a Score a patient at discharge on the participation index #4b Navigate the platform and interpret the results (graph, change score and severity score at discharge,) after scoring a patient at discharge on the participation Index and identify how these may inform decision-making *(4.1 Instruction on how to perform a behaviour; Competence. 6.1 Demonstration of the behaviour; Competence. 8.1*	#3a Navigate the platform and input scores for a patient at discharge on the MPAI-4 #3b Navigate the platform and interpret the results (MPAI-4 graph, change score and severity score at discharge,) and identify how these may inform decision-making *(4.1 Instruction on how to perform a behaviour; Competence. 6.1 Demonstration of the behaviour; Competence. 8.1 Behavioral practice/*	#3a Navigate the platform and input scores for a patient at discharge on the MPAI-4 #3b Navigate the platform and interpret the results (MPAI-4 graph, change score and severity score at discharge,) and identify how these may inform decision-making *(4.1 Instruction on how to perform a behaviour; Competence. 6.1 Demonstration of the behaviour; Competence. 8.1 Behavioral practice/*	RA leads patient case scenario in a small group activity format. Each group scores the patient at discharge then discuss item scoring as full group. A consensus score is reached. RA demonstrates how to navigate the platform to input the consensus score and access results. The admission results are either from the

Behavioral practice/ rehearsal; Competence. 9.2: Allow participant to express advantages and disadvantages; Autonomy and Connectivity)	*rehearsal; Competence. 9.2: Allow participant to express advantages and disadvantages; Autonomy and Connectivity)*	*rehearsal; Competence. 9.2: Allow participant to express advantages and disadvantages; Autonomy and Connectivity)*	previous activity or already entered for the patient. She facilitates discussion on how to interpret the discharge scores.
#5 Share your experiences using the participation index *(1.1 Goal setting (behaviour); Competence. 1.9 Commitment, Autonomy)*	#4 Reflection, share your experiences using the MPAI-4 *(1.1 Goal setting (behaviour); Competence. 1.9 Commitment, Autonomy)*	#4 Reflection, share your experiences using the MPAI-4 *(1.1 Goal setting (behaviour); Competence. 1.9 Commitment, Autonomy)*	Open discussion with clinicians asked to either write down or share their goal or intent to use the MPAI-4 or participation index

Table 10-3: Participant demographics as reported in survey 1

	Site 1	Site 2	Site 3
n	12/15	30/40	9/25
Age (mean, SD)	45.08 (9.99)	43.82 (12.50)	41.22 (8.84)
Years of experience (mean, SD)	17.83 (10.19)	11.86 (10.06)	7.56 (7.46)
MPAI-4 experience (%)	83	9	100
If yes, how many clients? (mean, SD)	28.10 (27.92)	11.33 (16.17)	43.89 (23.95)
Affiliated rehabilitation program (%)			
Intensive stroke outpatient rehabilitation	58	3	0
Home-based intensive stroke rehabilitation	0	9	0
Participation-based stroke outpatient rehabilitation	8	30	33
Participation-based stroke outpatient rehabilitation	17	39	44
Two stroke programs	8	3	22
Other neurological outpatient rehabilitation	0	18	0
Profession (%)			
Occupational Therapist	33	27	22
Physiotherapist	17	24	0
Psychologist	8	0	11
Speech Language Pathologist	25	18	11
Social Worker	8	9	33
Special Education Teacher	8	2	0
Other	0	9	22
Primary role (%)			
Clinician	92	91	78
Clinical coordinator	8	9	22

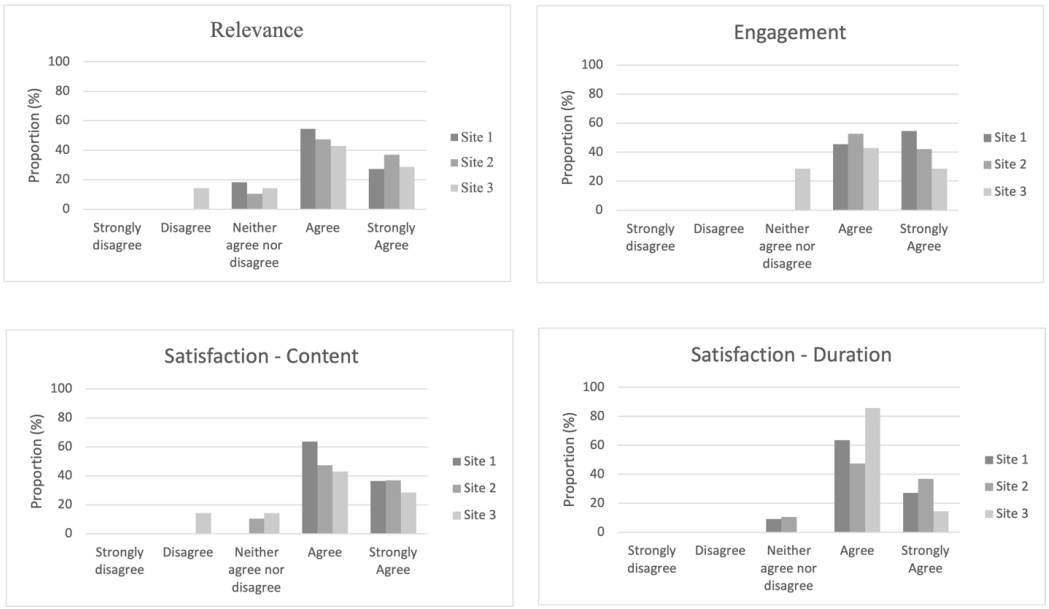

Figure 10-3: Reaction to the Training Session

MPAI-4 Learning and Behavioural Intent

The odds ratios (ORs) for each survey question rating in category j versus a lower rating are reported for the best fitting model (**Table 10-4; Appendix D**). For example, a participant rating their scoring knowledge as 5 versus a 1-4 (or a 4 versus a 1-3, etc.) on the rating scale increases by 7.02 [2.44, 20.20], $p<0.05$ between pre-training and 1-week post-training. Applying this interpretation across survey questions, participants rated themselves higher on all knowledge (ORs range: 6.64-20.41, $p<0.05$), confidence (ORs range: 6.71-34.64, $p<0.05$), and skill questions (ORs range: 3.97-28.41, $p<0.05$) between pre-training and both post-training timepoints.

In contrast, the ORs for most attitudes, commitment, and behavioural intent questions were not significant ($p>0.05$). Exceptions were significant increases between pre-training and post-training timepoints for three attitudes questions pertaining to patient portrait, treatment planning and progress (OR range: 3.58-5.75, $p<0.05$), and for interpretation behaviour (OR: 4.04 [1.44, 11.30], $p<0.05$). At 8-weeks post-training, attitudes ORs were no longer significant (OR range: 0.97-1.55, $p>0.05$) while improved MPAI-4 interpretation behaviour was maintained (OR: 11.52 [3.12, 42.58], $p<0.05$) and scoring behaviour significantly increased (OR: 8.22 [2.59, 26.04], $p<0.05$).

Site typically had no significant effect on an individual's likelihood to score higher on an outcome. There are no clear patterns amongst the exceptions. When models 2 or 3 fit better than model 1 (**Appendix C**), the number of MPAI-4 clients and/or years of clinical experience variables were often significantly associated to the outcome, although often very close to the 0.05 threshold.

Qualitative Results

Participant Characteristics

There was a total of six participants across Sites 1, 2 and 3, including three care coordinators and three clinicians, representing diverse professions (i.e., occupational therapists, physiotherapists, speech-language pathologists, and social workers).

Explanation of Survey Results

In the following sections, we describe the qualitative results captured in three themes from the NWKM: reaction, learning and behavioural intent (**Table 10-5; Appendix E**)

Reaction

Reaction captures participants' response to the training session and its pertinence to their jobs within three subthemes.

Customer Satisfaction

Customer satisfaction refers to the participant's approval of the training duration and content. For example, Site 3 had a 1-hour training session. This was shorter than other sites (**Table 10-2**), but a clinician expressed that this met their needs:

> *"When you have meetings on various topics, we have that duration [of 1-hour]. I think it gave people the chance to comment. We had the time." Clinician 3, Site 3*

While interview participants expressed satisfaction with the training content, some survey respondents stated that they would benefit from additional training:

> *"After using the MPAI-4 for 3 or so months regularly with clients, a follow-up session (short) would be useful." Clinician, Site 2*

Table 10-4: Odds Ratios and 95% Confidence Intervals from Best Fitting Cumulative Link Mixed Model

Outcome	Odds Ratio [95% CI]								
	Random Effect**	Survey 1 vs 2	Survey 1 vs 3	Site 1 vs 2	Site 1 vs 3	Age (years)	# MPAI-4s scored	Experience (years)	Role (clinician)
Knowledge									
Score patient	0.78	7.02* [2.44, 20.20]	8.47* [2.34, 30.73]	1.11 [0.28. 4.32]	1.19 [0.22, 6.36]	0.96 [0.90, 1.03]	1.05* [1.02, 1.09]	1.09* [1.01, 1.18]	
Interpret score	0.15	20.41* [7.18, 58.05]	6.64* [2.41, 18.33]	1.78 [0.61, 5.21]	0.41 [0.11, 1.47]	0.98 [0.93, 1.03]	1.03* [1.01, 1.06]	0.96 [0.91, 1.02]	2.82 [0.91, 8.76]
Apply to goal setting	1.03	14.30* [5.23, 39.07]	16.20* [4.80, 54.64]	1.08 [0.29, 4.02]	0.15* [0.03, 0.78]	1.03 [0.96, 1.09]	1.03 [1.00, 1.06]	0.93* [0.86, 1.00]	3.42 [0.81, 14.43]
Apply to treatment plan	0.00	13.84* [5.08, 37.68]	7.85* [2.49, 24.71]	0.74 [0.28, 1.97]	0.13* [0.04, 0.48]	1.03 [0.98, 1.07]	1.01 [0.99, 1.04]	0.92* [0.88, 0.97]	4.59* [1.51, 14.00]
Attitude									
MPAI-4 applies to select patients	2.08	0.72 [0.32, 1.63]	0.86 [0.33, 2.28]	4.45* [1.16, 17.04]	3.99 [0.72, 22.23]	1.00 [0.95, 1.05]			
MPAI-4 a priority	6.06	2.95 [0.80, 10.93]	0.92 [0.85, 1.00]	0.01 [0.00, 0.28]	0.00* [0.00, 0.12]	0.51 [0.07, 3.68]			
Prefer other measures	4.18	0.60 [0.24, 1.48]	0.60 [0.20, 1.83]	1.01 [0.18, 5.56]	11.22 [1.10, 114.09]	1.06 [0.99, 1.14]			
MPAI-4 relevant to patient care	2.59	1.63 [0.69, 3.87]	0.74 [0.25, 2.13]	2.75 [0.64, 11.76]	0.51 [0.08, 3.30]	0.99 [0.94, 1.05]			
MPAI-4 provides patient portrait	1.75	6.02* [2.26, 16.02]	1.65 [0.56, 4.86]	1.72 [0.35, 8.36]	0.14* [0.02, 0.93]	0.97 [0.90, 1.04]	1.02 [0.99, 1.05]	0.98 [0.90, 1.06]	5.86* [1.16, 29.70]
MPAI-4 informs treatment plan	0.97	4.29* [1.69, 10.88]	1.23 [0.42, 3.56]	3.62 [0.90, 14.53]	0.10* [0.02, 0.57]	1.05 [0.98, 1.12]	1.02 [0.99, 1.05]	0.89* [0.83, 0.96]	7.70* [1.67, 35.60]
MPAI-4 evaluates patient progress	4.54	3.63* [1.43, 9.26]	0.98 [0.33, 2.96]	1.59 [0.27, 9.22]	1.51 [0.16, 14.54]	0.98 [0.92, 1.05]			

MPAI-4 can justify treatment	0.87	1.81 [0.78, 4.21]	0.45 [0.16, 1.27]	0.07 [0.01, 0.38]	0.83 [0.21, 3.18]	0.98 [0.92, 1.04]	1.02 [0.99, 1.04]	0.98 [0.91, 1.04]	6.04* [1.52, 24.01]
Confidence									
Score patient	2.32	15.11* [5.05, 45.17]	34.64* [8.98, 133.63]	2.52 [0.50, 12.62]	0.76 [0.11, 5.18]	1.02 [0.96, 1.07]	1.08* [1.03, 1.12]		
Interpret score	2.2	23.71* [8.00, 70.30]	10.46* [3.29, 33.19]	1.23 [0.33, 4.58]	1.11 [0.19, 6.39]	0.97 [0.92, 1.02]			
Apply to goal setting	0.79	7.19* [2.87, 18.04]	6.71* [2.20, 20.49]	0.89 [0.25, 3.13]	0.92 [0.15, 5.51]	1.02 [0.96, 1.08]	1.03 [1.00, 1.06]	0.92 [0.86, 0.99]	
Apply to treatment plan	1.39	9.83* [3.64, 26.55]	8.64* [2.62, 28.50]	1.03 [0.25, 4.20]	0.05* [0.01, 0.32]	1.02 [0.95, 1.09]	1.03 [1.00, 1.06]	0.93 [0.86, 1.00]	
Skill									
Score patient	2.59	5.32* [2.03, 13.95]	3.97* [1.28, 12.34]	0.38 [0.09, 1.65]	2.05 [0.31, 13.73]	1.02 [0.96, 1.08]			
Interpret score	2.2	28.41* [9.07, 88.97]	11.69* [3.47, 39.30]	0.97 [0.26, 3.67]	0.92 [0.15, 5.51]	0.95 [0.90, 1.00]			
Apply to goal setting	0.71	9.97* [3.84, 25.91]	4.05* [1.42, 11.57]	0.56 [0.37, 2.00]	0.09 [0.47, 0.02]	1.00 [0.91, 1.05]	1.01 [0.98, 1.04]	0.96 [0.90, 1.02]	5.09* [1.32, 19.57]
Apply to treatment plan	0.38	11.73* [4.43, 31.04]	5.84* [1.86, 18.34]	0.44 [0.16, 1.41]	0.08 [0.02, 0.36]	1.00 [0.94, 1.06]	1.00 [0.98, 1.03]	0.93 [0.88, 0.99]	4.78* [1.36, 16.86]
Commitment	2.92	2.14 [0.91, 5.03]	1.45 [0.50, 4.27]	2.16 [0.36, 12.91]	0.08 [0.01, 0.73]	1.07 [0.98, 1.16]	1.04* [1.00, 1.08]	0.92 [0.84, 1.01]	
Behaviour									
Score patient	1.96	1.18 [0.52, 2.65]	7.87* [2.49, 24.88]	0.10* [0.03, 0.27]	2.25 [0.72, 7.06]	1.03 [0.99, 1.07]			
Interpret score	0.12	4.06* [1.45, 11.34]	11.64 * [3.15, 42.99]	0.26 [0.05, 1.37]	0.61 [0.09, 4.31]	0.99 [0.93, 1.05]			
Apply to goal setting	7.83	4.90 [0.78, 30.60]	0.93 [0.83, 1.04]	0.14 [0.01, 3.83]	0.17 [0.00, 35.20]	0.04* [0.00, 0.72]			
Apply to treatment plan	7.71	5.19 [0.86, 31.22]	0.92 [0.83, 1.03]	0.09 [0.00, 2.35]	0.08 [0.00, 15.83]	0.03* [0.00, 0.48]			

*** p value < 0.05; **between subject variance**
Note: Models 1 and 2 met the assumption of proportional odds. The test could not be run on Models 3 and 4

Table 10-5: Themes and Subthemes based on the New World Kirkpatrick Model

Theme	Subtheme	Conceptual definition	Operational definition	Exemplar quote
Reaction	Customer Satisfaction	The degree to which the participant is satisfied with the training	The degree to which the participant is satisfied with the content and duration of the training, or not.	"Duration, 1h? Yeah, that's fine, that's usually when you have meetings on various topics is the same duration too. I think it also gave people the chance to comment, since we had the time and engagement." **Clinician 3, Site 3**
	Engagement	The degree to which participants are actively involved in and contributing to the learning experience. Engagement levels directly relate to the level of learning that is attained. Personal responsibility and program interest are both factors in the measurement of engagement. Personal responsibility relates to how present and attentive participants are during the training. Program interest is more commonly the focus, including how the facilitator involved and captivated the audience.	The degree to which participants are actively involved in and contributing to the learning experience, or not.	"I also think about the others who have been there longer, Ben. We had a chance to, we could ask questions, make comments, all that makes it fun for everyone. So in my opinion people, they are satisfied" **Clinician 2, Site 3**
	Relevance	The degree to which training participants will have the opportunity to use or apply what they learned in training on the job. Relevance is important to ultimate training value because even the best training is a	The degree to which training participants will have the opportunity to use or apply what	"what I've heard at large from my group here is that they were very satisfied with the training. They felt it helped them and it got people on

		waste of resources if the participants have no application for the content in their everyday work.	they learned in training on the job, or not.	board with using it, using the MPAI because it was easier to use." **Care Coordinator 2, Site 2**
Learning	Attitude	The degree to which training participants believe that it will be worthwhile to implement what is learned during training on the job. Attitude is characterized by the phrase, "I believe it will be worthwhile" (to do this in my work).	The degree to which training participants believe that it will be worthwhile to implement what is learned during training on the job, or not.	"Well, you know I think it's super relevant. Of course, we are still somewhat in the context of research. But you know, I think that in the end when we have Canadian standards, then it will be really relevant. But for now…" **Clinician 3, Site 3**
	Commitment	The degree to which learners intend to apply the knowledge and skills learned during training to their jobs. It is characterized by the phrase, "I will do it on the job." Commitment relates to learner motivation by acknowledging that even if the knowledge and skills are mastered, effort still must be put forth to use the information or perform the skills daily.	The degree to which learners intend to apply the knowledge and skills learned during training to their jobs, or not.	"We see that the training served a purpose. It is commitment, motivation, adherence to the tool." **Care coordinator, Site 1**
	Confidence	The degree to which training participants think they will be able to do what they learned during training on the job, as characterized by the phrase, "I think I can do it on the job." Addressing confidence during training brings learners closer to the	The degree to which training participants think they will be able to do what they learned during training on the job, or not.	"it's not the confidence in using it, in doing it in scoring it. It's a confidence in using the scores for our decisions, for our treatment…the first MPAI doesn't give us

		desired on-the-job performance. It can proactively surface potential on-the-job application barriers so they can be resolved.		anything on how to make decisions for the intervention plan. So, we don't use the MPAI." **Care coordinator 2, Site 2**
	Knowledge	The degree to which participants know certain information, as characterized by the phrase, "I know it."	The degree to which participants know certain information, or not.	"Me, when I came out of the training to interpret, I was like "ahh Yes OK". But after trying to interpret it, I'm less sure now. I recognize that in myself." **Clinician 2, Site 3**
	Skill	The degree to which they know how to do something or perform a certain task, as illustrated by the phrase, "I can do it right now."	The degree to which they know how to do something or perform a certain task, or not.	"We saw elements there, in training, which were more predictive of certain changes. The red flags, things like that. But [in clinical practice] we don't really know. It's hard to make the MPAI-4 your own, it is hard to master it." **Clinician 2, Site 3**
Behavioural Intent	Critical Behaviours	Critical behaviors are the few, specific actions, which, if performed consistently on the job, will have the biggest impact on the desired results. There are perhaps thousands of behaviors a given employee might perform on the job; critical behaviors are those that have been identified as the most important to achieving organizational success	Critical behaviors are the few, specific actions, which, if performed consistently on the job, will have the biggest impact on the desired results. In relation to the MPAI-4, these are: 1) scoring the eligible clients on the MPAI-4 2) interpreting MPAI-4 scores 3) using the MPAI-4 scores to inform goal setting with a	"I'm not surprised that the [training evaluation] scores are lower, even eight weeks post training because the [MPAI-4] scores aren't used. They're not brought to the patient…right now, we're not showing anything. We're not using [the MPAI-4] in the

			client and using MPAI-4 scores to inform decisions about a client's treatment plan	intervention plan." **Care coordinator 1, Site 2**
	On the job learning	Creating a culture and expectation that individuals are responsible for maintaining the knowledge and skills to enhance their own performance will encourage individuals to be accountable and feel empowered. 1. Up to 70% of all learning takes place on the job 2. Personal responsibility and motivation are key partners to external support and reinforcement efforts for optimal performance. On-the-job learning provides an opportunity for employees and their employers to share the responsibility for performance	The degree to which the individual has access to learning opportunities and support from their place of work to optimize and pursue the use of the MPAI-4.	"I think with time we'll see the clinical applicability of the MPAI or lack thereof. So, I'm not sure how much you could adjust the training going forward. It's more about practice using it" **Care coordinator 1, Site 2**
	Required Drivers	Required drivers are processes and systems that reinforce, monitor, encourage, and reward performance of critical behaviors on the job. Common examples include job aids, coaching, work review, pay-for-performance systems and recognition for a job well done. Required drivers are key to accomplishing the desired on-the-job application of what is learned during training. They decrease the likelihood of people falling through the cracks, or deliberately crawling through the cracks if they are not interested.	Strategies or environmental factors that currently or are expected to reinforce, monitor, encourage, and reward performance of critical behaviors on the job and of training session impacts on learning.	"How we will train the new, the new clinicians, it will be done how, it is you mentoring, there will be training. Who, I do not know once a year where all the newcomers of each of the establishments, they will be put together, I just wonder how to train the new ones." **Care coordinator 1, Site 1**

Engagement

Engagement refers to participants being actively involved in the learning experience. A clinician expressed how they were engaged during the training at Site 3, which was the only session delivered without any small group activities:

> *"I raised my hand; I don't think I spoke, but you know people really had the room to do it. And you know, even though I didn't participate by talking, I was still active in my listening." Clinician 3, Site 3*

Relevance

Relevance refers to participants being able to apply training content in their work. One care coordinator explained that the clinical team often referenced the MPAI-4 training:

> *"I heard it in the [clinical] rounds. After, you know, according to the training what was said was XYZ. People were referring to the training" Care Coordinator, Site 1*

Learning

Learning captures participants' perceived acquisition of intended expertise from the MPAI-4 training session within five subthemes.

Knowledge

Knowledge refers to participants' comprehension of the MPAI-4. Interview participants indicated that the training session positively influenced their knowledge of the MPAI-4, as expressed by a care coordinator:

> *"[Knowledge] may be different following the training. We had you [the trainer], we talked, we had the case scenario, then we did the scores, then we said okay, well maybe we know this, we learnt" Care Coordinator, Site 1*

Confidence

Confidence refers to participants' perceptions that they can use what they learnt in their clinical practice. A care coordinator noted that the training session increased their confidence even though the MPAI-4 had been used by clinicians for the previous year:

"After the training what I understand is that people, they feel confident. They felt confident before because we've been using [the MPAI-4] for a long time… but after the training, everyone is sure" Care Coordinator, Site 1

Attitudes

Attitudes refers to participants' belief that the MPAI-4 is worth implementing. Participants often had negative perceptions of the MPAI-4. For example, there was widespread discontent with the rating scale, as expressed by one clinician:

"25 to 75% [encompassed by one rating] is a big jump. So, if they improve a lot from 30 to 50%, we won't see that." Clinician 1, Site 3

The perception that the MPAI-4 cannot capture a patient's evolution directly impacted participants' attitudes towards using the measure. For example, one care coordinator expressed their concern for applying the MPAI-4 scores to clinical decision-making:

"People are unsure of the individual clinical application. So, for sure the MPAI-4's not a priority for people, they only [score] it because it's mandated." Care Coordinator 1, Site 2

Commitment

Commitment refers to learners' dedication to applying the knowledge and skills learned during the training session. One participant expressed that commitment was not affected by the training but rather negatively influenced by it being a new, mandated task:

"I think, it's still one more step in the preparation of [the interdisciplinary team meeting], so maybe that's why there are those who are less committed" Clinician 3, Site 3

Skill

Skill refers to participants being able to use to the MPAI-4 in clinical practice, including scoring, interpreting, and applying the MPAI-4 to clinical decision-making. One care coordinator noted that although they gained knowledge and confidence from the training, they were not as sure of their ability to apply the MPAI-4 clinically:

"We don't know what to do with the measure. We know how to score it. But once we get a score, we have no clue what to do with that." Care coordinator 2, Site 2

Behavioural intent

Behavioural intent captures participants intention to apply what they learned in their clinical practice within three subthemes.

Critical Behaviours

Critical behaviours refer to clinicians' use of the MPAI-4 in clinical practice (i.e., scoring, interpretation, and application). As highlighted by one care coordinator, clinicians complete but rarely apply MPAI-4 scores to their clinical decision-making:

> *"The [MPAI-4] scores aren't used. They're not brought to the patient. We're not using it in the intervention plan." Care Coordinator 1, Site 2*

On the Job Learning

On the job learning refers to the clinical team having access to learning opportunities and workplace support for the MPAI-4. One clinician noted the importance of having the opportunity to test what was learnt during the training session in clinical practice:

> *"Between the second and the third survey there was a difference because we had time to try using the MPAI-4, we got to experience it." Clinician 2, Site 3*

Required Drivers

Required drivers refer to the strategies (i.e., methods or techniques) or contextual factors (e.g., physical, social, etc.) that influence the use of the MPAI-4. Participants mentioned strategies such as ongoing access to training materials, clinical champions and the project coordinator, and continued opportunities for critical discussions about the MPAI-4 within the clinical team. Influential environmental factors included the availability of research evidence and the digital platform. The latter is highlighted by one care coordinator:

> *"The [digital platform] is easy to use…[The platform] makes scoring so much faster. And the more we're using it, the more confident we get." Care Coordinator 2, Site 2*

Discussion

In this two-phase study we described the collaborative development of a tailored, theory-informed training session for the MPAI-4 across three rehabilitation sites, then evaluated its impact on clinician reaction, learning, and intent to use the outcome measure. Participants across sites found the training session to be relevant, engaging, and satisfying. Furthermore, the training session had a positive impact up to 8-weeks post-training on an individual's intent to score and interpret the MPAI-4, and on most learning outcomes (knowledge, confidence, skill) but not all (commitment, attitudes).

Participants' positive reactions to the training and lack of significance in the site variable in the CLMMs suggest that our collaborative, theory-informed tailoring process was successful across contexts. As suggested by other authors (20,23,30), developing training using a collaborative approach informed by theories and frameworks appears to be helpful and could be applied in other contexts to test its broader utility.

Despite largely positive reactions to the training session, it had mixed learning and behavioural impacts. Other authors evaluating training for OMs have reported improvements to knowledge but no change in attitudes, confidence, or behaviour (29); no improvements in clinicians' attitudes or behaviour (60); or no change in attitudes but improved behaviour (61,62). Authors' explanations varied, but tend to note the importance of influential contextual factors (60) such as mandates (29,60). Compared to the four highlighted studies and one systematic review of rehabilitation OM implementation, our training strategy is amongst the most successful. A key contributor to this success were the BCTs operationalized as a didactic lecture and small group patient case scenario activities, and linked to the SDT construct of competence achieved the anticipated impact on knowledge, confidence and skill, and to a lesser extent, attitude and behavioural intent. Contextual factors present before the training session (e.g., ministerial mandate) may have had an effect, but these were captured in the pre-training score. Any improvements from pre- to post-training seem most likely to be attributable to the training sessions, which was confirmed by interview participants.

In earlier MPAI-4 implementation studies in the same sites (44,63), clinicians and care coordinators relayed some negative attitudes towards the MPAI-4's rating scale and its perceived inability to detect patient progress. After presenting evidence for the MPAI-4 based on results from our systematic review its psychometric properties (64), we conducted a trainer-facilitated

group discussion at the end of the training session (BCT linked to the SDT construct of autonomy). This discussion was carefully facilitated to encourage constructive critical appraisal of the MPAI-4. Despite evidence from CLMMs indicating that training had a positive effect on clinician's attitudes pertaining to uses underpinned by psychometric evidence highlighted during the training session, improvements were not maintained at 8-weeks post-training. Qualitative and quantitative data collection at the same sites in complementary MPAI-4 implementation studies indicated that MPAI-4 attitudes and commitment were still not significantly improved 6-12 months following the training session and the use of other MPAI-4 implementation strategies (including booster training) (44,65). When exploring the reasons for this result, interview participants suggested that experience in using the MPAI-4 contributed to their perception that further investigation of the measure's content validity, responsiveness and interpretability is needed to address their concerns. Further investigation of these psychometric properties would also address the evidence gaps reported in the literature (64), and result in the anticipated benefits for patients and stroke programs, or conversely, lead to the identification of a narrower scope of benefits from the MPAI-4 when used in stroke programs as compared to its use with individuals with other acquired brain injuries.

Finally, interview participants highlighted the strong influence of contextual factors and strategies on training outcomes. For example, participants reported that the digital platform facilitated the development of MPAI-4 knowledge and confidence following the training session. In the case of Site 1, technical problems blocked the use of the platform immediately following the training, perhaps explaining why scoring behaviour increased 8-weeks but not 1-week post-training. Results of a systematic review of the barriers and facilitators to implementing OMs into rehabilitation practice similarly highlights the importance of digital tools (8). Echoing others (43,66,67), we recommend identifying and systematically selecting diverse, targeted strategies to address local barriers and enhance facilitators. While we focussed on the advanced training session in this manuscript, this strategy was one part of the multicomponent MPAI-4 implementation project (44). Diverse implementation strategies targeting levels beyond clinicians (e.g., patients, organizations, etc.) are required to achieve the use of OMs in clinical decision-making (13,16,68).

Limitations

We conducted this study at three geographically and organizationally similar sites with limited potential participants (n=80). We were only able to recruit a small sample size in our study. Thus, for some outcomes we did not have enough power to detect an effect. However, we mitigated this limitation by triangulating statistical results with data from the qualitative interviews. Evaluation across a greater number of diverse sites and/or using experimental designs would increase the eligible participant pool and could allow other meaningful variables to be added within the model (e.g., gender, clinical team size, etc.) and provide results that could be generalizable to a wider range of contexts.

Due to staffing constraints and post-COVID-19 wait times for rehabilitation services we could only interview a maximum of three clinicians per site. We acknowledge that an interview participant can only speculate why others at the site may have responded differently on the survey and that six interview participants is less than is recommended in qualitative research.(69) To mitigate these limitations, we targeted key informants who knew the clinical team well.

Conclusion

The BCTs linked to the SDT competence construct appear to have produced the anticipated positive impact on clinicians' knowledge, confidence, skills, and scoring and interpretation behavioural intent up to 8-weeks following training. In contrast, the BCTs linked to attitudes and commitment primarily via SDT's autonomy construct did not achieve the anticipated impact. Instead, non-training strategies such as generating targeted MPAI-4 psychometric evidence is required. While teams planning educational or implementation projects for OMs may benefit from adapting our training design process to their context, further testing of the linkages between SDT, BCTs and NWKM would provide further specific guidance.

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Conflict of interest statement

The authors declare no conflict of interest.

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Appendix A.

Training Description for Each Site

Table A.1: General characteristics of training sessions at each sites

	Site 1	**Site 2**	**Site 3**
What	In-person interpretation training	Virtual interpretation training	In-person interpretation training
Where	Room on site	Room on site	Room on site
When	November 23rd 2023 2 hours	May 1st and May 4th 2023 2 hours	April 13th 2023 1 hour
How	Case-based, interactive	Online training modules pre-requisite to attendance Brief overview then case-based, interactive session	Online training modules pre-requisite to attendance Brief overview then discussion based and interactive session
Who (learners)	All clinicians (15)	All clinicians (40 total split into 2 groups)	All clinicians (25)
Who (trainers)	Research team	Research team	Research team

Appendix B.

Survey Questions

PART A: Evaluation

REACTION to the MPAI-4 training session

Question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Relevance					
The MPAI-4 training session met my needs					
Satisfaction					
I was satisfied with the content in the MPAI-4 training session					
I was satisfied with the duration of the MPAI-4 training session					
Engagement					
I was actively engaged in the MPAI-4 training session					

Knowledge of the MPAI-4

Question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I know how to score a client on the MPAI-4					
I know how to interpret MPAI-4 scores					
I know how to use the MPAI-4 scores to inform goal-setting with a client					
I know how to use the MPAI-4 scores to inform decisions about a client's treatment plan					

Confidence using the MPAI-4

Question	Extremely confident	Very confident	Somewhat confident	A little confident	Not at all confident
How confident are you in your ability to score a client using the MPAI-4?					
How confident are you in your ability to interpret MPAI-4 scores?					

How confident are in you in your ability to use the MPAI-4 scores to inform goal-setting with a client?					
How confident are you in your ability to apply MPAI-4 scores to inform decisions about a client's treatment plan?					

Attitudes towards the MPAI-4

Question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
The MPAI-4 applies to only some of my clients					
The use of the MPAI-4 in my practice is a priority for me					
I prefer to use the standardized assessment(s) that I currently use instead of using the MPAI					
The MPAI-4 scores provide a comprehensive portrait of a client's current functional status					
The MPAI-4 evaluates outcomes that are relevant for a client's care					
The MPAI-4 scores help me develop my treatment plan.					
The MPAI-4 evaluates a client's progress over time.					
The MPAI-4 scores can be used to justify ongoing treatment to third parties (e.g., MSSS)					

MPAI-4 Skills

Question	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I can score a client on the MPAI-4					
I can interpret MPAI-4 scores					
I can use the MPAI-4 scores to inform goal-setting with a client					
I can use the MPAI-4 scores to inform decisions about a client's treatment plan					

Commitment to using the MPAI-4

Question	Extremely committed	Very committed	Somewhat committed	A little committed	Not at all committed
How committed are you to using the MPAI-4 in your clinical practice?					

MPAI-4 Behaviour

Question	Always	Often	Sometimes	Rarely	Never
I score eligible clients on the MPAI-4					
I interpret MPAI-4 scores					
I use the MPAI-4 scores to inform goal-setting with a client					
I use the MPAI-4 scores to inform decisions about a client's treatment plan					

Part B: Training needs

Do you have any comments or suggestions regarding your use of the MPAI-4 in your clinical practice?

_____

What further training would help you use the MPAI-4?

_____

- No further training necessary

Appendix C.
Interview Guides

Post-MPAI training Interview Guide [EN]

3. Thanks for taking the time to speak with me.
   We have 30 minutes scheduled for this interview today, but it can take less time - depending on how much feedback you give.

4. I will now be recording our conversation and enabling the transcription. [RECORD] + [enable transcription]
   **FOR ZOOM:* you can choose to hide the subtitles in the menu bar if they are bothering you.

5. You attended the advanced interpretation training session for the MPAI-4 a few months ago. Then, you and other attendees were invited to evaluate the MPAI-4 training session in a series of surveys. In this interview, I would like to share the results of the surveys with you to get your perspective on them. In particular, I want to better understand the reason for these results. For example, what was it that resulted in positive evaluations and what was missing to result in more negative evaluations?

   I plan to use this information to help ensure the MPAI-4 training has addressed the needs of the clinical team or update it as needed, and to inform training for future clinical practices that are being newly implemented at [JRH, Constance-Lethbridge, Lucie Bruneau]

6. Please feel free to share your point of view. <u>There are no wrong answers. Both positive and critical feedback are appreciated.</u>

   <u>My role is really to listen to your feedback and ask follow-up questions if needed to clarify my understanding</u>. You may find that you have no feedback to provide on some results – this is completely acceptable too. I encourage you to think out loud as much as possible as we go through the survey results.

   Do you have any questions before we begin?

7. **Content of the interview**

   I will share my screen with the survey results. We will start by going through the results for each group of questions, then we will consider the results of the survey as whole.

So, let's start with the first group of survey question results.

Why do you think the results for this question showed a high/medium/low impact of the training session? Why do you think the results for this [construct] showed a high/medium/low impact of the training session? Do you think this [question/construct] was addressed prior to the advanced MPAI training session? If so, when (i.e., which educational strategy amongst those already used for this implementation project?)

Overall impression of the survey results

Now, we will look at the results overall and consider them within the MPAI implementation project as a whole.

Do you have any comments on the survey results as a whole? Do you have any comments on how the advanced MPAI interpretation training session fit with the other educational strategies that have been used in this implementation project? Is there anything else relating to the advanced MPAI interpretation training session that you would like to add?

8. Perfect. That wraps it up. If anything else comes to mind, feel free to email me. Thank you so much for your participation. It really means a lot.

   Bye.

   [VIEW FULL TRANSCRIPT + **SAVE** TRANSCRIPT!!!!]

   STOP RECORDING. SAVE TO COMPUTER.

Post-MPAI training Interview Guide [FR]

1. Merci de prendre le temps de me parler. On a trente minutes pour cet entretien aujourd'hui, mais cela peut prendre moins de temps - selon la quantité de commentaires

2. Vous avez assisté à la session de formation à l'interprétation avancée pour le MPAI-4 en avril. Ensuite, vous et les autres participants avez été invités à évaluer la session de formation MPAI-4 dans une série de sondages. Dans cet entretien, j'aimerais partager avec vous les résultats des sondages afin d'obtenir votre point de vue sur ceux-ci. En particulier, je veux mieux comprendre la raison de ces résultats. Par exemple, qu'est-ce qui a donné lieu à des évaluations positives et qu'est-ce qui a manqué pour donner lieu à des évaluations plus négatives ?

   Je prévois d'utiliser ces informations pour m'assurer que la formation MPAI-4 a répondu aux besoins de l'équipe clinique ou pour la mettre à jour si nécessaire, et pour informer la formation des futures pratiques cliniques qui sont nouvellement mises en œuvre au [JRH, Constance-Lethbridge, Lucie Bruneau]

3. N'hésitez pas à partager votre point de vue. Il n'y a pas de mauvaises réponses. Les commentaires positifs et critiques sont appréciés.

   Mon rôle est vraiment d'écouter vos commentaires et de poser des questions complémentaires si nécessaire pour clarifier ma compréhension. Il se peut que vous n'ayez aucun commentaire à formuler sur certains résultats, ce qui est tout à fait acceptable. Je vous encourage à réfléchir à voix haute autant que possible pendant que nous examinons les résultats du sondage.

   Avez-vous des questions à poser avant de commencer?

4. Je vais maintenant enregistrer notre conversation et en permettre la transcription. [RECORD] + [enable transcription]

5. **Content of the interview**

   Je vais partager mon écran avec les résultats du sondage. Nous allons commencer par examiner les résultats de chaque groupe de questions, puis nous considérerons les résultats du sondage dans son ensemble.

   Commençons donc par les résultats du premier groupe de questions du sondage.

Pourquoi pensez-vous que les résultats de cette question ont eu un impact élevé/moyen/faible sur la session de formation ?
Pourquoi pensez-vous que les résultats de cette [construction] ont eu un impact élevé/moyen/faible sur la session de formation ?
Pensez-vous que cette [question/construction] a été traitée avant la session de formation avancée sur le MPAI ? Si oui, quand (c'est-à-dire quelle stratégie éducative parmi celles déjà utilisées pour ce projet de mise en œuvre) ?

Overall impression of the survey results

Maintenant, nous allons examiner les résultats dans leur ensemble et les considérer dans le cadre du projet de mise en œuvre du MPAI dans son ensemble.

Avez-vous des commentaires sur les résultats du sondage dans son ensemble ?
Avez-vous des commentaires sur la façon dont la session de formation avancée sur l'interprétation du MPAI s'intègre aux autres stratégies éducatives qui ont été utilisées dans ce projet de mise en œuvre ?
Y a-t-il autre chose que vous aimeriez ajouter concernant la session de formation avancée sur l'interprétation du MPAI ?

6. Parfait. C'est tout. Si quelque chose d'autre vous vient à l'esprit, n'hésitez pas à m'envoyer un courriel. Merci beaucoup pour votre participation. Cela signifie vraiment beaucoup.

   Au revoir.

   [VIEW FULL TRANSCRIPT + **SAVE** TRANSCRIPT!!!!]

   STOP RECORDING. SAVE TO COMPUTER.

Appendix D.
Cumulative Link Mixed Models

Table D.1: Brant's Test of Model 1 and Model 2

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Knowledge_score								
Omnibus	25.164	15	0.0478	*	99.346	18	2.9E-13	***
Event_NameT1	2.411	3	0.4915		1.77	3	0.6214	
Event_NameT2	15.988	3	0.0011	**	13.747	3	0.0033	**
Age	0.832	3	0.8418		0.864	3	0.8342	
Site3CCOMTL	1.238	3	0.7438		2.768	3	0.4288	
Site3CCSMTL -	0.097	3	0.9922		0.021	3	0.9992	
MPAI_clients					0.31	3	0.9581	
Knowledge_interpret								
Omnibus	17.24	15	0.3		18.79	18	0.4	
Event_NameT1	4.97	3	0.17		3.8	3	0.28	
Event_NameT2	1.92	3	0.59		1.39	3	0.71	
Age	5.93	3	0.11		5.48	3	0.14	
Site3CCOMTL	5.07	3	0.17		5.17	3	0.16	
Site3CCSMTL -	2.75	3	0.43		1.92	3	0.59	
MPAI_clients					2.24	3	0.52	
Knowledge_Goals								
Omnibus	21.9	15	0.11		22.472	18	0.21	
Event_NameT1	3.77	3	0.29		3.924	3	0.27	
Event_NameT2	4	3	0.26		4.131	3	0.25	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Age	1.22	3	0.75		1.371	3	0.71	
Site3CCOMTL	1.66	3	0.65		0.577	3	0.9	
Site3CCSMTL -	2.71	3	0.44		2.503	3	0.47	
MPAI_clients					0.946	3	0.81	
Knowledge_Treatment								
Omnibus	19.325	15	0.2		20.871	18	0.29	
Event_NameT1	4.224	3	0.24		4.618	3	0.2	
Event_NameT2	5.881	3	0.12		5.894	3	0.12	
Age	1.076	3	0.78		1.176	3	0.76	
Site3CCOMTL	1.279	3	0.73		0.992	3	0.8	
Site3CCSMTL -	0.342	3	0.95		0.354	3	0.95	
MPAI_clients					1.815	3	0.61	
Confidence_score								
Omnibus	18.403	15	0.242		17.194	18	0.51	
Event_NameT1	7.855	3	0.049 *		6.064	3	0.109	
Event_NameT2	2.881	3	0.41		1.68	3	0.641	
Age	7.745	3	0.052 .		7.004	3	0.072	
Site3CCOMTL	0.517	3	0.915		0.53	3	0.912	
Site3CCSMTL -	1.119	3	0.772		0.972	3	0.808	
MPAI_clients					0.717	3	0.869	
Confidence_interpret								
Omnibus	29.058	15	0.016 *		300.083	18	<0.0000000000000002	***
Event_NameT1	7.064	3	0.070 .		2.202	3	0.532	
Event_NameT2	3.457	3	0.326		3.257	3	0.354	
Age	7.998	3	0.046 *		6.964	3	0.073	
Site3CCOMTL	0.213	3	0.975		0.628	3	0.89	
Site3CCSMTL -	0.513	3	0.916		0.44	3	0.932	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
MPAI_clients					0.767	3	0.857	
Confidence_goals								
Omnibus	30.35	15	0.011 *		8.88	18	0.962	
Event_NameT1	7.77	3	0.051 .		6.98	3	0.073	
Event_NameT2	4.09	3	0.252		3.04	3	0.386	
Age	2.21	3	0.53		2.22	3	0.529	
Site3CCOMTL	2.88	3	0.411		6.23	3	0.101	
Site3CCSMTL -	9.93	3	0.019 *		3.7	3	0.296	
MPAI_clients					4.53	3	0.21	
Confidence_treatment								
Omnibus	7.862	15	0.93		12.385	18	0.83	
Event_NameT1	2.232	3	0.53		1.679	3	0.64	
Event_NameT2	0.047	3	1		0.007	3	1	
Age	0.241	3	0.97		0.412	3	0.94	
Site3CCOMTL	2.48	3	0.48		5.818	3	0.12	
Site3CCSMTL -	2.254	3	0.52		0.594	3	0.9	
MPAI_clients					3.886	3	0.27	
Attitudes_1								
Omnibus	17.495	15	0.29		22.51	18	0.21	
Event_NameT1	8.9	3	0.031 *		8.89	3	0.031	*
Event_NameT2	1.372	3	0.712		1.43	3	0.699	
Age	0.878	3	0.831		1.02	3	0.795	
Site3CCOMTL	4.882	3	0.181		1.14	3	0.766	
Site3CCSMTL -	2.981	3	0.395		3.61	3	0.307	
MPAI_clients					2.65	3	0.448	
Attitudes_2								
Omnibus	13.842	10	0.18		20.868	12	0.052	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Event_NameT1	0.134	2	0.935		0.189	2	0.91	
Event_NameT2	5.123	2	0.077 .		4.795	2	0.091	
Age	0.052	2	0.974		0.074	2	0.964	
Site3CCOMTL	2.667	2	0.264		5.784	2	0.055	
Site3CCSMTL -	0.089	2	0.956		1.692	2	0.429	
MPAI_clients					2.477	2	0.29	
Attitudes_3								
Omnibus	11.665	15	0.7		17.013	18	0.52	
Event_NameT1	5.723	3	0.13		5.818	3	0.12	
Event_NameT2	2.174	3	0.54		2.198	3	0.53	
Age	0.54	3	0.91		0.377	3	0.94	
Site3CCOMTL	3.036	3	0.39		2.72	3	0.44	
Site3CCSMTL -	0.051	3	1		0.207	3	0.98	
MPAI_clients					4.892	3	0.18	
Attitudes_4								
Omnibus	11.697	15	0.7		13.758	18	0.74	
Event_NameT1	0.487	3	0.92		0.503	3	0.92	
Event_NameT2	1.07	3	0.78		1.068	3	0.78	
Age	2.543	3	0.47		2.635	3	0.45	
Site3CCOMTL	2.185	3	0.53		0.554	3	0.91	
Site3CCSMTL -	2.456	3	0.48		1.916	3	0.59	
MPAI_clients					1.654	3	0.65	
Attitudes_5								
Omnibus	15.868	15	0.39		17.067	18	0.52	
Event_NameT1	0.987	3	0.8		0.971	3	0.81	
Event_NameT2	3.081	3	0.38		3.104	3	0.38	
Age	1.294	3	0.73		1.157	3	0.76	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Site3CCOMTL	3.518	3	0.32		2.88	3	0.41	
Site3CCSMTL -	1.923	3	0.59		1.298	3	0.73	
MPAI_clients					2.638	3	0.45	
Attitudes_6								
Omnibus	13.117	15	0.59		37.547	18	0.0044	**
Event_NameT1	0.376	3	0.95		0.498	3	0.9194	
Event_NameT2	5.395	3	0.15		5.817	3	0.1209	
Age	2.188	3	0.53		2.887	3	0.4093	
Site3CCOMTL	0.681	3	0.88		0.724	3	0.8674	
Site3CCSMTL -	1.779	3	0.62		2.576	3	0.4617	
MPAI_clients					7.197	3	0.0659	
Attitudes_7								
Omnibus	26.946	15	0.02918 *		49.21	18	0.000099	***
Event_NameT1	0.892	3	0.82724		0.93	3	0.8181	
Event_NameT2	4.126	3	0.24813		4.309	3	0.2299	
Age	1.82	3	0.6106		3.555	3	0.3137	
Site3CCOMTL	19.532	3	0.00021 ***		13.497	3	0.0037	**
Site3CCSMTL -	0.442	3	0.93152		0.254	3	0.9685	
MPAI_clients					12.479	3	0.0059	**
Attitudes_8								
Omnibus	14.94	15	0.46		34.882	18	0.0098	**
Event_NameT1	3.84	3	0.28		3.706	3	0.295	
Event_NameT2	1.17	3	0.76		1.119	3	0.7726	
Age	3.32	3	0.34		3.949	3	0.267	
Site3CCOMTL	3.35	3	0.34		0.631	3	0.8892	
Site3CCSMTL -	2.79	3	0.43		5.009	3	0.1711	
MPAI_clients					10.171	3	0.0172	*

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Skill_score								
Omnibus	18.382	15	0.243		10.037	18	0.931	
Event_NameT1	6.27	3	0.099	.	6.276	3	0.099	
Event_NameT2	3.675	3	0.299		3.591	3	0.309	
Age	0.599	3	0.897		0.39	3	0.942	
Site3CCOMTL	8.623	3	0.035	*	3.226	3	0.358	
Site3CCSMTL -	0.812	3	0.847		0.061	3	0.996	
MPAI_clients					-5.629	3	1	
Skill_interpret								
Omnibus	13.354	15	0.575		13.842	18	0.74	
Event_NameT1	0.296	3	0.961		0.067	3	1	
Event_NameT2	2.013	3	0.57		3.068	3	0.38	
Age	6.38	3	0.095	.	6.487	3	0.09	
Site3CCOMTL	0.986	3	0.805		1.074	3	0.78	
Site3CCSMTL -	2.857	3	0.414		2.009	3	0.57	
MPAI_clients					1.869	3	0.6	
Skill_goals								
Omnibus	15.01	15	0.45		21.552	18	0.25	
Event_NameT1	0.441	3	0.93		0.531	3	0.91	
Event_NameT2	2.73	3	0.44		2.695	3	0.44	
Age	2.389	3	0.5		1.95	3	0.58	
Site3CCOMTL	4.605	3	0.2		4.242	3	0.24	
Site3CCSMTL -	0.238	3	0.97		0.953	3	0.81	
MPAI_clients					4.195	3	0.24	
Skill_treatment								
Omnibus	18.382	15	0.24		22	18	0.23	
Event_NameT1	1.395	3	0.71		1.46	3	0.69	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Event_NameT2	4.688	3	0.2		4.71	3	0.19	
Age	3.437	3	0.33		2.54	3	0.47	
Site3CCOMTL	5.579	3	0.13		3.72	3	0.29	
Site3CCSMTL -	0.652	3	0.88		1.45	3	0.69	
MPAI_clients					1.92	3	0.59	
commitment								
Omnibus	11.214	15	0.74		22.767	18	0.2	
Event_NameT1	2.127	3	0.55		1.936	3	0.59	
Event_NameT2	1.186	3	0.76		1.292	3	0.73	
Age	0.733	3	0.87		0.775	3	0.86	
Site3CCOMTL	0.458	3	0.93		4.93	3	0.18	
Site3CCSMTL -	0.606	3	0.9		1.207	3	0.75	
MPAI_clients					5.988	3	0.11	
behaviour_score								
Omnibus	46.3	15	0.000048 ***		54.23	18	0.000017	***
Event_NameT1	4.93	3	0.17709		5.29	3	0.15186	
Event_NameT2	5.86	3	0.11848		5.15	3	0.16138	
Age	16.88	3	0.00075 ***		16.52	3	0.00089	***
Site3CCOMTL	9.45	3	0.02390 *		11.29	3	0.01027	*
Site3CCSMTL -	9.7	3	0.02134 *		9.04	3	0.02881	*
MPAI_clients					4.9	3	0.17899	
Behaviour_interpret								
Omnibus	14.539	15	0.49		15.314	18	0.64	
Event_NameT1	1.649	3	0.65		1.604	3	0.66	
Event_NameT2	0.288	3	0.96		0.331	3	0.95	
Age	5.418	3	0.14		5.389	3	0.15	

	X^2	df	pr(>chi)	significance level	X^2	df	pr(>chi)	significance level
Site3CCOMTL	6.059	3	0.11		4.44	3	0.22	
Site3CCSMTL -	0.897	3	0.83		1.156	3	0.76	
MPAI_clients					0.313	3	0.96	
Behaviour_goals								
Omnibus	-0.797	10	1		35.848	12	0.00034	***
Event_NameT1	2.618	2	0.27		2.614	2	0.27069	
Event_NameT2	0.592	2	0.74		0.596	2	0.74221	
Age	2.904	2	0.23		2.874	2	0.23767	
Site3CCOMTL	1.945	2	0.38		0.938	2	0.62573	
Site3CCSMTL -	0.138	2	0.93		0.232	2	0.89053	
MPAI_clients					0.245	2	0.88486	
Behaviour_treatment								
Omnibus	10.819	10	0.372		10.936	12	0.53	
Event_NameT1	1.471	2	0.479		1.473	2	0.48	
Event_NameT2	0.026	2	0.987		0.031	2	0.98	
Age	1.245	2	0.537		1.225	2	0.54	
Site3CCOMTL	6.107	2	0.047 *		4.416	2	0.11	
Site3CCSMTL -	0.697	2	0.706		0.532	2	0.77	
MPAI_clients					0.001	2	1	

Table D.2: AIC comparison (ANOVA) with highlighted cells as the selected model

outcome	base model versus model 1	base model versus model 2	base model versus model 3	base model	model 1	model 2	model 3
knowledge_score	0.0028	0.0009	0.0017				
knowledge_interpret	0.0106	0.0195	0.0104				
knowledge_goals	0.0706	0.0290	0.0181				
knowledge_treatment	0.2531	0.0162	0.0014				
confidence_score	0.0001	0.0001	0.0002				
confidence_interpret	0.0003	0.0012	0.0036				
confidence_goals	0.0223	0.0052	0.0114				
confidence_treatment	0.0305	0.0165	0.0365				
attitudes_1	0.4525	0.6269	0.7457				
attitudes_2	0.1139	0.2433	0.1180				
attitudes_3	0.7595	0.9444	0.8178				
attitudes_4	0.4299	0.6939	0.8551				
attitudes_5	0.3449	0.5871	0.1335				
attitudes_6	0.2870	0.0168	0.0011				
attitudes_7	0.3061	0.5785	0.5783				
attitudes_8	0.4077	0.6437	0.0603				
skill_score	0.0445	0.0531	0.1155				
skill_interpret	0.0382	0.0576	0.0581				
skill_goals	0.5473	0.4096	0.0528				
skill_treatment	0.8015	0.1087	0.0134				
commitment	0.0377	0.0250	0.0533				
behaviour_score	0.1941	0.3923	0.4746				
behaviour_interpret	0.2791	0.0618	0.1212				
behaviour_goals	0.5686	0.2832	0.4651				
behaviour_treatment	0.5988	0.3282	0.5106				

Appendix E.
Themes and subthemes with extended supportive quotes

Table E.1: Themes and subthemes

Theme	Subtheme	Conceptual definition	Operational definition	Exemplar quote
Behavioural Intent	Critical Behaviours	Critical behaviors are the few, specific actions, which, if performed consistently on the job, will have the biggest impact on the desired results. There are perhaps thousands of behaviors a given employee might perform on the job; critical behaviors are those that have been identified as the most important to achieving organizational success	Critical behaviors are the few, specific actions, which, if performed consistently on the job, will have the biggest impact on the desired results. In relation to the MPAI-4, these are: 4) scoring the eligible clients on the MPAI-4 5) interpreting MPAI-4 scores 6) using the MPAI-4 scores to inform goal-setting with a client and using MPAI-4 scores to inform decisions about a client's treatment plan	I think you know, we do it because we're asked to do it. Then we see the changes between the scores. I, personally, see that the numbers change, but it does not tell you much, but it will surely come with time. **Clinician 3, Site 3** "I'm not surprised that the [training evaluation] scores are lower, even eight weeks post training because the scores aren't used. They're not brought to the patient…right now, we're not showing anything. We're not using [the MPAI-4] in the intervention plan." **Clinical Coordinator 1, Site 2**

	On the job learning	Creating a culture and expectation that individuals are responsible for maintaining the knowledge and skills to enhance their own performance will encourage individuals to be accountable and feel empowered. 1. Up to 70% of all learning takes place on the job 2. Personal responsibility and motivation are key partners to external support and reinforcement efforts for optimal performance. On-the-job learning provides an opportunity for employees and their employers to share the responsibility for performance	The degree to which the individual has access to learning opportunities and support from their place of work to optimize and pursue the use of the MPAI-4.	"When research comes up with, you know, like A and we will need to know and we will need to, I guess, have some training on now that we know that this clientele could be more at risk because of, you know, those factors, what do we do with that because we will want to use it as predictive" **Clinical Coordinator 2, Site 2** "I think with time we'll see the clinical applicability of the MPAI or lack thereof. So I'm not sure how much you could adjust the training going forward. It's more about practice using it" **Clinical Coordinator 1, Site 2**
	Required Drivers	Required drivers are processes and systems that reinforce, monitor, encourage, and reward performance of critical behaviors on the job. Common examples include job aids, coaching, work review, pay-for-performance systems and recognition for a job well done. Required drivers	Strategies or environmental factors that currently or are expected to reinforce, monitor, encourage, and reward performance of critical behaviors on the job and of training session impacts on learning.	"Barring really interesting results that have, you know, direct clinical applicability and won't see people changing the way they set objectives based on MPAI scores."

		are key to accomplishing the desired on-the-job application of what is learned during training. They decrease the likelihood of people falling through the cracks, or deliberately crawling through the cracks if they are not interested.		**Clinical Coordinator 1, Site 2** "How we will train the new, the new clinicians, it will be done how, it is you mentoring, there will be training. Who, I do not know once a year where all the newcomers of each of the establishments, they will be put together, I just wonder how to train the new ones." **Clinical Coordinator 1, Site 1**
Learning	Attitude	The degree to which training participants believe that it will be worthwhile to implement what is learned during training on the job. Attitude is characterized by the phrase, "I believe it will be worthwhile" (to do this in my work).	The degree to which training participants believe that it will be worthwhile to implement what is learned during training on the job, or not.	Well, you know I think it's super relevant. Of course, we are still somewhat in the context of research. But you know, I think that in the end when we have Canadian standards, then it will be really relevant. but for now… **Clinician 3, Site 3** "I think that the team is it's an adjustment for the team. It was even flagged by our speech therapist where, you

				know, a lot of her clientele, they don't necessarily improve that much in their ability to speak or participate, but they feel more like comfortable. A lot of what we do is like helping them with adjusting to their condition" **Clinical Coordinator 1, Site 2** "Most of the clinicians don't see too much value in the ability section and flag that maybe people just want to do the participation section because that's where anticipating the biggest change or like improvement, I'll say so for sure. That that's where I guess these scores come from where most people don't anticipate really meaningful improvements, I think." **Clinical Coordinator 1, Site 2**

				"you know using this clinically with their clientele, people are unsure of the individual clinical application. So for sure it's not a priority for people, they do it because it's mandated." **Clinical Coordinator 1, Site 2** "The part about interpretation and application we still don't feel that we ever need to do an MPAI, so that is why people, why we're not using the MPAI for our benefit or for our client. I know it's being done for research. We understand the need so everyone's on board with doing it, but no one at this point. I feel that it it's a plus value for us." **Clinical Coordinator 2, Site 2**
	Commitment	The degree to which learners intend to apply the knowledge and skills learned during training to their jobs. It is characterized by the phrase, "I will do it on the job." Commitment	The degree to which learners intend to apply the knowledge and skills learned during training to their jobs, or not.	When I arrived [at Site 3], by then [the MPAI-4] was already established...You know, I do [the MPAI-4] right

		relates to learner motivation by acknowledging that even if the knowledge and skills are mastered, effort still must be put forth to use the information or perform the skills daily.		off the bat because that's how I learned to do this, but I think, it's still one more step in the preparation of [the interdisciplinary team meeting], so maybe that's why there are others who are less committed perhaps? Because I have done it from the beginning, I've been asked to do it, it's like automatic, you know. **Clinician 3, Site 3** We see that the training served a purpose. It is commitment, motivation, adherence to the tool. **Clinical Coordinator, Site 1**
	Confidence	The degree to which training participants think they will be able to do what they learned during training on the job, as characterized by the phrase, "I think I can do it on the job." Addressing confidence during training brings learners closer to the desired on-the-job performance. It can proactively surface potential on-	The degree to which training participants think they will be able to do what they learned during training on the job, or not.	For that client, I think when I saw the graph then I would think that I did something wrong when I first scored her...I was like then doubting myself because I was like shit, like, I mean, she hasn't changed, Her participation actually

		the-job application barriers so they can be resolved.		hasn't gotten worse, but it like, why are we all agreeing that things have gotten worse? **Clinician 1, Site 3** "In terms of, you know, applying this clinically with the clientele and to inform decision making, you know the team is less definitely less confident in, in the MPAIs ability for that. I think like they see it more in terms of program evaluation, more than individual client clinical application." **Clinical Coordinator 1, Site 2** "it's not the confidence in using it, in doing it in scoring it. It's a confidence in using the scores for our decisions, for our treatment. Then do the last MPAI, but the first MPAI doesn't give us anything on how to make decisions for the intervention plan. So we

				don't use the MPAI." **Clinical Coordinator 2, Site 2**
	Knowledge	The degree to which participants know certain information, as characterized by the phrase, "I know it."	The degree to which participants know certain information, or not.	"You know pre training, no one knows how to do the MPAI. Post training, people feel pretty good. I think now we see like that lower score from what I've heard from feedback from my team is for the more complex cases" **Clinical Coordinator 1, Site 2** "for the first one just scoring, I mean it for me that makes sense like after the training, it seemed like it got better overall, well, we understood how to score it better." **Clinician 1, Site 3** "Me, when I came out of the training to interpret, I was like "ahh Yes OK". But after trying it, I am like yeah to interpret it, I'm less sure now. I recognize that in myself,

				yeah." **Clinician 2, Site 3**
	Skill	The degree to which they know how to do something or perform a certain task, as illustrated by the phrase, "I can do it right now."	The degree to which they know how to do something or perform a certain task, or not.	"Maybe a gap [in the training] would be looking a bit more at interpreting the results. Uh, but I guess that'll come as we get more information by using the MPAI, on how to use it clinically, but for sure I think that would that was a gap and that was a big thing that the team highlighted to like how did, how did they really apply this clinically to their clientele." **Clinical Coordinator 1, Site 2** "So for the skills it's true that we haven't ever like spoken about concretely how we would use the MPAI to make goals or if we would, I think in general we never tried it so, you know, then people won't feel like they have the skills to do it." **Clinician 1, Site 3**
Reaction	Customer Satisfaction	The degree to which the participant is satisfied with the training	The degree to which the participant is satisfied with the	"Duration, 1h? Yeah, that's fine, that's usually

			content and duration of the training, or not.	when you have meetings on various topics is the same duration too. I think it also gave people the chance to comment, since we had the time and engagement." **Clinician 3, Site 3** "I thought the training was good. It was concise too. I like the examples that you brought to that you know people are prepared to groups for the different sections." **Clinical Coordinator 1, Site 2** "The purpose of that training was, you know how to use the tool. I think you accomplished that and you know, if we're, if you're looking into making like complex cases…just having them online on the website to refer to" **Clinical Coordinator 1, Site 2**
	Engagement	The degree to which participants are actively involved in and contributing	The degree to which participants are actively involved in and	"I also think about the others who have been

		to the learning experience. Engagement levels directly relate to the level of learning that is attained. Personal responsibility and program interest are both factors in the measurement of engagement. Personal responsibility relates to how present and attentive participants are during the training. Program interest is more commonly the focus, including how the facilitator involved and captivated the audience.	contributing to the learning experience, or not.	there longer, Ben. We had a chance to, we could ask questions, make comments, all that makes it fun for everyone. So in my opinion people, they are satisfied" **Clinician 2, Site 3**
	Relevance	The degree to which training participants will have the opportunity to use or apply what they learned in training on the job. Relevance is important to ultimate training value because even the best training is a waste of resources if the participants have no application for the content in their everyday work.	The degree to which training participants will have the opportunity to use or apply what they learned in training on the job, or not.	the relevance for me, you know, I totally agree because as I said I arrived in the Fall, I had no information before that. When I arrived I am told, Oh you have to do [the MPAI-4]. Here are the documents, but really here and there that I was learning a little more. but there, at least I had, like a lot of information that it was really relevant to me. **Clinician 3, Site 3** "what I've heard at large from my group here is that they were very satisfied with the

				training. They felt it helped them and it got people on board with using it, using the MPAI because it was easier to use.” **Clinical Coordinator 2, Site 2**

Chapter 11.
Integrated Discussion

In this chapter, I summarize the four projects which comprise this dissertation and discuss their link to the overall aim of this thesis which is to understand and optimize the sustainability and sustainment of the Mayo-Portland Adaptability Inventory – version 4 (MPAI-4) in three health regions in Québec. Following this summary, I discuss the theoretical, methodological, and practical contributions of this doctoral thesis. Finally, I describe the strengths and limitations of this thesis, propose avenues for future research and offer a concluding statement.

11.1. Summary of findings

In Canada, stroke is the tenth main contributor to years lost due to ill-health, disability, or early death (1). Stroke rehabilitation aims to reduce survivors' limitations and optimize activity and participation (2). Unfortunately, almost 50% of stroke survivors do not receive high quality rehabilitation care per best practices (3).

Best practices include person-centered care processes and the use of both outcome measures and direct interventions targeting identified impairments, activity limitations and participation restrictions. Of these, outcome measures have been found to be particularly underutilized in rehabilitation (4–7). Outcome measures can enhance care processes and patient outcomes (8,9) via their use in clinical and program evaluation. In clinical evaluation, outcome measures can be used at intake to predict which patients may benefit from an intervention, and at discharge to assess patient progress. In program evaluation, information from outcome measures is aggregated to inform programmatic decision-making such as such as patient severity data informing the financial and human resources allocated to that population.

In 2018, the Ministère de la Santé et des Services sociaux (MSSS) of Québec recognized that outpatient stroke rehabilitation programs were not using outcome measures for clinical nor program evaluation. To address this gap, the Ministry mandated that all outpatient programs use the MPAI-4 (10) to evaluate global stroke outcomes (i.e., limitations, activities, and participation) (11,12). The MPAI-4 is used around the world for this purpose (13–17). In response to this mandate, the MPAI-4 was implemented in three stroke outpatient rehabilitation

sites in Montréal and the greater Montréal area. As part of this process, the MPAI-4 implementation team comprised of researchers, managers, clinicians and IT professionals recognized early on that sustainment of the measure would be needed to reap its benefits. Sustainment refers to sustainability outcomes, including continued use, fit to workflow and financial viability, as examples. Evidence from systematic reviews suggests that newly implemented clinical practices are only sustained post-implementation 40-60% of the time (18–20). Poor sustainment can result in wasted funding and a loss of potential improvements in quality of care and patient outcomes (21).

As a first step towards improving sustainment, researchers in implementation science have generated descriptions of contextual features and strategies (21–26) that could influence sustainability (i.e., the process by which a clinical practice is sustained (27)). The next step is to generate evidence-based guidance for implementation teams so that they may improve sustainability. This is best achieved by understanding how (i.e., the mechanisms by which) sustainability strategies and contextual features produce certain sustainability outcomes (22,28–31). Very little research on the link between sustainability strategies, context and outcomes is available (32,33), and thus, there is limited sustainability guidance for implementation teams. The research presented in this doctoral dissertation addresses this gap.

The overall objective of this thesis was to understand and optimize the sustainability and sustainment of the MPAI-4 in three health regions in Québec. Four research projects within this thesis contribute to the overall aim. This dissertation was underpinned by an integrated knowledge translation (IKT) approach, whereby clinicians, managers and researchers worked together throughout the entire research process (34).

In *manuscript 1*, published in the *Archives of Physical Medicine and Rehabilitation* (20) the aim was to understand how (mechanisms) and in what circumstances (context) evidence-based practices (EBPs) in rehabilitation are sustained (outcome). In this realist review 115 documents were included, representing 61 unique implementation projects. In the included articles only 54% (n=33) of EBPs were sustained. Furthermore, sustainability planning was reported for only 26% of EBPs (n=16), but of these 94% were sustained (n=15). The Theory of Planned Behaviour (TPB) (35) and Normalization Process Theory (NPT) (36) informed the development and refinement of the main output of this review, the program theory that helps explain sustainment. The program theory was composed of 52 context-mechanism-outcome

configurations (CMOCs) with an explicitly linked strategy component. There were three overarching patterns amongst these CMOCs: (1) implementation and sustainability phases are interconnected, (2) continued use of the evidence-based practice can be interpreted as the ultimate sustainability outcome, and (3) intermediate sustainability outcomes (i.e., fit, financial viability, benefits, expertise) can become contextual features influencing other sustainability outcomes. In addition to its theoretical contribution to understanding how sustainability works, the program theory informed the sustainability planning of the MPAI-4 (*manuscript 2*), the delivery of an advanced MPAI-4 training session (*manuscript 4),* and the design and analysis of the sustainability evaluation (*manuscript 3*).

In *manuscript 2*, published in the *Journal of Clinical Evaluation in Practice*, the aim was to explore the MPAI-4 collaborative sustainability planning process. Sustainability planning was informed by the Clinical Sustainability Assessment Tool (CSAT), the Institut National d'Excellence en Santé et en Services Sociaux [National Institute of Excellence in Health and Social Services] (INESSS) MPAI-4 implementation toolkit and the program theory generated from the realist review reported in *manuscript 1*. Using a qualitative descriptive design three themes were identified that capture participants' perceptions of the collaborative sustainability planning process: (1) collaboration as a driver for sustainability, (2) co-created sustainability plan to achieve shared objectives, and (3) the iterative nature of sustainability planning. This manuscript directly responded to calls from sustainability (37,38) and IKT experts (39–41) to document and understand the process of sustainability planning (37,38,42), and IKT or other collaborative approaches (39,43). Additionally, it provided an opportunity to apply the program theory developed in manuscript 1 in sustainability planning practice.

In *manuscript 3*, published in the *Journal of Clinical Evaluation in Practice*, the aim was to understand how (mechanisms) and in what circumstances (context) the MPAI-4 is sustained (outcome) at one rehabilitation site. I conducted a realist evaluation using a mixed method, embedded single case study design, to test and refine the program theory developed in *manuscript 1*. The refined program theory consisted of 18 CMOCs that included the strategy component explicitly. The CMOCs provided evidence for four overarching patterns: (1) implementation and sustainability phases are interconnected, (2) sustainability outcomes build on each other recursively, with patient benefits as the keystone outcome, (3) sustainment is achieved

to varying levels across different sustainability outcomes (i.e., high-low continuum of values), and (4) the work of sustaining the MPAI-4 is shared amongst stakeholders.

Finally, in *manuscript 4*, currently under review in the *Disability and Rehabilitation*, the aim was to develop a tailored, theory-informed advanced training session for the MPAI-4, and evaluate its impacts on clinicians' reaction, learning and intent to start or continue to use the MPAI-4. The collaborative training development process informed by self-determination theory (SDT) (44) and behaviour change techniques (BCTs) (45) was followed by an explanatory sequential mixed method study informed by the New World Kirkpatrick's Model (NWKM) to evaluate the training session. Participants reported that the training session was engaging, satisfying and relevant, but had mixed learning and behavioural intent outcomes. Results from cumulative links mixed models of the longitudinal survey data suggest that individuals rate themselves higher on MPAI-4 knowledge, confidence, skills and behavioural intent up to 8 weeks post-training session, but not on MPAI-4 attitudes or commitment. The interview data helped shed light on the survey data in three important ways. Specifically, the qualitative data suggested: 1) that the training session was engaging, satisfying and relevant, and had positive learning and behavioural impacts, 2) that their negative attitudes and commitment towards the MPAI-4 are due to perceived limitations in the measure, especially in the rating scale, and 3) that the training session's impacts were affected by contextual factors such as the availability and acceptability of a digital platform. Since the both qualitative and quantitative results suggest that the theory-informed training session was largely effective across sites despite the differences in duration, content and mode of delivery, other outcome measure implementation teams could consider using this method to design educational strategies as part of their implementation projects.

11.2. Theoretical Contributions

There were two main theoretical contributions of this thesis: (1) the development and iterative refinement of program theories explaining how and under what circumstances rehabilitation practices – in particular outcome measures – are sustained, and (2) the iterative testing of existing theories and frameworks.

11.2.1. Development and iterative refinement of program theories explaining sustainability

Through multiple rounds of testing and application of the program theories from *manuscripts 1 and 3*, this thesis responds to calls for iterative theorizing in implementation science (46). Specifically, the program theory developed in the realist review in *manuscript 1* was applied in *manuscript 2* and *manuscript 4,* and further refined in the realist evaluation in *manuscript 3*. The result of this iterative development and testing is a more advanced understanding of sustainability in four major areas: 1) the conceptualization of sustainability; 2) the new perspectives for the sustainability and sustainment of outcome measures; 3) the relationships between context, strategies, mechanisms, and outcomes, and 4) the emphasis on influential sustainability strategies and contextual features. Each of these is discussed in the following sections.

Conceptualization of sustainability

The overall sustainability process is depicted in *manuscript 1* as primarily linear with limited recursive relationships between influential sustainability components (i.e., context, strategies, mechanisms and outcomes). In contrast, in *manuscript 3* the relationship is entirely recursive in that the influential sustainability components iteratively influence each other. The findings in *manuscript 1* and *manuscript 3* align more with the historical and modern view of sustainability, respectively. The historical view places sustainability as the end goal of a linear process (19,47) while the modern view of the past 5-10 years is of sustainability as a dynamic, iterative process of ongoing change (48–50). Since the program theory in *manuscript 1* drew on literature primarily situated within the linear view, this conceptualization of sustainability is reflected in that manuscript. In contrast, the MPAI-4 implementation team approached sustainability according to a dynamic view, in which constant change and adaptation are expected (48) (as described in *manuscripts 2 and 3*). Furthermore, *manuscripts 2 and 3* provide empirical evidence to support the dynamic view of sustainability, including highlighting the importance of planning for adaptation over time (*manuscript 2*) and identifying CMOCs that help explain how and in what circumstances adaptation can result in sustainment (*manuscript 3*).

According to the modern view of sustainability, the level of sustainment will change over time (21,48). Since the program theories developed in this dissertation indicate that outcomes

influence one another, changes in sustainment are not only due to changes in context or strategies (23,26,51–55) but also changes in other outcomes. For example, based on the CMOCs in both program theories developed in this dissertation if expertise for a given EBP decreases, so will its use. By extension, if use of an EBP decreases, so will its intended benefits. This dissertation highlighted these explicit relationships between sustainability outcomes, which participants in *manuscript 2* indicated helped them prioritize tasks within the sustainability planning process.

New perspectives for the sustainability and sustainment of outcome measures

The program theory explaining the sustainability of an outcome measure (i.e., the MPAI-4) (*manuscript 3*) challenges the common definitions of sustainability and sustainment in the literature which were primarily developed from findings of implementation projects of direct interventions. For example, Moore and colleague's 2017 definition of sustainability drew on 209 articles, of which only three were of outcome measures and six others included them (e.g., as part of a clinical practice guideline) (56). In the context of this dissertation, these differences include: (1) financial requirements, (2) the multiple dimensions of outcome measure use, and (3) lead times for receipt of benefits.

First, the MPAI-4 requires significant ongoing funding to support the digital platform (*manuscript 3*), as is the case with outcome measures in general (57–59). While many direct interventions such as physical activity interventions for at-risk and sedentary individuals also require ongoing funding (60) they usually do not require the same software or data architecture as most outcome measures. Due to the financial implications of implementing such outcome measures, successful implementation projects have often secured long-term funding to support technical requirements along with initial implementation funding, as in the MPAI-4 project (*manuscript 3*). This upfront, long-term funding requirement for outcome measures does not fit well with some sustainability conceptualizations in the literature. Specifically, the end of initial funding has been used to delineate between implementation and sustainment phases (e.g., defined as the "*continued use of program components and activities beyond their initial funding period*" (19)).

Second, as identified in the program theory in *manuscript 3*, there are multiple dimensions of outcome measure use (i.e., scoring, interpretation, application to clinical decision-making, program evaluation and research use). In contrast, the program theory in *manuscript 1*

includes one dimension of use (i.e., use with a patient, reported at clinician, organizational or systems levels). Consistent with existing sustainment definitions (23,56,61) and frameworks (21,48), use is often measured and reported unidimensionally in the literature (23,49,56,62), including in outcome measure implementation projects as scoring only (63–65). The results of this thesis challenge this unidimensional conceptualization of continued use as a sustainability (and implementation) outcome and suggest that it may be inappropriate for outcome measures. Implementation teams for outcome measures and other similar tools that are meant to inform decision-making (e.g., clinical decision support tools) should consider the dimensions of use that are required to achieve anticipated benefits. As demonstrated in the CMOCs in *manuscript 3*, different strategies are needed to target the different dimensions of outcome measure use.

Finally, the time to observe benefits from the use of an outcome measure is longer than for a direct intervention at a program level and, as demonstrated in the MPAI-4 implementation project, often at the individual patient level as well. Program-level benefits from the use of outcome measures like the MPAI-4 accumulate slowly as the data are aggregated, then clinicians or managers interpret and apply the information from the aggregated data to their decision-making. Clinicians in the MPAI-4 implementation project also indicated that analyses of local data that matched current psychometric evidence were important to gain trust in applying MPAI-4 scores to their patient-level decision making. Results of a systematic review of the experiences of clinicians using patient-reported outcome measures similarly indicated that clinicians across included studies expressed a lack of trust in these measures, slowing their integration of them into their clinical decision-making and delaying the receipt of benefits from them (66). In contrast, when using a direct intervention, the clinician can observe the patient that they are working with and can often observe the benefits from that practice (or lack thereof). Drawing from the program theories in *manuscript 1 and manuscript 3*, and the results of *manuscript 2* and *manuscript 4* suggests that the extended time it may take to observe the benefits of newly implemented outcome measures may negatively influence sustainability and sustainment. For example, the long wait to observe benefits contributed to poor attitudes and a lack of buy-in amongst clinicians, threatening the sustainability and sustainment in the MPAI-4 project (*manuscript 3)*. While observable patient benefits would have made the MPAI-4 sustainability process easier, the results of this thesis challenge the existing literature that suggests that benefits are a requirement for sustainment (49) – within a reasonable timeframe. In the MPAI-4 project,

stakeholders do not expect benefits at the individual or program levels for at least another 1-2 years (i.e., 2-3 years post-implementation), and at the time of this dissertation, are willing to wait in expectation of these future benefits.

Relationships between context, strategies, mechanisms and outcomes

In the last 10 years, researchers have highlighted the pressing need to understand relationships between context, strategies, mechanisms, and outcomes in implementation science broadly (28,29) and sustainability specifically (22). Moving beyond descriptions of these factors, this dissertation provided evidence to explain how the use of a strategy within a certain context generates the resulting sustainability outcome. Specifically, the CMOCs making up the program theories in *manuscripts 1 and 3* provided these specific hypotheses. This research has therefore provided guidance on the which strategy to can be used to achieve sustainment given a certain set of circumstances (22). This guidance was applied in *manuscript 2* and *manuscript 4* to inform sustainability planning and prompt the development of advanced training sessions, respectively. The explanations of sustainability generated from this doctoral research are not only useful in practice because they can suggest a strategy to select to achieve a certain outcome in a specific context, but also represent testable hypotheses that researchers can continue to test and refine.

Influential sustainability strategies and contextual features

The program theories in *manuscripts 1 and 3* as well as the sustainability plan developed in *manuscript 2* highlighted some particularly influential strategies and contextual features. In terms of strategies, these include early sustainability planning (especially concurrently with implementation planning), ongoing training, adaptation and access to an acceptable digital platform. Influential contextual factors include staff turnover, the provincial mandate to adopt the MPAI-4 and the perception of the utility of the measure. All of these have been previously identified as influential for sustainability (20,26,51), including for outcome measures specifically (67). In this way, the results of this dissertation aligns with the current literature. However, the unusual influence of turnover and the provincial mandate were specific to this doctoral research and further advance our understanding of these factors, as described in the following paragraphs.

Turnover amongst clinical teams is often cited as a major barrier to sustainability (22,63,68). It was also highlighted as a barrier to be overcome during MPAI-4 sustainability

planning (*manuscript 2*). However, in *manuscript 3* CMOCs indicate that relevant and acceptable MPAI-4 orientation training for new clinical team members can make the influx of newly trained clinicians a facilitator of sustainability. Participants in both *manuscripts 3 and 4* representing new and long-time members of the clinical team independently proposed that, unlike for members of the team who need to modify their existing workflow, new team members would more easily accept the MPAI-4 because it does not represent a practice change. Thus, the influx of new clinicians to a clinical team represents an opportunity to strengthen the sustainability and sustainment of an evidence-based practice, if the appropriate orientation strategy is in place. Furthermore, the newer team members may be a form of peer support, in this case influencing peers to use the new practice (69,70). This challenges the dominant view of turnover as a barrier to sustainment (68).

Government mandates are typically cited as supporting the implementation and sustainability of evidence-based practices (51). However, like Copeland and colleagues (71), we found that the imposition of outcome measures led to negative attitudes towards the tool (see *manuscript 2, manuscript 4,* and *manuscript* 3 CMOCs). We posit that a facilitating factor of mandates would be follow up that incentivizes sustainment. For example, the MSSS could incentivize the use of the MPAI-4 by aggregating and comparing these scores at the provincial level as part of benchmarking between sites or regions. It is currently unclear if, and how, the MSSS will follow up on their MPAI-4 mandate. Stakeholders' experience of the MPAI-4 mandate challenges the common conceptualization that mandates are either a facilitating contextual factor (51) and/or strategy (72).

11.2.2. Testing of existing theories and frameworks (iterative theorizing)

A process of iterative theorizing (46) helped inform the development of the program theories but was also applied to existing theories and frameworks. Based on how the theories were used throughout this doctoral research, I highlight strengths and areas which could be improved. This information may contribute to their further refinement and application by other researchers.

In *manuscripts 1* and *3* Normalization Process Theory (NPT) (36) and the Theory of Planned Behaviour (TPB) (35) were used in combination to holistically inform the development and testing of the program theory. Although the TPB was applied in this context and appears to

have complimented NPT, the application of NPT was challenging. In a 2018 systematic review of the uses and limits of NPT, the authors of at least 13 of 130 included articles reported obstacles or challenges in applying NPT. Critiques were primarily focused on NPT terminology, specifically the overlap between NPT constructs and the difficult, technical vocabulary used to describe each NPT domain and construct (73). For example, Leon and colleagues reported that the fit of the intervention within the clinical workflow could be coded to interactional workability, relational integration or skill-set workability constructs which hindered their ability to code this concept (74). Other authors applying NPT as a coding frame have reported similar challenges (75,76). This was also the case in this doctoral research, especially within *manuscript 1* when NPT was used as a deductive framework to code mechanisms. In fact, authors of the systematic review found that difficulty coding to NPT was more common when the theory was used deductively rather than when the framework loosely informed a more inductive approach (73). Recently, the developers of NPT have tried to address these recurring difficulties by developing an NPT coding manual that may be applied when using qualitative content analysis. In addition to presenting an NPT codebook, the authors have made the language much simpler. Although this article with recent guidance on how to code was published after the use of NPT as a coding frame was completed in this dissertation, it is likely that this update would address concerns identified in the systematic review and I echo from my experience during this dissertation. Authors using NPT in the future should consider reporting on the utility of the NPT coding frame and/or the updated definitions provided within it.

SDT (44), BCTs (77) and the NWKM (78) were used in *manuscript 4*. BCTs provided a structured method to operationalize SDT and the NWKM informed the goals of the training session. The NWKM, SDT and BCTs were compatible, in that combined, they provided an explanation for and guided the evaluation of relevant training outcomes. However, it was difficult to create links between SDT and BCTs, particularly for the connectivity and autonomy SDT constructs. The previous links between SDT and BCTs made by other authors (79–81) informed those made in *manuscript 4* between these theories. Future work could continue to build on the explicit guidance on the points of connection between SDT and BCTs so that their combined use is optimized in future implementation projects. There were also some minor concerns raised regarding the NWKM, specifically in how some of the constructs are operationalized in a survey. During one of the interviews, a participant noted that they conflated

the knowledge ("I know how to…") and skills ("I think that I can do…") constructs, thinking that the questions were redundant. As the wording for each construct is taken directly from NWKM, perhaps clearer language is needed, especially in a survey format. Construct clarity is key to support a common conceptualization, which in turn supports accurate measurement and discussion of that construct (82).

In summary, the theories (i.e., TPB, NPT, BCTs) and frameworks (i.e., NWKM) that were used in this dissertation were informative, but further development or refinement may be helpful. In implementation science, theories and frameworks promote transferability and a shared understanding among researchers and practitioners by providing a common language that can allow for easier comparison and application across studies and contexts (83,84), and can inform implementation and sustainability planning and evaluation (84,85). However, research has indicated that the misuse or superficial use of theories or frameworks is not uncommon (83) and that their continued proliferation may hinder both the identification and selection of the most suitable ones to support an implementation project (86). Researchers have recommended focusing on using existing theories and frameworks, testing, and further refining them as needed (46). As already seen in the updates of Kirkpatrick's model (78) and NPT (36,87,88) over time, a cycle of iterative theorizing can lead to important improvements in the utility of the theory or framework.

11.3. Methodological Contributions

This thesis makes three main methodological contributions: (1) the benefits and value of the IKT approach; (2) the innovative application of realist review and realist evaluation methodologies; and (3) the comprehensive measurement of sustainability and sustainment.

11.3.1. Benefits and value of IKT

Collaboration via an IKT approach underpinned this dissertation. In the empirical studies reported in *manuscripts 2, 3* and *4* the use of an IKT approach resulted in a more nuanced conceptualization of sustainability and sustainment. For example, clinical stakeholders in *manuscripts 2* and 3 indicated that an emphasis on continued benefits was essential to align with the patient-centred care model that they work within. By incorporating feedback such as this,

sustainability and sustainment were defined in a way that was relevant to all stakeholders, in turn enhancing the relevance of the resulting research. This finding supports what researchers suggest the impacts of using an IKT approach would be on sustainability (89,90). Furthermore, the relationships built with stakeholders as part of the IKT approach created opportunities to disseminate the results of this dissertation amongst both the clinical and wider research team.

In a recent meta-synthesis of IKT casebooks published by the IKT Research Network (91) the authors of only one included project reported IKT having an impact on sustainability. Authors of the meta-synthesis noted that a key area for future research would be to investigate the extent to which and how, collaboration impacts sustained practice change (91). Evidence from this dissertation indicates that there are benefits of using an IKT approach for the sustainability of an evidence-based practice. Collaborating closely with various stakeholders (i.e., managers, clinicians, IT specialists, project management professionals) helped us contextualized and therefore tailor the implementation efforts associated with each project. This is further supported by the results from *manuscript 3*, in which 3 of 18 CMOCs link collaboration to enhanced sustainability and sustainment. As a direct example of the positive impact of collaboration, in *manuscript 2* we identified the importance of shared outcomes that collectively fit diverse stakeholders' needs, consistent with Smith and colleagues' 'unifying outcomes' concept (89). In *manuscript 4*, without the close collaboration and relationships with participating rehabilitation sites, we would not have known that additional, advanced training sessions on the MPAI-4 were needed. Our response to this need contributed to the research team maintaining the relationships that we have built with the clinical teams over the years and helped optimize the success of the MPAI-4 implementation project.

Each manuscript reports on the collaboration process with stakeholders including providing extensive detail of the process in the appendices. Experts in IKT and other collaborative approaches have highlighted the need for thorough descriptions of collaboration so that the active ingredients and best practices can be identified (34,92,93). This dissertation makes an important first step towards that aim. Building on this work, a targeted investigation into the long-term benefits, challenges and potential solutions with sustaining such a collaboration would be a meaningful avenue of future research, especially in relation to evidence-based practice sustainability (*as discussed in the future research section).*

11.3.2. Innovative application of realist review and evaluation methodologies

Although realist methodologies were first developed in 1997 (94), these methodologies have only gained traction in implementation science (95) over the past 5-10 years (96,97). However, in this time their use has greatly increased because they offer researchers the opportunity to investigate causal mechanisms (i.e., the how and why) (22,30,96,98). Three components of the realist synthesis and realist evaluation designs employed in this dissertation were innovative and could serve as examples for other researchers.

Typically, realist methodologies are used to better understand a single intervention. For example, the sustainability of Lean in pediatric healthcare (32) or the impact of a specific home services program for community-dwelling patients (99). In contrast, in the realist synthesis in *manuscript 1*, sustainability was investigated without specifying a single intervention. Only one other realist synthesis has been conducted on a process in general, namely a review on the process of collaborative approaches to research by Jagosh and colleagues (100). While integrating data across varied interventions adds a layer of complexity to an already complex methodology, it also provides a robust method for investigating the core contextual features that influence the process under study. The results of *manuscript 1* demonstrate that it is possible to apply a realist review methodology in this manner to synthesize sustainability information from diverse contexts and interventions, something which is difficult to achieve and often a source of frustration for authors of systematic reviews in implementation science (101–104).

In *manuscript 3*, I applied a realist evaluation methodology to understand a single intervention – MPAI-4 sustainability. In this case the use of a mixed method design was the unusual feature. Despite realist experts (including Pawson who is the creator of the methodology (94,105),) recommending the use of both qualitative and quantitative methods to best capture the diverse context, mechanism and outcome components (106), these designs are often not employed by realist evaluation authors (95,97,107). This weakness in available realist evaluations was highlighted by Pawson and Manzano-Santaella (107), and confirmed in two systematic reviews of realist evaluations in which less than 50% of included studies employed mixed-methods, with the rest employing qualitative designs (95,97). When realist evaluations are based only on qualitative data, outcome data are collected via self-report which is prone to bias (e.g. social desirability bias) (108). But the limitation of foregoing quantitative data in realist evaluations further effects the integrity of the results, as Pawson and Manzano-Santaella state:

"*Setting aside all problems to do with selectivity, social desirability effects, chatty bias, researcher partisanship, and so on, the problem is that hand-picked, personalized [qualitative] description of outcomes cannot reveal collective outcomes patterns. Realist evaluation presupposes pattern*" (107). The results of this dissertation underscore the utility of mixed methods in realist evaluation – by combining mixed methods and realist approaches, it was possible to develop a deeper understanding of the phenomenon under study (109,110). *Manuscript 3* can stand as an exemplar for others, especially due to the detail provided in Appendix D of that manuscript which notes the data source (i.e., patient chart review, survey, interview, documents, results and/or data from prior MPAI-4 implementation project studies) for each strategy, context, mechanism and outcome component, for each CMOC.

An additional unusual feature in both the realist review and evaluation was explicitly dividing the mechanism into its two separate components – human reasoning (for which the term mechanism is retained) and resources (for which the term strategies is used, a more common word for this similar concept in implementation science) (30). Dividing the mechanism into its two component parts has been recommended in implementation science to better align with the terminology typically used in this field (30). Furthermore, by dividing the mechanism into two parts, the mechanism is not the strategy alone, a common pitfall researchers run into when using realist methodologies (111).

11.3.3. Measurement of Sustainability and Sustainment

The CSAT was used to measure sustainability capacity, or the ability of each site to sustain the MPAI-4 (112). The results from this measure informed MPAI-4 sustainability planning in manuscript 2 and were used to evaluate sustainability in *manuscript 3* – recognized gaps in the literature (113,114). Participants in *manuscript 2* reported mixed perceptions of the CSAT: some thought it prompted reflection of a range of sustainability factors while others thought that they could have easily shared the information that the CSAT generated if asked. Several implementation team members stated that while they appreciated a numerical score to prompt planning, they thought that several items were irrelevant for this project (e.g., 'the [MPAI-4] engages other medical teams and community partnerships as appropriate' as no medical teams nor community partners were engaged to begin with). Some items were perceived as irrelevant during MPAI-4 planning but may be useful as part of sustainability evaluation over

time (e.g., 'the [MPAI-4] has evidence of beneficial outcomes'). In *manuscript 3*, the scores were applied to the development of CMOCs, although the items that were previously highlighted as irrelevant by participants were interpreted cautiously unless also triangulated with qualitative data. In sum, though the CSAT informed the selection of sustainability strategies during sustainability planning and was used as part of evaluating sustainability, it may benefit from further psychometric investigation (as discussed in the future research section).

Consistent with recommended best practices (22,23,56), in *manuscript 3* sustainment is measured as a diverse set of primarily continuous outcomes, including use, fit to workflow, benefits, expertise and financial viability. These comprehensive sustainment data were collected using a variety of interview and survey questions, as well as existing measures. However, given the relative lack of existing measures of sustainment (114,115), innovative ways to measure some sustainability outcomes were needed. A Visual Analog Scale (VAS) was developed, which is a novel method to measure outcomes in implementation science (101).

VAS originated in measuring pain intensity and have since been applied to measure other health outcomes (116–118). According to a 2020 systematic review of outcome measures in implementation science, VAS have not previously been used to measure implementation outcomes (101). In *manuscript 3*, the results from four VAS about the sustained use of the MPAI-4 triangulated with other data collected on the sustained use of the MPAI-4. Thus, VAS appear to fit the needs of sustainment measurement – they are pragmatic (119–121), have the potential to be applied to all sustainment subconstructs and are scored on a continuous scale (22,101,114). A structured approach to the development and psychometric testing of VAS to measure sustainability (or implementation) outcomes is merited (*as discussed in the future research section*).

11.4. Practice Contributions

This dissertation has practical contributions to: (1) the implementation, scale-up and spread of the MPAI-4, (2) the understanding of the evidence-based use of the MPAI-4, and (3) the larger digital health implementation project that the MPAI-4 project is embedded within.

11.4.1. MPAI-4 implementation, scale-up and spread

This dissertation had a direct impact on the MPAI-4 implementation project in which it was conducted. The knowledge gained in each project was communicated to implementation stakeholders and used to inform decision-making in each of the three participating sites. In addition, knowledge of the MPAI-4 was shared with new sites and programs as part of a subsequent phase of scale-up and spread. For example, adaptations of MPAI-4 implementation strategies for use in traumatic brain injury are already underway (e.g., MPAI-4 educational strategy (*manuscript 4*), digital platform, etc.). Furthermore, there are preliminary discussions to implement the MPAI-4 in stroke rehabilitation at a new site according to the same process detailed in *manuscript 2*. The information gained on how to successfully sustain the MPAI-4 will continue to be applied during scale-up and spread, as is recommended for these related processes (122–124). Continued evaluation of sustainability in conjunction with scale-up and spread of the MPAI-4 could be a valuable direction for future research.

11.4.2. Understanding the evidence-based use of the MPAI-4

The MPAI-4 was first developed over 30 years ago, but in this time, there have been no published implementation studies. *Manuscripts 2, 3* and *4* address this gap. Although not an objective of this thesis, clinical stakeholders shared information concerning the content validity of the MPAI-4 during data collection. Stakeholders perceived limitations with the MPAI-4's rating scale and the relevance of some of the items to a stroke population. They also expressed how they wanted to use the MPAI-4 in the future to make it a practice worth sustaining (e.g., use admission scores to predict participation outcomes). This could provide fertile ground for additional psychometric testing (e.g., predictive validity). A systematic review published in 2023 of the MPAI-4's psychometric properties conducted by the full research team involved in this MPAI-4 implementation project exposed similar gaps in content validity and other psychometric properties in the existing literature (12). Taken together, the evidence suggests that for the MPAI-4 to be sustained, further psychometric testing is needed to address the perceived limitations and to further inform the evidence-based use of the measure (*as discussed further in the future research section*).

The need for further psychometric testing of some of its key properties leads to critique of the top-down approach of the MPAI-4 mandate. In order to help standardize rehabilitation care, policy-makers made a centralized decision that effected the entire province (125). However, local clinical teams are concerned about the lack of transparency in the decision-making process for the mandate, especially due to the limitations they perceive with the MPAI-4. The uncertainty as to whether the perceived limitations with the MPAI-4 can be addressed, and if changes may be made to the MPAI-4 mandate as part of another top-down decision-making process, currently have a small negative effect on sustainability. Over time as psychometric information becomes available, and the future of the mandate is clarified, these may become either positive or negative influences on MPAI-4 sustainability.

11.4.3. MPAI-4 implementation within a larger digital health implementation project

The MPAI-4 implementation project took place within a larger program, specifically, BRILLIANT (Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies in Community Mobility Rehabilitation). The objective of the BRILLIANT program is to optimize the mobility of persons with acquired brain injury across their lifespan. A large research and IT team is developing and deploying a comprehensive platform that will collect the MPAI and other outcome measures. The aim is to create a database that combines clinical outcome measures, patient reported outcome measures, wearables data, and administrative data to evaluate the factors that result in poor mobility so that personalized mobility interventions tailored to specific patient sub-groups can be developed. Clinicians could then use this monitoring system to deliver the right intervention to the right person at the right time. Ultimately this would optimize a patient's functional potential and meaningful participation in the community. The MPAI-4 is amongst the first of several projects which will feed into the database, thus informing clinical decisions. The series of studies in this thesis have provided a road map to successfully implement and sustain subsequent BRILLIANT digital platforms, and to continue to measure and feedback data that is meaningful to clinicians and decision-makers.

11.5. Strengths and Limitations

11.5.1. Strengths

There are two main strengths of this thesis beyond those mentioned in individual manuscripts or that are recurrent amongst them: (1) the use of theory and/or frameworks enhancing the transferability of research results and informing sustainability success, and (2) the use of an IKT approach and selected study designs supporting a contextualized understanding of sustainability.

First, in *manuscripts 1, 2, 3* and *4* theories, frameworks and/or measures were used to inform the research project (i.e., data collection, analysis and reporting) and sustainability practice (i.e., sustainability planning, training development and delivery). These included NPT, TPB, SDT, BCTs, NWKM and the CSAT. By using theories and frameworks to guide each of the research projects, results are reported in a common language that makes the results easily comparable to other EBPs and contexts, enhancing their transferability and building on the existing evidence base (83,84). The theories, frameworks and measures applied to sustainability practice provided a structured approach to sustainability planning and the advanced training session that optimized their success according to best practice as recommended in the literature (126,127).

Second, the use of an IKT approach (*manuscripts 2, 3* and *4*) or extensive stakeholder consultation (*manuscript 1*) promoted a more contextualized understanding of sustainability and sustainment. *Manuscripts 1* and *3* explicitly included context within the study objective, while *manuscripts 2* and *4* included the concept via the inclusion and comparison of multiple sites. In *manuscripts 2, 3* and *4* the use of an IKT approach optimized data collection concerning contextual factors throughout the project, especially as they changed due to key events (e.g., COVID-19, new data privacy law, etc.). Context is a key component in differences in implementation outcomes across sites, thus it is widely recommended in implementation science that information on context be collected, analyzed and reported (52,53,128,129).

11.5.2. Limitations

In addition to the specific limitations reported in each manuscript, additional limitations arose due to the modifications made to adapt to project delays, and/or are limitations that apply to the broader program of research reported in this dissertation.

As described in Chapter 2, both COVID-19 and a new law regulating patient data delayed the MPAI-4 implementation project and data collection for this dissertation. The major modifications included changing the design in *manuscript 3* from a multiple case study to a single case study design and changing the project in *manuscript 4* from psychometric testing of the CSAT to the design and evaluation of the advanced MPAI-4 interpretation training sessions.

There are limitations to a single case study design that are not present in a multiple case study design, especially in realist evaluations. Since realist methodologies stress the importance of context, conducting data collection in diverse settings to refine the program theory is ideal. Thus, multiple case studies are typical (95). The limitation of only collecting data on contextual features in one setting was mitigated through the embedded analysis at the level of the clinician, in which clinicians' sustainment of the MPAI-4 was compared rather than sites (i.e., cases). This comparison allowed for demi-regularities (i.e., recurring patterns) to be identified to refine the program theory.

In changing the planned project of *manuscript 4*, we were unable to estimate the CSAT's psychometric properties. The interpretation of the CSAT in this dissertation has suffered as a result. Namely, CSAT scores were only cautiously applied to inform decision-making for MPAI-4 sustainability (*manuscript 2*) and in the refinement of CMOCs (*manuscript 3*).

Across *manuscripts 2, 3* and *4* I used some measures and survey questions that have not been psychometrically tested. Specifically, we developed VAS to measure sustainment intensity (*manuscript 3*) and survey items based on the NWKM (*manuscripts 3* and *4*). Although they were theory-informed, expert-written and piloted for clarity, the results were treated with caution. Results from these measures and survey questions were triangulated with other data in all cases.

Finally, despite securing funding to compensate patient partners in accordance with best practices (130), we ultimately did not engage a patient partner in the MPAI-4 implementation project. Including a patient partner was deprioritized in favour of having a faster implementation timeline – especially following delays. When explicitly asked about excluding a patient partner,

stakeholders provided different explanations. Individuals at Sites 2 and 3 thought that patient partners were unnecessary on this project. A manager in Site 1 thought that while patients' insights would have been valuable, they were too difficult to engage. These perceptions mirror findings from the past 20 years in which time often restrains teams from working with a patient partner (130–132) and that patient partners aren't always seen as a priority (133). While there were barriers to including a patient partner, that does not mitigate the limitation of not engaging them. Including a patient's voice may have made the results of the project more relevant to them, as the ultimate recipients of the benefits of using the MPAI-4.

11.6. Future research

The results presented in this dissertation indicate several potentially fruitful theoretical and methodological (measurement) avenues for future research.

11.6.1. Theoretical

There are three theoretical avenues for future research: (1) continued iterative theorizing of the program theory, and other theories used to inform our understanding of sustainability, (2) the identification of milestones or indicators that can (help) mark the shift from implementation to sustainment, and (3) explanations of how IKT works, including in projects with mixed or negative results.

First, researchers can continue the process of iterative theorizing of the program theory, and other theories used to inform our understanding of sustainability. A recent systematic review (23) and umbrella review (134) identified over a dozen commonly used theories that explain sustainability. When the implementation theory comparison and selection tool (T-CaST) was applied by the umbrella review authors to evaluate the capability of each theory to explain sustainability, they found that no theories achieved a perfect score which suggests that theory refinement is needed (135,136). Furthermore, research agendas developed by leading implementation experts in 2015 (38) and 2019 (37) both highlighted the need to test existing sustainability theories and better understand causal mechanisms. Based on the results of this dissertation, the combination of NPT and TPB within the program theory developed in *manuscript 1* and *manuscript 3* seems to be a promising combination of theories to explain

sustainability. We recommend that researchers continue to test these and other theories that have the highest explanatory potential regarding sustainability (134).

Second, the identification of milestones or indicators that can (help) mark the shift from implementation to sustainment would be fruitful direction for future research that could further our understanding of these entwined phases. We recommend that researchers conduct a longitudinal evaluation of implementation and sustainment, and compare key indicators between these phases or identify important milestones to mark the transition from one phase to the other. Results from this research would offer researchers firmer guidance on when an evaluation of sustainment should take place, as compared to an implementation evaluation. Current guidance from RE-AIM states that sustainment should be evaluated at least one year following implementation (21), increased from six months post-implementation in earlier guidance (135). In manuscript 3 of this thesis, we asked questions of clinical stakeholders to determine if they had moved from implementation to sustainment before conducting the sustainment evaluation. For example, asking if the MPAI-4 was a normal process within their workflow. A more robust understanding of the transition between these phases would standardize investigations of implementation and sustainment, enhancing comparability across studies and contexts.

Finally, future research into the links between the use of collaborative approaches such as IKT and sustainability would be beneficial. The CMOCs in *manuscript 3* provide testable hypotheses that could inform such an investigation. Furthermore, echoing calls of authors of a recent meta-synthesis of IKT projects (91), authors working with collaborative approaches should report detailed descriptions of IKT projects with mixed or negative results. Understanding why collaborative projects are unsuccessful is as important as understanding their success.

11.6.2. Methodological (Measurement)

There are three methodological avenues for future research, all regarding measurement: (1) investigation of the sustainability of outcome measures as unique EBPs; (2) psychometric testing of sustainability measures (VAS and CSAT); (3) psychometric testing of the MPAI-4.

First, targeted investigations of the sustainability of outcome measures are required because they have unique sustainability processes and outcomes when compared to direct interventions. Outcome measure initiatives such as HealthMeasures have released implementation guides for the Patient-Reported Outcomes Measurement Information System

(PROMIS) measures (137), but these are focussed on adoption. Since outcome measures need to be used over the long-term for their potential benefits to be realized, further investigation into the sustainability of outcome measures and the subsequent development of recommendations to optimize their sustainment would be advantageous.

Second, psychometric testing of sustainability and sustainment measures is urgently needed. The sustainment VAS used in *manuscript 3* is a promising area for future development. VAS align with calls for implementation science measures to be pragmatic (114,119,121,138) since it may be possible to use one question to measure each sustainability outcome. This would lead to about 5-10 questions (depending on which outcomes are relevant in a certain context) to holistically measure sustainment on a continuous scale. A maximum of 10 questions is recommended in implementation science to keep measures practical (121). Sustainment VAS development and psychometric testing could be informed by guidance and frameworks from the health sciences (139), social sciences (140,141) or from implementation science (119), or perhaps most productively, draw on all of these. Regardless, the development of the VAS should start with item creation because the VAS developed in this dissertation were not fully probed for comprehensibility, relevance or comprehensiveness.

The CSAT would also benefit from further psychometric development and testing. In particular, the CSAT is quite long (35 questions) and has some questions that users mentioned were not relevant to them in the rehabilitation context or when implementing outcome measures. Further investigation of the CSAT's content validity in these settings may be beneficial, as would testing to see if the measure is reliable with less items. Furthermore, predictive validity for the CSAT would be very useful to implementation teams. Specifically, linking a CSAT score from pre- or during implementation to an anticipated level of sustainment a certain amount of time post-implementation.

Finally, further psychometric testing of the MPAI-4 would address key barriers to sustainability identified throughout this dissertation. The content validity, predictive validity, responsiveness and minimal important change information that participants highlighted as core areas for future research for the measure's use in stroke rehabilitation are consistent with the evidence gaps as reported in our team's systematic review of the MPAI-4's psychometric properties (12). Further research on the MPAI-4 could help address the barrier that the measure presents to sustainment, or conversely, justify the MPAI-4's de-implementation.

11.7. Conclusion

This dissertation makes an original and valuable contribution to the practice, methods and theory of sustainability and sustainment. The four manuscripts in this dissertation employed a wide range of rigourous methods and involved clinical and IT stakeholders. Collectively, the manuscripts in this thesis: (1) develop and refine a program theory explaining how sustainability works in rehabilitation, especially for outcome measures, (2) highlight the benefits of an IKT approach for sustainability, (3) demonstrate the comprehensive measurement of sustainment, (4) contribute to the success of the MPAI-4 implementation project thus far; and (5) highlight ways to sustain and improve on this success into the future. These contributions have advanced the literature and indicate promising avenues for future research.

In an era of mounting pressure on healthcare personnel, organizations and systems, a focus on both implementing and sustaining new evidence-based practices may play a key role in achieving the quintuple aim in healthcare: (1) pursuit of better patient outcomes, (2) improved patient experience, (3) improved clinician experience, (4) improved health equity and (5) cost-effective care (38,142,143). Achieving the quintuple aim (144) will not be possible with just one solution. However, considering the words of leading health journalist in Canada, André Picard, that "*the healthcare system is in an implementation crisis*" (145), a focus on optimizing implementation and sustainability may be a good place to start.

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