KNOWLEDGE BROKERS IN REHABILITATION: WHO THEY ARE, HOW THEY ARE UTILIZED, AND HOW THEY ARE TRAINED TO IMPROVE EVIDENCE-BASED PRACTICE

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December, 2020

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy (Rehabilitation Sciences)

Dedication

“The God of heaven, he will prosper us; therefore we his servants will arise and build”

Book of Nehemiah 2:20

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LIST OF ABBREVIATIONS

BC: British Columbia
CC: Courtiers en Connaissances
CFIR: Consolidated Framework for Implementation Research
CHERRIES: The Checklist for Reporting Results of Internet E-Surveys
CHSRF: The Canadian Health Services Research Foundation
CIHR: Canadian Institutes of Health Research
CMO: Context-Mechanism-Outcomes
CoP: Community of Practice
CRIR: Centre de recherche interdisciplinaire en réadaptation
DCs: Chiropractors
EBP: Evidence-Based Practices
EPOC: Cochrane Effective Practice and Organization of Care Review Group
ETO: Educational training opportunities
KBs: Knowledge brokers
KT: Knowledge translation
KTECOP: The Canadian Knowledge Transfer and Exchange Community of Practice
LBP: Low back pain
LO: Les leaders d'opinion
MeSh: Medical Subject Headings
MSK: Musculoskeletal disorders
NP: Neck pain
OLs: Opinion leaders
ON: Ontario
OTs: Occupational therapists
PARiHS: The Promoting Action on Research Implementation in Health Services framework
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PTs: Physiotherapists
QC: Quebec
RCT: Randomized Control study
SLPs: Speech-language pathologists
SRQR: The Checklist for qualitative studies: Standards for Reporting Qualitative Research
TICD: Tailored Implementation for Chronic Diseases
UK: United Kingdom
USA: United State of America
WA: A weighted-average
WHO: World Health Organization
WIDER: Workgroup for Intervention Development and Recommendations

ABSTRACT

Despite available evidence to support optimal practices in rehabilitation, significant knowledge-practice gaps persist. Though knowledge brokers (KBs) can promote the uptake of research evidence to inform clinical practices, four major knowledge gaps were identified in the rehabilitation literature, potentially hindering their utilization. First, evidence on mechanisms underpinning KBs roles, and guidance on the type of support needed for successful implementation of these roles in rehabilitation contexts was scarce. Secondly, little was known about who KBs are, the type of work they do, and their training. Thirdly, no prior research has discussed the factors influencing the utilization of KBs to inform their employment within the rehabilitation sector. Lastly, the characteristics and content of educational training opportunities (ETO) offered to healthcare professionals who wish to undertake KBs roles, across Canada were unknown. Establishing a portrait of Canadian KBs working in the rehabilitation sector may inform health care organizations and knowledge translation specialists on how best to advance KBs' practices.

The overall objective of this thesis was to increase our knowledge about KBs to optimize their utilization in promoting the uptake of research evidence into rehabilitation clinical practice. Specifically, manuscript (1) aimed to highlight the differences and similarities between opinion leaders (OLs) and KBs with respect to context, mechanism, and outcomes. In particular, the objective was to describe the common patterns of OLs and KBs with respect to the context they work in, the mechanisms by which they impact outcomes, and the types of outcomes they influence. Manuscript (2) aimed to describe the profile of KBs working within rehabilitation settings in Canada, including the sociodemographic and professional characteristics, work activities, and training. Manuscript (3) aimed to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings, and manuscript (4) aimed to identify and describe current educational training opportunities (ETO) for KBs in Canada and to explore whether these programs meet the competencies needed for the KBs roles.

The first manuscript was a realist review. A search strategy was developed in collaboration with an academic health-sciences librarian. The subject headings (MeSH), keywords, and abstract/text words for knowledge translation, OLs and KBs, and rehabilitation, and their synonyms were searched across five databases (OVID MEDLINE, EMBASE,

PsycINFO, CINAHL, and Cochrane databases) from inception to November 2019. Results highlighted many common features between OLs and KBs. Both were embedded in the organization, having specific skillsets, using educational meetings to influence the target audiences, and being able to impact all types of professional outcomes. Moreover, this manuscript drew a separate portrait for the context in which OLs and KBs work and their influence on practice change.

The second manuscript was a descriptive study using a cross-sectional online survey, which was completed by 198 KBs working in rehabilitation institutions across Canada. The online survey consisted of 20 questions covering three topic areas: 1) socio-demographic and professional characteristics, 2) KBs work activities, and 3) KB training opportunities. Results showed that KBs were mostly experienced clinicians with over 15 years of clinical work, who performed their brokering activities part-time. Most KBs had higher education credentials (e.g. Master's degree). In addition, this study highlighted that the linking agent role was the most frequent role performed by KB participants, followed by the capacity builder, and the information manager. Findings also highlighted a lack of training opportunities for KBs

The third manuscript was a qualitative descriptive study using semi-structured telephone interviews among 23 KBs in rehabilitation settings across Canada. The interview guide was informed by the Consolidated Framework for Implementation Research (CFIR) and consisted of 20 questions covering the five domains (characteristics of individuals, inner setting, process, outer settings, and innovation characteristics). Findings were also analysed based on the CFIR. Factors likely to influence KBs roles were mainly associated with three levels: individual, organizational, and brokering process. *At the individual level,* having certain skillsets was viewed as favorably impacting the performance of KBs, having personal attributes was found as common traits of KBs participants, and being an insider appeared to facilitate networking and engagement in brokering activities. *At the organizational level,* networking and engagement with different stakeholders were seen as essential elements of the brokering activities, while providing several forms of organizational support may impact the success of KBs roles. *At the brokering process level*, the lack of training for KBs and of participants' awareness of the existing KB-related training were highlighted. Further, needs for standard evaluation tools to monitor KBs performance and for creating a provincial or national community of practice (CoP) for KBs were raised.

The fourth manuscript was a Canada-wide environmental scan aiming to identify ETO using three strategies (online search, phone calls, snowball). Each ETO was analyzed according to KBs' competencies and roles. Results provided an informative portrait of what existing ETO covered, and pointed to a number of gaps in the trainings. The primary focus of included ETO was on developing knowledge brokering skills to fulfill the capacity builder role. The second focus was on research skills needed to perform the evaluator role. However, ETO developers paid less attention to the other types of competency-role combinations such as developing communication skills to fulfill the facilitator role, developing mediation skills to fulfill the linking agent role, and providing knowledge and skills related to the information manager role.

This thesis is the first attempt to draw an overall portrait for KBs working in the rehabilitation sector in Canada. This portrait included KBs' characteristics (personal and professional), roles and activities, factors influencing their roles, and cross-Canada training opportunities. The first manuscript created a context-mechanism-outcomes configuration which suggested the preferable features of OLs and KBs (e.g., being embedded in the organization, adequately skillful, and well-trained; performing the required roles; and using KT interventions adapted to the local context). The second manuscript highlighted that KBs are mostly expert clinicians who perform brokering activities on a part-time basis. Participants mostly perform linking agent, capacity builder, and information roles. Moreover, few participants received formal training to perform brokering activities. The third manuscript identified the individual, organisational and process level factors likely to hinder or promote the use of KBs including skillsets and networking abilities; culture, resources, and leadership support; and the need for specific training for KBs and for evaluation tools to monitor their performance. Lastly, the fourth manuscript suggested that ETO focused primarily on preparing participants with the research and knowledge brokering skills required to perform the capacity builder and evaluator roles. Comprehensive educational training covering all KBs roles and competencies are needed.

ABRÉGÉ

Malgré les preuves disponibles pour soutenir les pratiques optimales en réadaptation, des lacunes importantes persistent entre les pratiques actuelles et les données probantes. Bien que les courtiers en connaissances (CC) peuvent promouvoir l'adoption des données de recherche pour éclairer la prise de décision clinique, quatre lacunes persistent dans la littérature en réadaptation, entravant ainsi l'utilisation optimale des CC sur le terrain. Premièrement, la littérature portant sur les mécanismes qui sous-tendent les rôles des CC, et sur les conseils quant au type de soutien nécessaire pour une mise en œuvre réussie de ces rôles dans des contextes de réadaptation était rarissime. Deuxièmement, on en savait peu sur qui sont les CC, le type de travail qu'ils effectuaient, et leur formation. Troisièmement, les facteurs influençant l'utilisation des CC et limitant ainsi leur emploi dans le secteur de la réadaptation étaient méconnus. Enfin, bien que de nombreux organismes offrent des formations aux professionnels de la santé qui souhaitent occuper des rôles liés au CC, les caractéristiques et le contenu de ces offres de formation pédagogique demeuraient inconnus.

L'objectif global de cette thèse était d'accroître nos connaissances sur les CC afin d'optimiser leur utilisation en favorisant l'adoption des preuves issues de la recherche dans la pratique clinique de la réadaptation. Plus précisément, le manuscrit (1) visait à mettre en évidence les principales différences et les similitudes entre les leaders d'opinion (LO) et les CC en ce qui concerne le contexte, le mécanisme et les résultats; et à décrire les modèles communs des LO et des CC en ce qui a trait au contexte dans lequel ils travaillent, les mécanismes par lesquels ils influencent les résultats, et les types de mesures de résultats qu'ils influencent. Le manuscrit (2) visait à décrire le profil des CC travaillant dans des milieux de réadaptation au Canada, y compris les caractéristiques sociodémographiques et professionnelles, les activités de travail, et la formation. Le manuscrit (3) visait à identifier les facteurs susceptibles de favoriser ou d'entraver l'utilisation optimale des CC dans les milieux de la réadaptation. Enfin, le manuscrit (4) visait à identifier et à décrire les formations offertes aux CC au Canada et à explorer si ces programmes s'arriment avec les compétences requises pour occuper les rôles des CC.

Le premier manuscrit était une revue réaliste. Une stratégie de recherche documentaire a été élaborée en collaboration avec un bibliothécaire universitaire en sciences de la santé. Les descripteurs (MeSH terms), les mots-clés et les mots des résumés et textes pour l'application

des connaissances, LO, CC et la réadaptation, et leurs synonymes ont été recherchés dans cinq bases de données (OVID MEDLINE, EMBASE, PsycINFO, CINAHL et bases de données Cochrane) depuis leurs créations jusqu'à novembre 2019. Les résultats ont permis de mettre en évidence de nombreuses caractéristiques communes aux LO et aux CC; notamment, occuper un poste au sein des l'organisation, avoir certaines compétences particulières, utiliser des stratégies éducatives visant à influencer leurs cibles publiques, et pouvoir influencer l'ensemble des mesures de résultats (outcomes) professionnels. De plus, ce manuscrit a dressé un portrait distinct des LO et des CC.

Le deuxième manuscrit était une étude descriptive avec sondage en ligne complété par 198 CC travaillant dans des établissements de réadaptation à travers le Canada. Le sondage se composait de 20 questions portant sur trois thématiques, soit: 1) les caractéristiques sociodémographiques et professionnelles, 2) les activités professionnelles de CC, et 3) les offres de formation disponibles aux CC. Les résultats ont démontré que la plupart des CC étaient des cliniciens expérimentés avec plus de 15 ans de pratique clinique et effectuant leurs activités de courtage à temps partiel. De plus, cette étude a souligné que le rôle de l'agent de liaison est le principal rôle effectué par les CC, suivi par le rôle visant à développer les capacités, et enfin, gestionnaire de l'information. Ce manuscrit soulignait également le manque de formation adéquate pour les CC. Néamoins, la majorité des répondants possédaient des diplômes d'études supérieures (par exemple, une maîtrise) et occupaient un rôle de CC depuis plus de 10 ans.

Le troisième manuscrit était une étude descriptive qualitative avec entrevues téléphoniques semi-structurées chez 23 CC en milieu de réadaptation à travers le Canada. Le guide d'entrevue reposait sur le Cadre Consolidé d'implantation en recherche (Consolidated Framework for Implentation Resarch) et comprenait 20 questions couvrant cinq domaines (caractéristiques des individus, cadre/milieu intérieur, processus, cadres extérieurs et caractéristiques de l'innovation). Les résultats ont démontré que les facteurs susceptibles d'influencer les rôles des CC sont principalement associés à trois niveaux: individuel, organisationnel, et processus. Au niveau individuel, certaines compétences étaient perçues comme ayant un impact favorable sur les performances des CC, les attributs personnels étaient considérés comme des traits communs des participants aux CC, et le fait d'être un initié semblait faciliter le réseautage et l'engagement dans les activités de courtage. Au niveau organisationnel, le réseautage et l'engagement avec différentes parties prenantes sont

considérés comme un élément essentiel des activités de courtage, et fournir plusieurs formes de soutien organisationnel peut avoir un impact favorable sur le succès des rôles des CC. Au niveau du processus de courtage, le manque de formation spécifique aux CC et le peu d'information accessible aux participants relatifs aux formations existantes ont été soulignés, de même que le besoin d'outils d'évaluation standardisés pour évaluer la performance des CC et la nécessité de créer une communauté de pratique pour les CC à l'échelle provinciale ou nationale ont également été soulevées.

Le quatrième manuscrit était une analyse environnementale au Canada visant à identifier les formations actuellement disponibles aux CC. Pour ce faire, trois stratégies de recherche ont été utilisées : la recherche en ligne, des appels téléphoniques, et une approche de type boule de neige. Chaque formation rencontrant les critères d'éligibilités a été analysée en termes des compétences et des rôles occupés par les CC. Les résultats ont fourni une description du contenu des formations existantes, tout en soulignant des lacunes importantes des formations. Le principal objectif des formations identifiées était de parfaire des compétences chez les apprenants visant à remplir le rôle lié au développement des capacités. Le second objectif portait sur les compétences de recherche nécessaires afin d'occuper un rôle d'évaluateur. Cependant, les formations disponibles accordaient peu ou pas d'attention aux autres types de compétences, dont développer des compétences en communication pour occuper un rôle de facilitateur, développer des compétences de médiation pour occuper un rôle d'agent de liaison, ou encore procurer les connaissances et compétences requises pour occuper un rôle de gestionnaire de l'information.

Cette thèse est la première à tenter de dresser un portrait relativement complet des CC travaillant dans le secteur de la réadaptation au Canada; ce portrait incluait les caractéristiques des CC (personnelles et professionnelles), les rôles et les activités, ainsi que les facteurs susceptibles d'influencer leur activité et performance et les offres de formation. Le premier manuscrit a créé une configuration contexte-mécanisme-résultats qui a suggéré les caractéristiques souhaitables des LO et CC (par exemple, étant activement impliqué au sein de l'organisation, des habiletés particulières adéquates, être bien formé, réalisant des fonctions nécessaires, et mettant en œuvre des interventions de transfert de connaissance adaptées au contexte local). Le deuxième manuscrit indique que les CC sont pour la plupart des cliniciens experts qui ont tendance à effectuer des activités de courtage à temps partiel ciblant leurs pairs. Les participants jouent principalement des rôles d'agents de liaison, de création de

capacités et d'informations. De plus, peu de participants ont reçu une formation spécifique aux rôles et activités de courtage. Le troisième manuscrit a identifié les principaux facteurs individuels, organisationnels et procéduraux susceptibles d'entraver ou de promouvoir l'utilisation des CC, notamment : les compétences et capacités de réseautage; la culture, les ressources disponibles et le soutien au leadership; et la nécessité d'une formation spécifique adaptée aux CC et d'outils permettant d'évaluer leurs performances. Enfin, le quatrième manuscrit suggérait que les formations se concentraient principalement à fournir aux participants les compétences de recherche et en courtage de connaissances nécessaires pour occuper les rôles liés au de développement ou renforcement des capacités et d'évaluateur. Une formation pédagogique complète couvrant tous les rôles et compétences de base des CC apparait nécessaire.

ACKNOWLEDGEMENTS

After this long journey, I would first like to thank my God who gives me the strength, patience, perseverance, guidance, and motivation to overcome all issues I have been through to achieve my goals.

During my graduate studies, I was blessed to work with exceptional people who helped me grow as a researcher. It is a pleasure to take this opportunity to acknowledge their contributions. My sincere gratitude goes to my supervisor Dr André Bussières, who pricelessly guided and supported me through my PhD work. I am immensely grateful for his endless generosity in supervising my thesis studies and facilitating the uptake of new knowledge and expertise. I am extremely indebted to him for his kindness in regularly meeting with me and reviewing my papers in a timely manner. It was a great privilege for me to work with my co-supervisor Dr Sara Ahmed, and I would like to thank her for her continuous support and guidance through the entire PhD Program. This dissertation could not have been completed without the significant contributions of my thesis committee member, Dr. Aliki Thomas, whose insights and priceless critique have greatly enriched the manuscripts of this thesis. The contributions of my supervisors and my committee have truly strengthened my research ideas, methodologies, and interpretation of results through constant feedback and key insights.

My friends and colleagues played an essential role throughout my PhD journey. My gratitude goes to my graduate colleagues: Rehab Alhasani, Kedar Mate, Diana Zidarov, Owis Eilayyan, Fadil Al Zoubi, and Ahmed Abou-Sharkh; and my undergraduate friends: Julien Bachir and Kalee Belanger; and the research assistants: Melanie Christine Baniña and Mushirah Hossenbaccus for their unconditional support and friendship. I learned a lot from everyone of you and appreciate all the insightful ideas and constructive feedback received throughout the years. Special thanks goes to Rehab Alhasani who participated as a second reviewer for the first study. Another huge thank you goes to Kedar Mate who participated in the fourth study, spending numerous hours analyzing the data independently and meeting afterward to reach consensus. I would like to greatly appreciate Dr Diana Zidarov who conducted interviews with French-speakers participants, and Julien Bachir, Kalee Belanger, and Melanie Christine Baniña for helping analyze the data. Also, I would like to acknowledge the effort done by Mushirah Hossenbaccus who made a huge number of phone calls to recruit participants. Lastly and not least, I would like to thank Ahmed Abou-Sharkh for recording the

French version of the YouTube video. Finally, this work would not have been accomplished without the participation of the Canadian knowledge brokers who gave their valuable time to fill out the online survey and to participate in the interviews.

I would also like to thank the staff of McGill IT services for their support with the Lime Survey platform hosted by McGill University. I am extremely grateful to Gabrielle Krim and Matthew Bacz for their support. A very special thanks to Meghan Storey who helped in circulating the online survey via the KT Canada newsletter. Finally, a special thank you to Anne DeChavigny, an English editor, for her assistance in reviewing the manuscripts. She always found the time to review my documents, no matter how busy she is.

This thesis is dedicated to my parents, to my father, Reda Eldairy, may he rest in peace, the person who I really miss in this life, and to my mother, Laila Attiaallah, for her endless support, unconditional love, sustained encouragement; her sacrifices have made me who I am today. Last but not least, I could not have accomplished my work without the love and support from my family and friends.

During my PhD, I have been generously financially supported by the Richard and Edith Strauss Canada Foundation for the fellowship and the grants that facilitated my academic life and helped me to accomplish my research projects.

PREFACE

Statement of originality

The studies presented in this thesis are the results of my own original work with guidance and feedback from members of my supervisory committee. Chapters 3, 5, 7, and 9 are the original material and they contribute to knowledge in the field of knowledge translation in Canada. The originality of this thesis lies in the new insights gained on who knowledge brokers are, how they work, what factors influence their work, and whether and how they are trained. The findings of this thesis highlighted the common features, including characteristic and skills that appear to be required for KBs to enhance their impact among their peers. Findings also showed the common roles and tasks that Canadian KBs are performing and identified the training opportunities available for them to improve their performance. This thesis provides evidence that can be used to strengthen the adoption of KBs as a knowledge translation strategy to narrow research-practice gaps in rehabilitation and optimize health care services.

Contribution of authors

The four manuscripts included in this thesis are the work of Dina Gaid, the PhD Candidate, with extensive guidance from Dr. André Bussières, Dr Sara Ahmed, and Dr Aliki Thomas.

Manuscript 1: Designing the study, developing and applying the search strategy, data extraction, data analysis, interpretation of results and writing of the first draft were conducted by the PhD Candidate under the supervision of Dr. André Bussières and Dr Sara Ahmed. Dr. Aliki Thomas, a committee member, provided extensive expertise on the science of knowledge translation. Rehab Alhasani was the second reviewer who participated in scanning the identified records, data extraction, and data analysis. Dr Sara Ahmed, Rehab Alhasani, Dr. Aliki Thomas, and Dr. André Bussières are co-authors on this manuscript; they contributed to the refinement of this manuscript for journal publication. This study (manuscript 1 presented in chapter 3) is currently under revision in the Journal of evaluation in clinical practice (submitted on May 9th, 2020).

Manuscript 2: Designing the study, developing the instrument (the online survey), recruitment of participants, data collation, statistical analysis, interpretation of results and writing of the first draft were conducted by the PhD Candidate. Dr Sara Ahmed, Dr. Aliki Thomas, and Dr. André Bussières are co-authors on this manuscript; they provided continuous feedback on the development of the instrument, the interpretation of the results and the refinement of the manuscript for journal publication. This study (manuscript 2 presented in chapter 5) is under revision in the journal Health Research Policy and Systems (submitted on August 20th, 2020).

Manuscript 3: Designing the study, developing the interview guide, recruitment of participants, conducting semi-structured interviews, transcribing of interviews, data analysis, interpretation of results and writing of the first draft were conducted by the PhD Candidate. Dr Sara Ahmed, Dr. Aliki Thomas, and Dr. André Bussières are co-authors on this manuscript; they provided substantive feedback on the development of the interview guide, the data coding process, the interpretation of the results and the refinement of the manuscript for journal publication. This study (manuscript 3 presented in chapter 7) is under revision at Implementation Science (submitted on August 27th, 2020).

Manuscript 4: Designing the study, data collation, data validation, data analysis, interpretation of results and writing of the first draft were conducted by the PhD Candidate. Dr Kedar Mate was the second reviewer who participated in the data extraction and the data analysis. Dr. Kedar Mate, Dr. Sara Ahmed, Dr. Aliki Thomas, and Dr. André Bussières are co-authors on this manuscript; they provided continuous feedback on the interpretation of results and the refinement of the manuscript for journal publication. This study (manuscript 4 presented in chapter 9) is under a revision at the Journal of Continuing Education in the Health Professions, (submitted on August 12th, 2020).

Thesis organization and overview

This thesis consists of four manuscripts. Following the guidelines of Graduate and Postdoctoral Studies (GPS) of McGill University for a manuscript-based thesis, additional chapters were incorporated into the thesis. As this is a manuscript-based thesis, there are repetitions. The organization of the thesis is as follows:

Chapter 1 presents the introduction of the literature on knowledge translation science, different knowledge translation strategies, knowledge brokers, knowledge brokers' theories and frameworks, knowledge brokers' roles and skills, and lastly, the research gaps related to knowledge brokers in the rehabilitation literature.

Chapter 2 outlines the rationale and objective of each project.

Chapter 3 presents the first manuscript entitled "Determinants that influence knowledge brokers' and opinion leaders' role to close knowledge practice gaps in rehabilitation: A realist review". This manuscript has been submitted to the Journal of evaluation in clinical practice.

Chapter 4 presents the integration of manuscripts 1 and 2.

Chapter 5 presents the second manuscript entitled "Profiling Knowledge Brokers in the Rehabilitation sector across Canada: A descriptive study". This manuscript has been submitted to the Health Research Policy and Systems.

Chapter 6 presents the integration of manuscripts 2 and 3.

Chapter 7 presents manuscript three entitled "Perceived barriers and facilitators to using knowledge brokers in Canadian rehabilitation settings". This manuscript has been submitted to Implementation Science.

Chapter 8 presents the integration of manuscripts 3 and 4.

Chapter 9 presents manuscript four entitled “A nationwide environmental scan of knowledge brokers training”. This manuscript has been submitted to the Journal of Continuing Education in the Health Professions.

Chapter 10 presents the global discussion of the entire thesis and the conclusion of the thesis

Corresponding references, tables, figures and supplementary material are presented at the end of each manuscript. Referencing styles are according to journal requirements. A complete reference list for the entire thesis is provided at the end of the thesis. Ethics approval was obtained from the McGill University Faculty of Medicine Institutional Review Board.

CHAPTER 1
Introduction

This chapter presents a discussion on the presence of research-practice gaps in healthcare systems and in the rehabilitation sector in particular. Knowledge translation is then introduced as a potential solution to close important research-practice gaps in rehabilitation. The relative effectiveness of different knowledge translation strategies is discussed, with a focus on knowledge brokering. Following that, the related theoretical foundation, including knowledge translation theories and frameworks, types of brokering roles and skills are presented. Research gaps related to knowledge brokering will be introduced at the end of this chapter. The research reported in this dissertation resulted in four manuscripts.

1.1 Research-Practice Gaps in Healthcare

Over the course of last 10-15 years, healthcare scientists have emphasized the importance of integrating research evidence into daily clinical practices[1,2] as a means to improve efficiency and effectiveness of healthcare services throughout the world.[3] However, the optimal use of research evidence in healthcare systems remains an ongoing challenge.[4,5] The vast amounts of information generated by researchers worldwide, coupled with a humans' limited capacity to keep up with the growth of evidence, causes substantial delays in adopting and applying research findings into clinical practices.[6] It is generally acknowledged that closing gaps between the knowledge that is generated and its application in daily practice can take years, even decades.[7,8] It is estimated that it can take up to 17 years for only 14% of research findings to be adopted into clinical practice.[9] Such research-practice gaps can negatively impact the health outcomes of individuals and communities (i.e. under-use of effective treatments, incorrect use of treatments, over-use of unproven treatments etc.) and lead to inefficient use of limited health care resources.[4,10-12] For example, McGlynn et al. have shown that 30% - 45% of patients do not receive care based on research evidence.[13] Likewise, 50% of healthcare interventions are not based on the research evidence, and 20-25% are not needed or are potentially harmful.[13]

1.1.1. Research-practice gaps in rehabilitation

In 2017, the prevalence of individuals who needed rehabilitation services worldwide increased dramatically by nearly 183 million relative to 2005;[14] These individuals represent 74% of years lived with disability in the world.[14] Rehabilitation "aims to enable people with health conditions experiencing or likely to experience disability to achieve optimal functioning in interaction with the environment".[15] According to the World Health Organization (WHO), rehabilitation is a fundamental health "intervention" for individuals with health conditions that cause limitations in functioning.

Despite the availability of clinical practice guidelines to inform rehabilitation practices,[16-23] substantial research-practice gaps persist among clinicians.[24-37] For instance, surveys conducted among physiotherapists (PTs) in Australia,[33] America[34] and Canada[23,35] indicated that only 44% of PTs use research-based evidence to inform their practice.[33] Likewise, surveys conducted among occupational therapists (OTs) showed that fewer OTs rely on research evidence in the intervention planning process.[36] Numerous studies have discussed the barriers to integrate the research evidence into clinical practices, namely:
lack of time,[38-42] lack of resources[38,41-43] (i.e., limited access to search engines), lack of research skills,[38,41] and organisational support.[40,41]

1.2. Knowledge Translation: A Process Used to Bridge Research-Practice Gaps

Research transfer, research utilization, knowledge utilization, knowledge exchange, knowledge transfer, and knowledge translation (KT) are all terms that have been used interchangeably to describe the process of transferring research findings into clinical practice.[26,44] The Canadian Institutes of Health Research (CIHR) defines KT as "the exchange, synthesis and ethically-sound application of knowledge – which includes a complex system of interactions among researchers and users - to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system".[45] The reliance on KT to promote the use of research evidence in rehabilitation practices has grown over the past decades.[46,47] Knowledge translation is a complex process, which includes several ways (or strategies) to exchange information between researchers and various stakeholders, build capacities, change behaviours, and implement optimal clinical practices.[26]

1.2.1. Relative effectiveness of KT strategies

The Cochrane Effective Practice and Organization of Care Review Group (EPOC) taxonomy[48] has provided a classification of different KT interventions, including distribution of educational materials, educational meetings, local consensus processes, educational outreach visits, local opinion leaders, patient-mediated interventions, audit and feedback, reminders, tailored messages, and mass media (Appendix 1). Several systematic reviews have evaluated the relative effectiveness of different KT interventions aiming to improve the uptake of research evidence into clinical practice.[49-55] Overall, passive KT interventions such as the dissemination of printed educational materials[51,56] and educational conferences[52] have a 2-6% absolute improvement in professional practice behaviour compared to no intervention. In contrast, active KT interventions such as audit and feedback[55] and educational outreach[57] have been shown to be more effective in changing professional behavior,[58] with approximately a 10% practice change.[58-61]

The use of intermediary individuals is also associated with higher improvement in practice behavior[54,62] in many healthcare sectors.[63-73] Employment of intermediary individuals appears to be more effective than using tailored messages alone to influence practitioners' behavior.[74,75] In rehabilitation, the most common types of intermediary individuals are knowledge brokers[3,75-83] and opinion leaders.[58,84-89] A meta-analysis showed that practitioners are 2.76 times more likely to adopt evidence-based guidelines when a knowledge broker promoted these.[90] Likewise, opinion leaders showed improvement in practice behavior change with approximately 12%.[54] Authors reporting on the similarity of knowledge brokers and opinion leaders indicated that they are both typically embedded in social systems, and have mutual relational properties in term of gaining trust and seeking out those who are similar to themselves.[91] Specifically, knowledge brokers represent the human forces that bring people together to build relationships, uncover needs, share ideas, understand goals and mutual interests to promote uptake of evidence into clinical practice.[37,82,89,92-94] In contrast, opinion leaders are recognized as experts in their domain,[63,91] in addition to being socially connected and respected individuals exerting their influence in their workplace through their leadership abilities.[89,95,96]

1.3. Knowledge Brokers

Given the complexity of KT processes,[26] neither researchers nor clinicians alone can drive the uptake of research evidence into clinical practices.[97] A promising solution is the use of 'knowledge brokers' as a human force positioned in-between research and clinical worlds.[25,98] Various terms are used to describe individuals who perform knowledge brokering activities, including boundary spanner, research navigator, research liaison officer, knowledge translator, research broker, and knowledge broker.[25] The Oxford English Dictionary defines brokers as "middlemen, intermediaries, or agents who act as negotiators, interpreters, messengers or commissioners between different merchants or individuals".[99] The activities performed by knowledge brokers have been described in various fields (environment,[100,101] education,[102,103] agriculture,[104] management,[105] and international development.[106]) as well as in various contexts (research projects[25], research institutions,[107] and community-university partnerships[108]).

Knowledge brokers have been widely utilized in many healthcare sectors over the past decade[109,110] in one-on-one interactions to change providers behaviour,[74] and consequently reduce related research-practice gaps.[25,31,92,97,111-116] The Canadian Health Services Research Foundation (CHSRF) has defined knowledge brokers (KBs) as "one of the human forces which bring people together to build relationships, uncover needs, share ideas and evidence aiming to improve job productivity".[92] Knowledge brokers act as intermediaries between researchers who produce scientific knowledge, and clinicians and other knowledge users who apply this knowledge.[110,117,118] Knowledge brokers become more important when stakeholders have limited time and inadequate background to understand the original research.[97,119] The overall goal of knowledge brokering is to encourage targeted stakeholders to use research findings to inform decision making.[94] Traditionally, "brokers favour neither clinicians nor researchers, but instead act as go-betweens, serving the needs of both".[25] (P.2) They link practitioners with researchers, facilitate interactions between them to better understand goals, cultures, and environmental limitations of each other's work, and allow them to work collaboratively to support evidence uptake.[37,82,89,93,94] Knowledge brokers can work across different organisations as well as work intra-organisationally.[120] They may belong to different professions than from those they aim to influence,[121,122] or belong to the same professional group[123,124] and they may be external to,[47] or embedded within an organization.[125]

1.3.1. The theoretical basis of knowledge brokers

Several theories and frameworks help to conceptualize and understand the various roles of knowledge brokers. The *Two-Communities theory*[126] by Caplan (1979) contends that "social scientists and policymakers live in separate worlds with different and often conflicting values, different reward systems, and different languages" (p.459). This theory describes a human force working towards bridging gaps between knowledge producers and policymakers through personalised relationships.[126] A more recent theory from the environmental sciences has conceptualized KBs as *boundary spanning*.[101,127] The concept of boundary spanning describes activities occurring at organizational boundaries[128-130] in which boundary-spanning individuals act as communicative linkages to represent and connect the organizational members to its environment,[131] in addition to spreading ideas within organizations.[132] They can play a critical role in innovations, especially in health care organizations,[133] and in the diffusion of knowledge between and within organizations.[134,135] The main difference between boundary spanner and knowledge broker is that the former is usually seen to facilitate connections between boundaries such as geographical distances or different areas of expertise,[136,137] while the latter seems to facilitate discussions within their own organization with individuals who share common knowledge bases.

Roles of knowledge brokers are embedded within few existing KT frameworks. First, the *Promoting Action on Research Implementation in Health Services (PARiHS)* framework (Figure 1),[138] describes the facilitation strategies driven by human resources according to the nature of the evidence and the characteristics of the context. This framework proposed that the facilitator is the key element affecting the context in which implementation is taking place as well as impacting clinicians to make sense of the evidence that is being implemented.[138] Second, the *K* Spectrum,*[139] (Figure 2) describes how knowledge is shared between different groups of people in order to allow change to happen. In this framework, KBs play an essential role in helping to create a common understanding of a complex two-way process. This framework presents the KBs role in various forms, including: information intermediaries (information managers), concerned with accessing evidence from multiple sources and sharing evidence with targeted groups of people; knowledge translators (capacity builders) who communicate evidence in a way that is easy to understand and can enhance its application; knowledge brokers (linking agents), concerned with connecting, bridging, linking, and creating common ground among groups of people with different perspectives; and, innovation brokers

(facilitators) who are engaged in negotiations, building collaborative relationships, and initiating and guiding negotiations. Although the K* framework provides a relatively comprehensive model for knowledge brokering, it disregards the role of KBs as an evaluator which includes evaluating the context, the processes and outcomes of KT process, in addition to evaluating the KB's own performance. The evaluator role is critical, as it is used to assess the impact of the other roles.[79]

Knowledge brokering is commonly aligned with three main types of roles: knowledge management, where KBs develop systems and processes to access and disseminate research;[25,140-142] linkage and exchange, where they facilitate interaction between policy-makers and researchers;[140,142-144] and capacity-building, where they provide individualized training and one-to-one support.[47,75,141,142,145-147] Despite those aforementioned frameworks that collectively target more than one KBs role in the KT process, they were not developed specifically for knowledge brokering, and as a result, do not encompass all the possible roles of KBs.

1.4. Roles of Knowledge Brokers

Recently Glegg et al.[79] proposed the Role Model for Knowledge Brokering to outline the five role domains of knowledge brokering activities in healthcare. The **Information Manager** role consists of seeking and sharing relevant health research as well as context-specific knowledge. This role includes one's ability to understand the contextual evidence across settings that can be important to exchange with stakeholders to inform decision-making processes. An information manager is also responsible for delivering key information to specific audiences in ways that will best promote its uptake, and in improving access to evidence in the clinical setting through academic affiliations and collaborations. The **Linking Agent** role includes the KBs ability to connect and foster trust and relationships among people with shared interests, and facilitate "shared agendas", link researchers and clinicians, decision-makers, and/or other key stakeholders that can expedite the KT process by creating opportunities for knowledge exchange, facilitating the creation of networks of individuals or groups with overlapping interests, and promoting understanding about other members' local contexts. The **Capacity Builder** role concerns developing of positive attitudes toward evidence, developing skills, establishing a common language among stakeholders as well as providing education and mentoring in the clinical setting on research skills and how to apply

research evidence. The **Facilitator** role involves: 1. supporting knowledge users to find ways to integrate research findings into the local context, 2. developing collaborations to address identified knowledge or skill gaps, 3. promoting inter-professional knowledge exchange, 4. fostering a cultural shift within an organization to enhance the valuing of research evidence. Lastly, the **Evaluator** role focuses on an evaluation of the context, the processes and outcomes of KT at the research and clinical levels, and the KB's own knowledge brokering performance. Because the Role Model for Knowledge Brokering encompasses all types of brokering roles reported in previous research, this model is useful for analysing knowledge brokering roles in healthcare research.

To be able to perform these various brokering roles, multiple skillsets are needed for KBs. The following section presents the different types of skills needed for KBs.

1.5. Skills of Knowledge Brokers

Skills described as beneficial for KBs[76,116,148] are classified by the CHSRF[92] and others[37,146] into four categories: personal, research, communication, mediation skills as follows:

1. **Interpersonal Skills:** include being inspirational, imaginative, entrepreneurial, trustworthy, credible, creative, good listener, flexible when dedicating time for brokering, enthusiastic when initiating contacts and actively engaging others, and being able to identify links between ideas and pieces of information.[37,47,62,76,148-151]
2. **Communication Skills:** include having strong oral and written communication skills, having access to colleagues, understanding the clinical and organizational contexts, and having active listening skills to gain insight into the interest of colleagues; communication skills are used to bring people together and facilitate their interaction, using a variety of methods targeted to the needs of the diverse stakeholders.[76,148,152,153]
3. **Research Skills:** include being aware of the best sources of synthesized evidence, being able to search for less formal contextual evidence such as policy documents and evaluation reports, being able to evaluate the evidence's quality, importance, and applicability to a particular context, and being able to gather and critically appraise the research evidence.[37,76,148,154]
4. **Mediation Skills** include being able to build effective relationships, encourage collaboration with individuals who would not normally work together, identify the

common goals, and negotiate mutually beneficial roles of group members.[37,76,148] Importantly, the skills that are required in one context are likely to differ significantly from those needed in a different context; they may include facilitating partnerships, clarifying research needs or supporting organizational change.[155]

In summary, research evidence is supportive of the utilization of KBs in healthcare settings. Furthermore, the types of roles performed by KBs as well as the skillsets that are required to perform these roles are well described in the literature. Nonetheless, a number of research gaps still need to be addressed to maximise the utilization of KBs in rehabilitation settings. These gaps are explored in the next section.

1.6. Research Gaps to Enhance the Impact of Knowledge Brokers in Rehabilitation

Although there is a growing interest in utilizing KBs to reduce research-practice gaps,[27,31,37,75,83,92,97,111-115,118,156] at least four important knowledge gaps have been identified in relation to their utilization in the Canadian rehabilitation context.

First, there is a need to better understand how KBs and opinion leaders (OLs) work with respect to the context in which they work, the mechanisms by which they work, and the types of outcomes targeted.[37,47,54,62,82,113,157] In addition, exploring the similarities and differences between those OLs and KBs is essential to properly employ each of them. Drawing a context-mechanism-outcome configuration for the OLs' and KBs' prominent patterns can guide KT scientists and employers on how to best utilize them to promote research utilization.

Second, there is a paucity of data on the estimated number of KBs working in the rehabilitation field across Canada. Moreover, their profile (i.e., personal and professional characteristics) has not been reported to date and there is little research that explores their work activities,[47,54,62] how they are selected [158] or their preparation/training for fulfiling their roles.[94] Knowledge of OLs and KBs characteristics and roles can guide researchers who aim to employ them in rehabilitation settings, help employers to optimize their integration in rehabilitation settings, and benefit agents themselves by providing a clearer understanding of the various roles and activities they may perform to better achieve the targeted outcomes.

Third, identifying the organizational and individual factors barriers and/or facilitators to employ KBs in their work environment becomes a key component of the KT process.[159-161] Exploring these factors, whether individual barriers/facilitators for individuals who perform brokering roles (e.g., knowledge, beliefs, selection, and training) or organizational barriers/facilitators that those individuals could face (e.g., lack of organizational support)[76] is essential for developing strategies to increase the likelihood of optimal employment of brokering roles. Till date, no previous research has explored the organizational or individual barriers/facilitators associated with the knowledge brokering roles for promoting the uptake of research evidence within the Canadian Rehabilitation settings.

Last, there is a need to better describe existing educational training opportunities to support knowledge brokering roles in Canada.[94] Previous research[94] has emphasized the importance of developing optimal educational training opportunities to provide individuals performing brokering roles with the required competencies to fulfil their assigned roles.[79] Although a number of Canadian institutions offer training opportunities to prepare health professionals to perform these roles, the characteristics and the content of those trainings are unknown.

Considering the above-mentioned research gaps, the ability of rehabilitation organizations to optimally employ and prepare knowledge brokers to fulfill their roles in the rehabilitation setting remains limited. Robust research is needed to address these research gaps to enrich our knowledge about knowledge brokers in rehabilitation and to ultimately improve clinical rehab practices and the health outcomes of Canadians.

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Figure 1. The Promoting Action on Research Implementation in Health Services (PARiHS) framework[138]

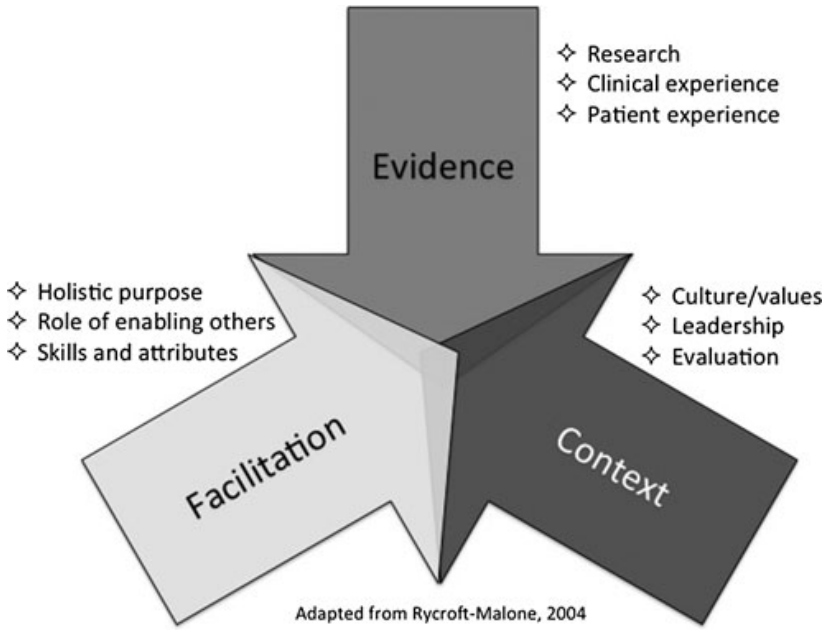
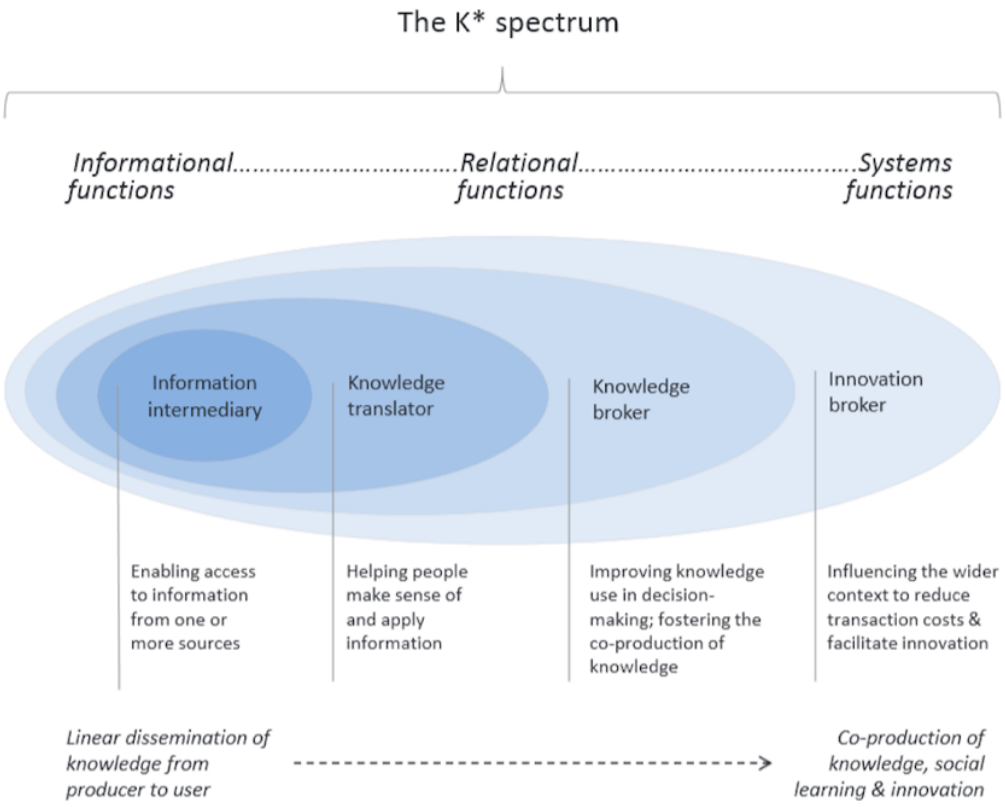


Figure 2. K* Spectrum[139]



CHAPTER 2
Thesis Objectives

Overall Objective: The overall objective of this thesis is to increase our knowledge about knowledge brokers to optimize their utilization in promoting the uptake of research evidence in rehabilitation clinical practice.

Objective 1: The objective of the first project was to highlight the differences and similarities between OLs and KBs with respect to context, mechanism, and outcomes. A secondary objective was describing the common patterns of OLs and KBs with respect to the contexts they work in, the mechanisms by which they impact outcomes, and the types of outcomes they influence.
Manuscript 1: Determinants That Influence Knowledge Brokers' and Opinion Leaders' Role to Close Knowledge Practice Gaps in Rehabilitation: A Realist Review.

Objective 2: The objective of the second project was to describe the profile of KBs working within rehabilitation settings in Canada. The specific objectives were to describe the sociodemographic and professional characteristics, work activities, and training of KBs.
Manuscript 2: Profiling Knowledge Brokers in the Rehabilitation Sector Across Canada: A Descriptive Study.

Objective 3: The objective of the third project was to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings.
Manuscript 3: Perceived Barriers and Facilitators to Using Knowledge Brokers in Canadian Rehabilitation Settings.

Objective 4: The aim of the fourth project was to: 1. describe the characteristics of the educational training opportunities (location, duration, frequency, format, target audience, and fees); 2. describe the features of the syllabi (types of knowledge, skills, roles, learning strategies, and assessment methods used); and 3. determine whether the educational training opportunities meet the competencies related to the five roles of KBs.
Manuscript 4: A Nationwide Environmental Scan of Knowledge Brokers Training

CHAPTER 3

Manuscript 1: Determinants That Influence Knowledge Brokers' and Opinion Leaders' Role to Close Knowledge Practice Gaps in Rehabilitation: A Realist Review

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* *This manuscript has been published to the Journal of Evaluation in Clinical Practice*

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Received: 10 May 2020 | Revised: 5 August 2020 | Accepted: 31 August 2020

DOI: 10.1111/jep.13482

ORIGINAL PAPER

Journal of Evaluation in Clinical Practice
International Journal of Public Health Policy and Health Services Research

WILEY

Determinants that influence knowledge brokers' and opinion leaders' role to close knowledge practice gaps in rehabilitation: A realist review

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[Correction added on 27 October 2020, after first online publication: Author order was incorrect and has been corrected in this version.]

Abstract

Rationale: Despite the available evidence to support optimal practices in rehabilitation, significant knowledge practice gaps persist. Opinion leaders (OLs) and knowledge brokers (KBs) can enhance the success of knowledge translation (KT) interventions and improve uptake of best practices among clinicians. However, the literature on the mechanisms underpinning OLs'/KBs' activities, and guidance on the type of support needed for successful implementation of these roles in rehabilitation contexts is scarce. This research aimed to highlight the differences and similarities between OLs and KBs with respect to context, mechanism, and outcomes as well as describe the common patterns of OLs and KBs by creating a context-mechanism-outcomes configuration.

Methods: We conducted a realist review to synthesize the available evidence on OLs/KBs as active KT strategies. A search was conducted across five databases up to November 2019. Two independent reviewers extracted the data using a structured form. A context-mechanism-outcome configuration was used to conceptualize a cumulative portrait of the features of OLs/KBs roles.

Results: The search identified 3282 titles after removing duplicates. Seventeen studies (reported in 20 articles) were included in the review. Findings suggest a number of desirable features of OLs/KBs roles that may maximize the achievement of targeted outcomes namely being (a) embedded within their organization as “insiders”; (b) adequately skilled to perform their role; (c) identified as able to fulfil the role; (d) appropriately trained; and (e) able to use different KT interventions.

Conclusion: Findings of this realist review converge to create a context-mechanism-outcomes configuration with suggestions to optimally utilize OLs/KBs in rehabilitation. The configurations suggest desirable features that can lead to a greater potential to achieve targeted goals. It is preferable that OLs/KBs be embedded in the organization and that they are adequately skilful and well-trained. Also, OLs/KBs should perform the required roles using KT interventions adapted to the local context.

KEYWORDS
implementation, knowledge brokers, knowledge translation, opinion leaders, realist review, rehabilitation

1 | INTRODUCTION

Adopting evidence-based practices (EBP) has been acknowledged as necessary by health care administrators and decision makers aiming to improve efficiency and effectiveness of health care services.[1] However, the optimal utilization of EBP is considered a persistent challenge for decision makers and practitioners.[2] Knowledge translation (KT) aims to promote the use of EBP in health care[3] in order to reduce the gap between the latest evidence and clinical practices in order to ensure that research informs clinical decisions.[4] KT experts have advocated for the use of opinion leaders (OLs) and knowledge brokers (KBs), as active types of KT strategies,[5,6] to enhance the initial success and sustainability of strategies throughout the KT cycle.[7] Reviews have shown that using OLs[8] and KBs[9] is associated with up to 12% improvement in practitioners' practice behaviour[10,11] across various health care disciplines,[12-22] including the field of physical rehabilitation.[23-30]

OLs are defined as "innovative, socially connected, and respected persons, who can influence behavioral change in their workplace through their interpersonal skills, leadership abilities and positioning within the communication structures of the workplace."[8,31,32] OLs can influence individuals' attitudes towards best practices, not because of their formal position in the system, but because they are recognized as "experts" in their domain.[12,33] In contrast, KBs are defined as one of the human forces that bring people together to build relationships, uncover needs, share ideas, and evidence aiming to improve job productivity.[34] KBs link practitioners with researchers, facilitate the interactions between the two in order to better understand goals, cultures, and environmental limitations of each other's work, and help promote uptake of evidence into clinical practice.[8,35-38]

Despite evidence to support the impact of OLs/KBs on clinical practice change, prior research has not explored essential aspects of those strategies, including the similarities and differences between OLs/KBs, and the links between the context of the settings in which they work, the mechanisms by which OLs/KBs work, and the types of outcomes targeted.[3,10,11] Further, few studies have described how OLs/KBs can be identified within clinical settings[39] or the types of training and/or preparation they have received to facilitate their tasks.[37] Understanding of the dynamic nature of OLs/KBs as KT researchers and their related context-mechanism-outcomes configuration will guide KT scientists and employers on how to best utilize OLs/KBs to promote research utilization. Thus, it is important to systematically synthesize available evidence on how OLs/KBs function, and explore the similarities and differences between both of them.

The principal aim of this research was to highlight the differences and similarities between OLs and KBs with respect to context, mechanism, and outcomes. A secondary objective was to describe the common patterns of OLs and KBs with respect to the context they work in, the mechanisms by which they impact outcomes, and the types of outcomes they influence.

2 | METHODS

We conducted a realist review to synthesize the evidence on OLs' and KBs' context, mechanism, and outcomes (CMO).[40-43] Realist review is a theory-driven method aimed at uncovering theories that underpin the targeted intervention,[44-47] with respect to context and outcomes, in a systematic process of synthesizing relevant literature.[46-48] We used *the Role Model for Knowledge Brokering*[49] to guide the categorization of knowledge brokering activities by role domain. This model applied a number of theoretical perspectives to the knowledge brokering process, which helped in exploring its underlying mechanisms. We undertook the following comprehensive steps of realist review methods proposed by Pawson[45]:

2.1 | Clarify scope

The overarching questions of this review were (1) what are the differences and similarities between OLs and KBs in terms of CMOs? *and* (2) what are the relationships between OLs' and KBs' CMOs that promote EBP utilization?

2.2 | Search for evidence

A search strategy was developed in collaboration with an academic health-sciences librarian using two steps: We first selected relevant databases and analyzed text words contained in the title and abstract, and of the index terms used to describe the article. We then searched for subject headings (MeSH), keywords, and abstract/text words for KT, OL, and KB, and rehabilitation, and their synonyms across five databases (OVID MEDLINE, EMBASE, PsycINFO, CINAHL, and Cochrane databases) from inception to November 2019 (Appendix 1). We exported final searches into EndNote and removed duplicates. Two independent reviewers (DG and RA) screened the titles and abstracts of studies identified by applying the eligibility criteria. The same reviewers then independently assessed full-text reports of potentially eligible studies. Reviewers met to resolve disagreements. A third reviewer (AB) was involved if a consensus could not be reached.

2.2.1 | Inclusion criteria

Types of studies

We included studies using all research designs as long as they employed OLs and KBs as KT strategies within physical rehabilitation settings and were published in the English language.

Types of participants

Physical rehabilitation practitioners including physiotherapists (PTs), occupational therapists (OTs), speech-language pathologists (SLPs), chiropractors (DCs), and osteopaths.

Type of interventions

KT strategies employing OLs or KBs and directed towards physical rehabilitation practitioners were included. In this review, OLs and KBs strategies could be used alone or in combination with other types of KT interventions (eg, distribution of educational materials, educational meetings, educational outreach visits, audit and feedback, and reminders).

Types of outcomes

All types of professional outcomes (eg, professional knowledge, attitude, and behaviour) used to investigate the impact of OLs or KBs strategies were included.

2.2.2 | Exclusion criteria

Articles were excluded if OLs or KBs were (1) used for purposes other than for promoting the uptake or application of research evidence into clinical practice, such as facilitating focus groups and interviews, or administering survey questionnaires, or coaching patients; (2) used as teaching assistants in university settings; (3) employed in fields other than physical rehabilitation (eg, medicine or nursing); or (4) employed at managerial, organizational, or provincial levels. Studies published in abstract form, conference proceedings, or protocols, and in a language other than English were also excluded.

2.3 | Appraise studies and extract data

According to Pawson's method for realist reviews, the use of a quality appraisal checklist is not recommended.[47] Instead, studies were appraised using the judgement "good and relevant enough"[50] to describe articles that provided relevant information about OLs or KBs, without assessing quality in relation to study design or other standard criteria of quality. Realist review affords teams the opportunity to work within different epistemologies, and as such "low-quality" studies by typical standards (eg, case series, case-control, cohort studies, and randomized controlled trials)[51] or studies using different designs may yield data that can contribute towards our understanding of complex CMO configurations.[47] There is no standard data extraction matrix for realist reviews, as each article is expected to contribute different information to the review.[47] Nonetheless, a structured extraction form, adapted from the Workgroup for Intervention Development and Evaluation Research (WIDER) Recommendations,[52] was piloted on a sample of six articles. No modifications were required. The final data extraction sheet included the following categories: country, design, employing OLs or KBs, type of practitioners (ie, PT, OT), patients' population, setting, status, pertinence, OLs/KBs affiliation, types of skills, preparation process, OL/KB roles, types of KT interventions, and types of outcomes. Data extraction was completed by two reviewers (DG and RA) and the agreement between the two was tested on the first three articles. The first author then proceeded to extract the rest of the articles, which were reviewed by a second reviewer (RA).

2.4 | Analysis

We conducted a qualitative content analysis, followed by a quantitative numerical analysis.

2.4.1 | Qualitative content analysis

The data were first categorized into CMO. The data in each category were then organized into themes deductively; for example, context-related data were organized into themes including settings, characteristics, and skills of OLs/KBs. Each theme was then categorized into subthemes, which were further considered using either an inductive or deductive approach. Figure 1 displays the diagrammatic presentation for the themes and the subthemes derived from the data extraction.

Specifically, the *context-related data* were categorized into (1) the type of setting in which the intervention was conducted (clinical, research, or academic setting); (2) the professional characteristics of OLs/KBs in term of the affiliation (practitioner or researcher), the employment status (performing their KT activities part-time or full-time), and the pertinence (internal or external); and (3) the skills of OLs/KBs, which were in turn classified into interpersonal skills, clinical skills, research skills, communication skills, and mediation skills, based on previous research.[7,34,53-55]

The *mechanism-related data* were categorized into (1) the preparation/training process for OLs/KBs; (2) the roles of OLs/KBs (ie, information manager, capacity builder, linking agent, facilitator, and evaluator) which were classified based on the Role Domains Model for Knowledge Brokering[49]; and (3) the types of KT intervention associated with OLs/KBs, which were classified according to the Cochrane Effective Practice and Organization of Care Review Group (EPOC) taxonomy[56] (Appendix 2).

The *professional outcomes-related* data were categorized according to the "Tailored Implementation for Chronic Diseases" (TICD) checklist[57] into (1) professional behaviour (ie, nature of the behaviour and capacity to plan change); (2) cognitions (ie, agreement with the recommendations and attitude towards the guidelines); and

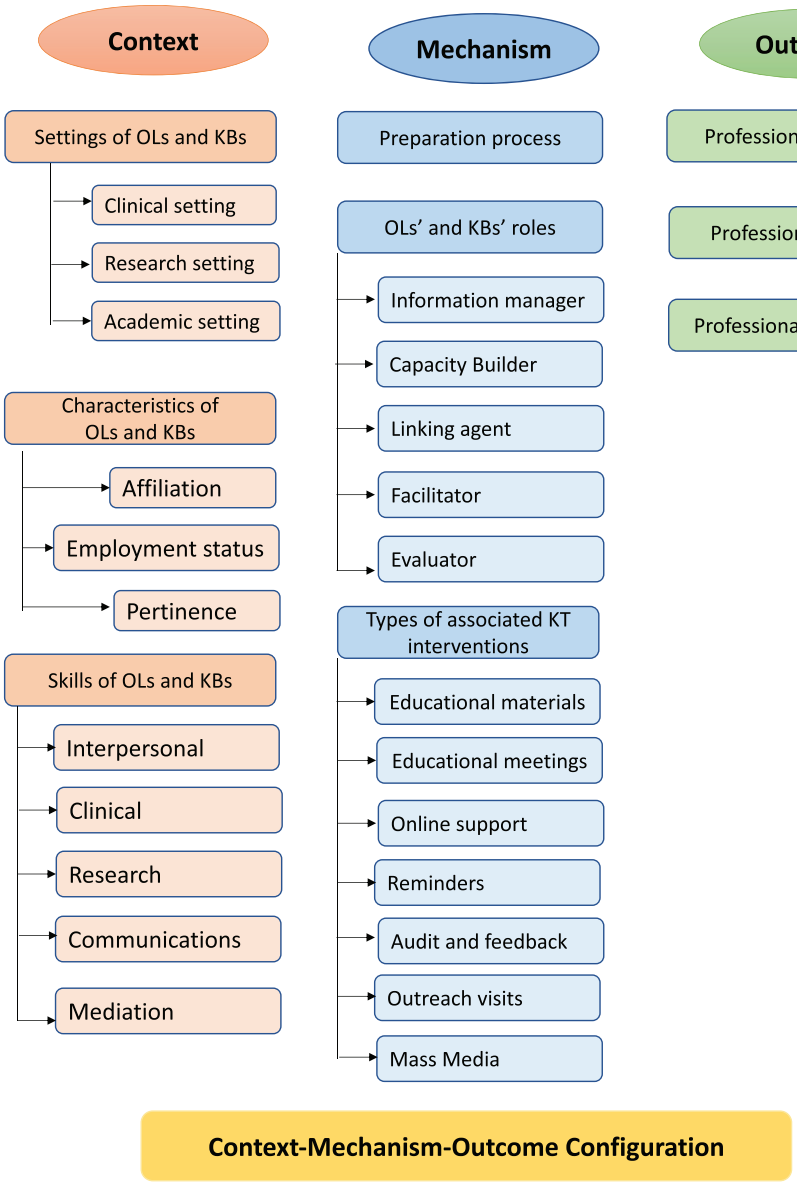

FIGURE 1 A diagrammatic presentation for the themes derived from the data extraction

(3) professional knowledge (ie, domain knowledge and awareness with recommendations). TICD is a recently developed checklist, used to identify determinants of professional practice to be used in health care for patients with chronic diseases.

2.4.2 | Descriptive numerical analysis

The numerical analysis (counts and frequencies) consisted of calculating the frequency of each theme corresponding to each category in the included studies. The numerical analysis helped to draw the prominent patterns within each category. Matching tables were then developed to compare between OLs/KBs in terms of CMO categories to highlight the common pattern in each of OLs and KBs and the relationships between the context-mechanism-outcomes categories. The first author (DG) analyzed the data and the analysis was reviewed by a second reviewer (RA).

3 | RESULTS

Search strategies yielded 3282 titles after removing duplicates. Screening of titles and abstracts identified 184 potentially eligible articles, and 17 studies (reported in 20 articles) were included in the analysis.[1,23-30,38,49,53,58-65] Of those 17 studies, nine employed KBs to perform KT activities, and eight others employed OLs (Figure 2, PRISMA flowchart). Table 1 presents the characteristics of the included studies. Table 2 and Figure 3 present the count (%) of studies reporting on OLs/KBs CMOs.

3.1 | Context-related data

3.1.1 | Settings

Most of the OLs (75%) as well as KBs (88%) performed their roles in clinical sites, whether hospitals, rehabilitation centres, or

clinics.[1,24-27,29,30,38,49,53,58-60,62-65] Only one study employed OL in educational venues[28] and another study utilized a KB[61] through a virtual community of practice.

3.1.2 | Characteristics

Up to 75% of OLs and 77% KBs were rehabilitation practitioners[1,23-25,27-29,38,53,58-64] working in the same site with their target practitioner group,[1,23-25,28-30,38,49,53,58,60-64] and performing their KT roles on a part-time basis with their clinical work.[1,23-26,28,38,53,58,59,61-65] Six studies failed to fully report the characteristics.[26,27,29,30,49,60]

3.1.3 | Skills

Clinical skills was the most common type of skills reported across studies for OLs (88%)[23-29,64] and KBs (78%).[1,38,53,58,59,61-63,65] Similarly, *interpersonal skills* were equally reported for OLs (50%)[27,29,30,64] and KBs (44%).[1,53,58,59,62,65] Having *research skills* was deemed essential for KBs (56%),[1,38,49,53,58,61,65] however, these skills were less common for OLs (38%).[24,25,27,29] *Communication skills* were reported more frequently for OLs (50%)[24,25,27,29] than for KBs (33%).[1,38,53,58,62] While performing *mediation skills* was not often reported for OLs (38%)[27,29,64] or KBs (22%).[1,38,53,58] Nine studies failed to clarify the types of OLs/KBs skills, or did not describe all types of skills required.[23-26,28,30,38,49,59,60] Appendix 3

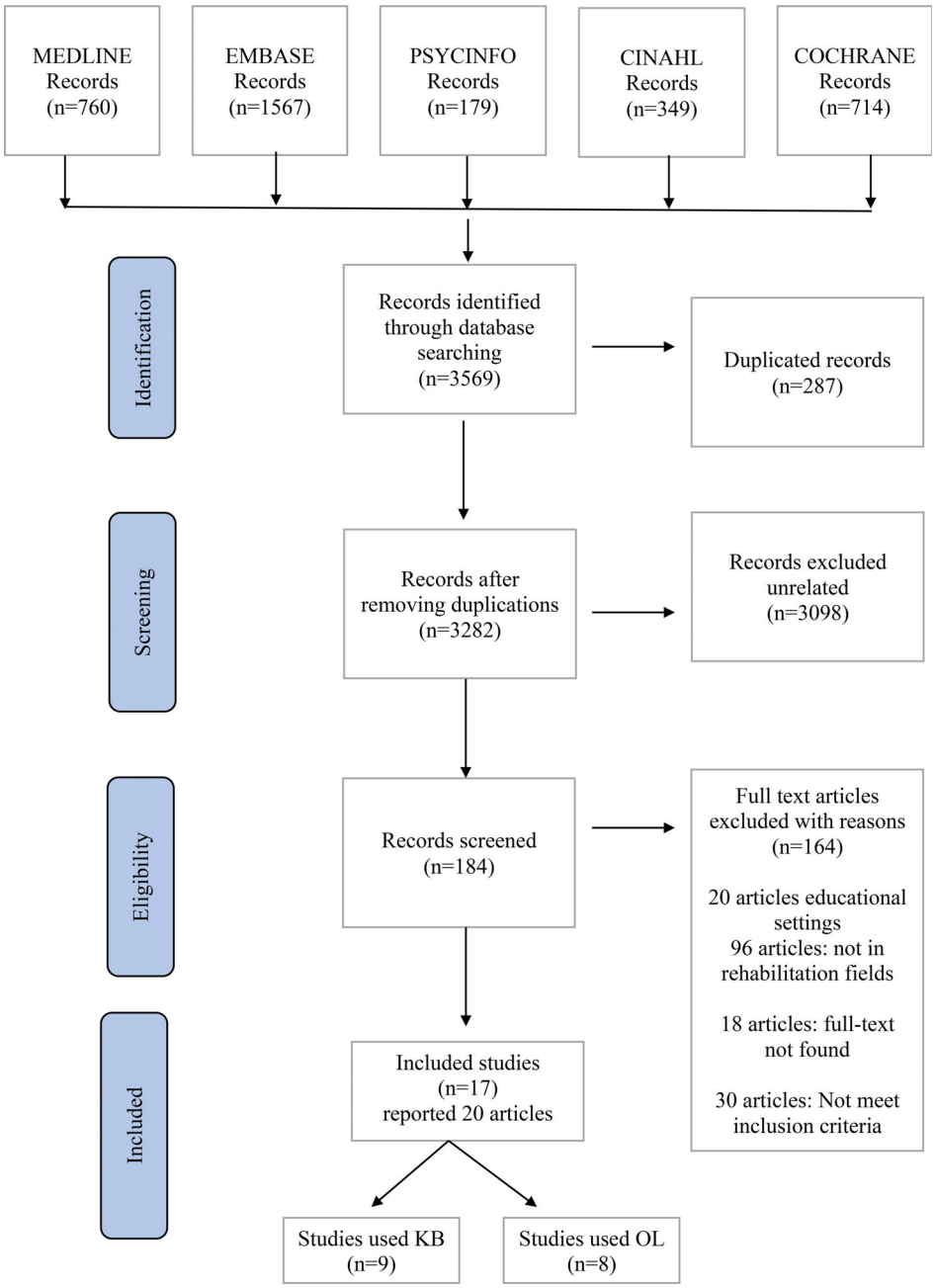

FIGURE 2 PRISMA flow chart (from inception to November 2019)

TABLE 1 Characteristics of the included studies

Study	Country	Design	OLs/KBs	Practitioners population	Patients population
Ammendolia et al. 2004[23]	Canada	Pre-Post	OL	DCs	LBP
Kay Stevenson et al. 2004[24]	UK	Cluster-RCT	OL	PTs	MSKs
Kay Stevenson et al. 2006[25]	UK	Cluster-RCT	OL	PTs	LBP
Trudy Rebbeck et al. 2006[26]	Australia	Cluster-RCT	OL	PTs	NP
Gross et al. 2009[27]	Canada	Pre-Post	OL	PTs	MSKs
Dianne J Russell et al. 2010[58]	Canada	Pre-Post	KB	PTs	Pediatric
Lisa M. Rivard et al. 2010[53]	Canada	Mixed-Methods	KB	PTs	Pediatric
Cameron, D et al. 2011[1]	Canada	Descriptive	KB	PTs	Pediatric
Rebbeck et al. 2013[28]	Australia	Pre-Post	OL	PTs, DCs, osteopaths	NP
Schleifer et al. 2014[38]	USA	Case report	KB	PTs	Pediatric
Anaby et al. 2015[59]	Canada	Pre-Post	KB	PTs, OTs, and SLPs	Pediatric
Emily Karlen et al. 2015[29]	USA	Case report	OL	PTs	LBP
Phoenix et al. 2015[60]	Canada	Case report	KB	PTs, OTs, and SLPs	Pediatric
Glegg et al. 2016[49]	Canada	Descriptive	KB	PTs, OTs, and SLPs	Pediatric
Hurtubise, Karlen et al. 2016[61]	Canada	Descriptive	KB	PTs	Pediatric
Lynch et al. 2016[30]	Australia	Cluster-RCT	OL	Allied health and senior nursing staff	Stroke
Mia Willems et al. 2016[62]	Netherlands	Pre-Post	KB	Pts, OTs, nurses	Stroke
Wielaert et al. 2016[63]	Netherlands	Mixed-methods	KB	SLPs	Stroke
Sibley et al. 2018[64]	Canada	Pre-Post	OL	PTs	Balance impairment
Romney et al. 2019[65]	USA	Mixed-methods	KB	PTs	Inpatient rehabilitation

Abbreviations: UK: United Kingdom, USA: United State of America, RCT: Randomized Control study, OL: Opinion leaders, KB: knowledge brokers, PTs: Physiotherapists, OTs: Occupational therapists, SLPs: Speech language pathologists, DCs: Chiropractors, LBP: Low back pain, NP: Neck pain, MSKs: Musculoskeletal disorders.

provides examples of different types of OLs'/KBs' skills reported in the included studies.

3.2 | Mechanism-related data

3.2.1 | Preparation/training process

None of the OL studies reported on the training process. However, six studies (67%) reported that KBs had received their training prior to starting their brokering activities[1,53,58,62,63] via in-person interactive workshops,[1,53,58,62,63] which included various activities[1,49,53,58,59,61-63] [1,49,53,58,59,61-63] such as assessment of the local context,[1,53,58,62] orientation about topic area and KB roles,[62] and providing supporting resources[1,49,53,58,59,61,62]). The preparation process was not sufficiently described in 14 studies.[23-30,38,49,59-61,64,65]

3.2.2 | Roles

The role of capacity builder has been commonly performed by OLs (88%)[24-30,64] and KBs (78%).[1,53,58-63,65] This role included delivering educational meetings,[1,23-26,28-30,53,58-60] providing relevant information,[1,53,58-61] and tailoring KT intervention[1,53,58,60]). The second common role is the information manager, which also reported for both, OLs (50%)[23,27,29,64] and KBs (44%).[1,49,53,58,61,65] This role included performing self-learning and research activities[1,23,27,29,53,58,61] and developing resources based on the context's needs.[1,23,27,29,49,53,58,60] Occasionally, KBs played the facilitator role (67%)[1,38,49,53,58,59,61,63] (ie, reaching out to relevant stakeholders by different means[1,29,30,53,58,61,62]), but this role is rarely performed by OLs (13%).[64] Also, the linking agent role was not common for KBs (44%)[1,53,58,61-63] and OLs (25%).[29,30] while the evaluator role was performed only by KBs (44%).[1,49,53,58,60,62]

3.2.3 | Types of associated KT interventions

Conducting educational meetings was the most common type of professional KT interventions,[23-28,30,38,49,59-61,63-65] that was used by both OLs (88%) and KBs (78%), followed by distribution of educational materials (OLs [63%] and KBs [44%]).[23,26,27,30,38,59,63-65] Less commonly associated interventions were: providing online support (OLs [13%] and KBs [56%]),[1,29,38,49,53,58,59,61] reminders (OLs [13%] and KBs [22%]),[30,38,63] audit and feedback (OLs [13%] and KBs [22%]),[30,63,65] outreach visits (OLs [25%] and KBs [11%]),[23,26,63] and media (OLs [13%]).[23]

TABLE 2 Studies reporting on opinion leaders' and knowledge brokers' context-, mechanism-, and outcome

	Opinion Leaders (n = 8 studies)	Knowledge brokers (n = 9 studies)
Context		
Setting (clinical setting)	6 (75%)	8 (88%)
Characteristics		
• Affiliation (practitioner)	6 (75%)	7 (77%)
• Pertinence (insiders)	6 (75%)	7 (77%)
• Status (part-time)	5 (62%)	7 (77%)
Skills		
• Clinical experience	7 (88%)	7 (78%)
• Interpersonal skills	4 (50%)	4 (44%)
• Research skills	3 (38%)	5 (56%)
• Communication skills	4 (50%)	3 (33%)
• Mediation skills	3 (38%)	2 (22%)
Mechanism		
Preparation	0 (0%)	6 (67%)
Roles		
• Capacity builder	7 (88%)	7 (78%)
• Information manager	4 (50%)	4 (44%)
• Facilitator	1 (13%)	6 (67%)
• Linking agent	2 (25%)	4 (44%)
• Evaluator	0 (0%)	4 (44%)
KT interventions		
• Educational meeting	7 (88%)	7 (78%)
• Educational materials	5 (63%)	4 (44%)
• Online	1 (13%)	5 (56%)
• Reminder	1 (13%)	2 (22%)
• Audit and feedback	1 (13%)	2 (22%)
• Outreach visits	2 (25%)	1 (11%)
• Media	1 (13%)	0 (0%)
Outcomes		
Professional behaviour	8 (100%)	4 (44%)
Professional cognitions (including attitudes)	6 (75%)	2 (22%)
Professional knowledge	4 (50%)	2 (22%)

Abbreviations: KT, knowledge translation.

3.3 | Outcomes-related data

The most common type of professional outcomes used to evaluate the impact OLs and KBs were professional behaviour change (OLs [100%] and KBs [44%]),[23,25-30,38,58,59,62,64] followed by practitioners' cognitions (OLs [75%] and KBs [22%]),[23,25-28,59,64,65] including practitioners' attitudes towards guidelines in general,[24,26-28,64,65] agreement with the recommendation,[23] preferred learning style,[24] emotions,[25] intention and motivation,[59] and self-efficacy.[64] Practitioners' knowledge[25,26,28,38,58,64] and skills[25,38,58,64] were reported less (OLs [50%] and KBs [22%]).

4 | DISCUSSION

The aim of this review was to highlight the differences and similarities between OLs and KBs with respect to context, mechanism and outcomes, and describe the common patterns of OLs and KBs. The CMO configuration identified the common features and patterns that may explain and ultimately improve OLs'/KBs' performance.

4.1 | Similarities and differences between OLs and KBs

It was common for both OLs/KBs to be embedded in the organization since most of them were practitioners performing KT activities as "insiders" in their clinical settings. This allowed them to be aware of practitioners' needs, schedules, clinical roles, caseloads, current knowledge, and past experiences in their local context.[1,53,58] This is consistent with evidence from studies in other health care sectors suggesting that OLs/KBs should be practitioners[9] working in their own setting.[9,66]

Previous literature has shown that enthusiastic agents were influential with the relevant stakeholder groups,[1,53] and succeeded in increasing the retention rate of study participants in research projects.[58] Findings from this review are consistent with previous literature has found that interpersonal skills (ie, being positive, enthusiastic, creative, persuasive, motivated, trusted, willing to share knowledge, accessible to colleagues, and able to set realistic expectations) were important for both OLs/KBs. Moreover, it seems that having clinical experience is important for both OLs and KBs, while OLs appear to have superior clinical skills such as adopting advanced practices, but only adequate clinical background is required for KBs. Communication and mediation skills appear to be associated with OLs (more so than with KBs), as they were described as being willing to share knowledge and actively engaging with their peers.[27] Research skills seem to be more closely linked with KBs, as they are responsible for synthesizing evidence and developing resources as part of their information manager role.[1,38,53,58]

OLs were described as clinical experts who adopted advanced practices; this may explain why they are not offered formal training. Conversely, KBs commonly received in-person training before starting their roles; this was done to help clarify their activities and the targeted outcomes, as well as to provide the necessary resources and on-going support throughout the duration of a project.[1,38,53,58] There is a need to increase awareness of existing training programmes for OLs/KBs to promote their potential impact on health care systems.[49]

Both OLs and KBs used educational meetings as an active KT intervention; however, employing other types of KT interventions seems to be responsive to their ability to employ some interventions. For example, given that OLs are usually willing to teach their peers

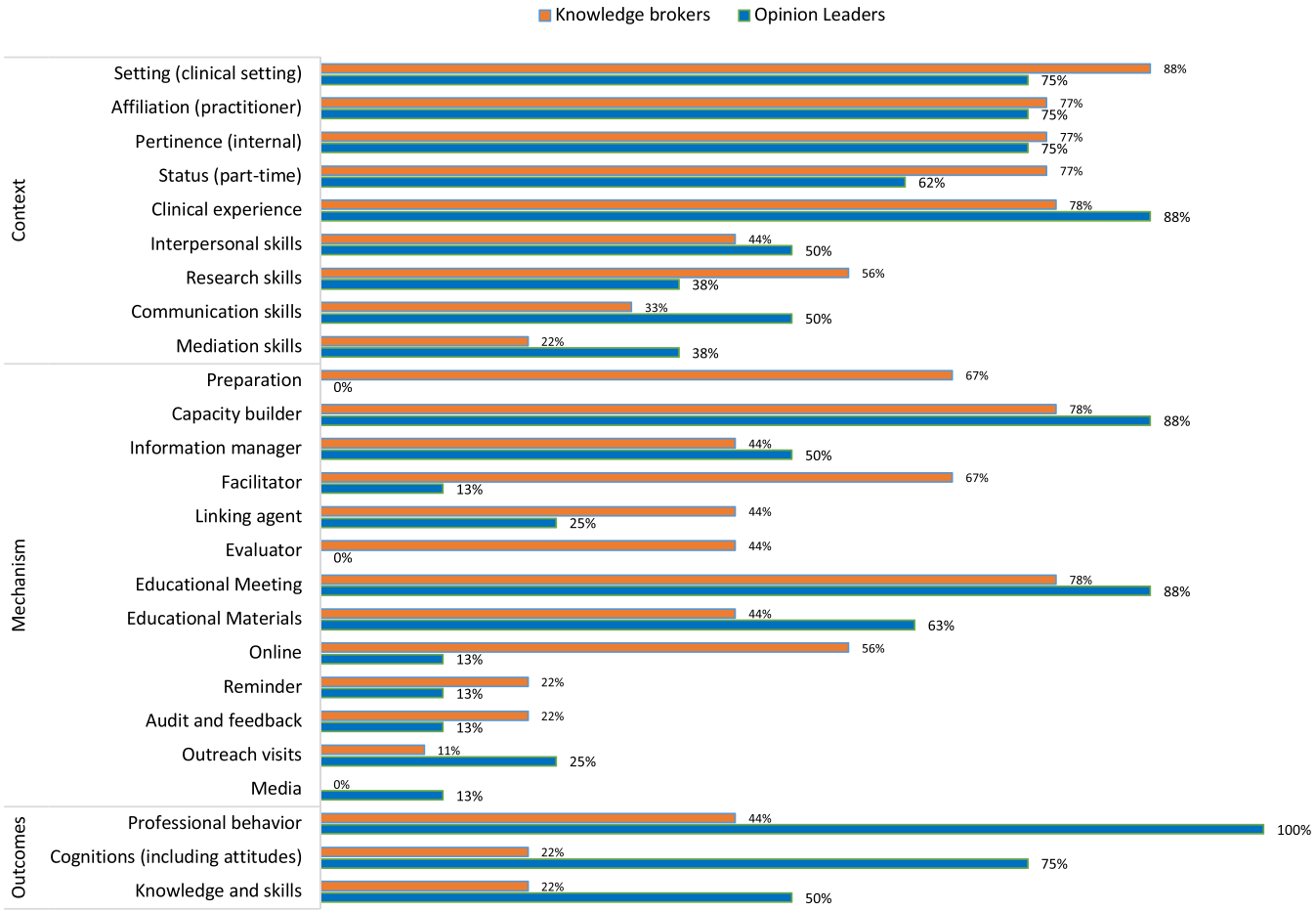

FIGURE 3 Studies reporting on opinion leaders' and knowledge brokers' context-, mechanism-, and outcome

and act as a role model for them,[27] it is no surprise that they commonly distributed educational materials. However, KBs also commonly provided online on-going support as they were being favoured with their interpersonal attributes such as enthusiasm, persuasiveness, curiosity to learn, and positive disposition.

4.2 | CMO configuration

Both OLs and KBs were able to impact all types of professional outcomes (behaviour, attitude, and knowledge) to different degrees; however, it appears that each of them has employed different mechanisms to impact the targeted audiences. Drawing a separate portrait for each can guide KT researchers and employers when employing OLs/KBs to align the performed roles with required skills, with the suitable KT interventions to maximize their impact.

Findings draw a prominent pattern for OLs as they commonly perform the capacity builder role. This role seems to require certain skillsets such as having interpersonal and communication skills, plus being considered as experts in their clinical field. Integrating those skills to achieve the capacity builder role was conceptualized when OLs act as role models,[6] who are willing and able to share knowledge and teach their peers via conducting educational meetings. However, OLs were likely to perform other types of roles. Firstly, when there is a need for synthesizing evidence and developing resources, OLs played the role of information managers who employ their research skills to be able to develop knowledge products and distribute educational materials among their peers. Secondly, in cases where the linking agent role was needed, which was not often, mediation skills were employed to engage their peers via outreach visits.

A wider range of responsibilities seem to be expected from KBs; the drawn pattern of KBs indicated that they perform all five brokering roles to different degrees. The prominent role was the capacity builder, followed by facilitator role; this explains why KBs needed to have an adequate clinical background on the topic they work on, plus interpersonal and communication skills. Facilitating educational meetings during educational interventions and providing online support (when facilitating on-going discussions) were suitable KT interventions to achieve these roles. Also, KBs performed information manager and evaluator roles; this requires adequate research skills to seek the right information, share knowledge with target audiences, and evaluate their engagement in the brokering activities. Developing educational materials, and using audit and feedback as KT interventions, were consistent with those two roles. Lastly, KBs performed the linking

agent role as they had adequate mediation skills to send reminders and perform outreach visits.

5 | STRENGTHS AND LIMITATIONS

This research has many strengths, including the rigorous search strategy reviewed by a health-sciences librarian, data analysis which was guided by the Role Domains Model for Knowledge Brokering framework[49] used to report on the roles performed by OLs/KBs, the EPOC taxonomy[56] used to report types of KT interventions combined with OLs/KBs, and the TICD checklist[57] which was used to report outcomes related to OLs/KBs strategies. There are also limitations to consider. Firstly, poor reporting in included studies (eg, a lack of reporting of OLs/KBs strategies) limited our ability to fully recreate the CMO configuration. Secondly, this review was restricted to interventions delivered to rehabilitation practitioners; as such, the results cannot be taken as evidence for the other health care disciplines. Notwithstanding its limitations, this research provides a deeper understanding of the CMO configuration of OLs/KBs to interested researchers, practitioners, and administrators working in rehabilitation sectors.

6 | CONCLUSION

This review highlights the common patterns of OLs and KBs roles with respect to their CMOs. The CMO configurations suggest that OLs and KBs who were embedded in the organization (internal agent), adequately skilful (having clinical experience and adequate interpersonal and communication skills), and well-trained; and who played the required roles as well as using different KT interventions; had greater potential to achieve targeted goals. These CMO configurations can help employers who intend to utilize OLs/KBs in rehabilitation settings to be better informed on the possible roles that OLs/KBs can perform. These configurations also help OLs/KBs themselves to recognize the different types of skills seem to be needed for different roles. Lastly, findings can guide researchers that will conduct KT studies using OLs/KBs strategies as to how they can maximize OLs/KBs impact. In general, this research can improve the utilization of OLs/KBs in physical rehabilitation.

ACKNOWLEDGEMENTS

We thank *Nisha Patel* for assistance with scanning a number of records and helping in identifying relevant records.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Gaid D, Ahmed S, Alhasani R, Thomas A, Bussières A. Determinants that influence knowledge brokers' and opinion leaders' role to close knowledge practice gaps in rehabilitation: A realist review. *J Eval Clin Pract*. 2020;1–11. https://doi.org/10.1111/jep.13482

CHAPTER 4
The Integration of Manuscripts 1 and 2

4.1 Research questions of manuscripts 1 and 2

Manuscript 1:

This manuscript aimed to highlight the similarities and differences between opinion leaders and knowledge brokers with respect to context, mechanism and outcomes as well as describe the common patterns of opinion leaders and knowledge brokers by creating a context-mechanism-outcomes (CMO) configuration.

Manuscript 2:

This manuscript aimed to describe the profile of knowledge brokers working within rehabilitation settings across Canada. including the sociodemographic and professional characteristics, work activities, and training they received.

4.2 Integration of manuscripts 1 and 2

The previous chapter (manuscript 1) provided a synthesis of what was reported previously in the literature about opinion leaders and knowledge brokers. This manuscript highlighted the common features and differences between opinion leaders and knowledge brokers. Yet, there was a need to explore the profile of KBs who working within rehabilitation settings in Canada (manuscript 2). Manuscript 2 provided a portrait of the characteristics of KBs, their working activities, the training they received for the KB role. Comparing what was reported in the rehabilitation literature to the real-world of KBs' profile helped better understand the characteristics of KBs and how their role can be supported by academic and healthcare organisations.

CHAPTER 5

Manuscript 2: Profiling Knowledge Brokers in the Rehabilitation Sector Across Canada: A Descriptive Study

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ABSTRACT

Background: Knowledge brokers (KBs) can help promote the uptake of the latest research evidence into clinical practice. Little is known about who they are, the type of work they do, and their training. Establishing a portrait of Canadian KBs working in the rehabilitation sector may inform health care organizations and knowledge translation specialists on how best to advance KBs practices. The overall goal was to describe the profile of KBs working to promote the uptake of evidence within rehabilitation settings in Canada. Specifically, this study aimed to describe the sociodemographic and professional characteristics, work activities, and training of KBs.

Methods: A cross-sectional online survey was administered to KBs working in rehabilitation settings across Canada. The survey included 20 questions covering sociodemographic and professional characteristics, work activities, and training opportunities. Response frequency and percentage were calculated for all categorical variables, and the weighted average (WA) for each role was calculated across participants. Descriptive analysis was conducted for all open-ended questions.

Results: Of 475 participants accessing the website, 198 completed the survey questionnaire, including 99 clinicians, 35 researchers, and 26 managers. While over two-third of respondents had completed a graduate degree, only 38% reported receiving KBs-related training. The respondents' primary roles corresponded to a linking agent (WA=1.84), followed by capacity builder (WA=1.76), information manager (WA=1.71), facilitator (WA=1.41), and evaluator (WA=1.32).

Conclusions: KBs are mostly expert clinicians who tend to perform brokering activities part-time targeting their peers. Participants mostly perform linking agents, capacity builder, and information roles. Moreover, only a few participants received formal training to perform brokering activities.

Keywords: Rehabilitation, Knowledge Brokers, Knowledge Brokering, Knowledge Translation, Survey

Background

Health care administrators and decision-makers emphasize the importance of evidence-based practices (EBP) as a means to improve efficiency and effectiveness in service delivery. [1] However, ensuring optimal use of EBP in health-related settings remains an ongoing challenge for decision-makers and practitioners alike. [2] Knowledge translation (KT) is a process used to promote EBP in healthcare [3] and reduce the gap between routine practice and best available evidence. [4]

Several systematic reviews and meta-analyses have reported on the effectiveness of KT interventions for promoting EBP. [5-11] Overall, the use of passive KT interventions such as dissemination of printed educational materials (PEMs) [12] and professional educational conferences [9] show a 2-6% absolute improvement in professional practice compared to no intervention. In contrast, active KT interventions, including audit and feedback [5] and educational outreach [13] have been shown to be more effective in changing professional behavior, [14] with approximately a 10% practice change. [14-17] Several reviews suggest that the use of intermediary individuals [18, 19] is associated with the highest improvement in practice behavior, up to 12% [11, 20] among practitioners in various healthcare disciplines, [21-31] including rehabilitation. [14, 32-38] Professionals who act as intermediaries in facilitating knowledge exchange between researchers and clinicians are referred to as human agents, [39] change agents [20] or opinion leaders, [11] while the most commonly used term in literature is brokers or knowledge brokers. [40]

Knowledge brokers (KBs) are defined as one of the human forces which bring people together to build relationships, identify practice needs, and share ideas to improve job productivity. [41] A recent systematic review reported that knowledge brokers can increase practitioners' adoption of evidence-based guidelines by 2.76 times (95% CI, 2.18-3.43). [42] Employment of KBs appears to be more effective than using tailored messages alone in influencing practitioners' behavior in clinical settings. [19, 43] Thus, KT experts advocate using KBs [44, 45] to enhance the success and sustainability of the whole KT process, [46] and consequently reduce the research-practice gap. [41, 45, 47-53] Since KBs activities are highly context-specific, [54, 55] their roles can vary greatly. [56] Of interest, Glegg et al. [57] recently developed the Role Model for Knowledge Brokering which encompasses all possible KBs activities that are classified into five main domains: 1. information manager, 2. linking agent,

3. capacity builder, 4. facilitator, and 5. evaluator. Additional file 1 presents each role, with definitions and examples of related tasks.

While there is evidence that KBs help reduce research-practice gap, [19, 41, 45, 47-53, 58-62] studies have found that there is a lack of knowledge about the personal and professional characteristics of KBs in the rehabilitation context, [55] their specific work activities, [40, 63] and the type of training that they have received to perform their role. [41, 55, 60, 64-67] This scarcity of research can limit health care organizations' ability to advance KBs practice [45, 68]. Robust research is needed in order to 1. guide researchers who aim to utilize KBs in rehabilitation settings, 2. help employers to optimize the integration of KBs in rehabilitation settings, and 3. benefit KBs themselves by providing a clearer understanding of the various roles and activities they may perform to better achieve the targeted outcomes.

The overall aim of the study was to describe the profile of KBs working within rehabilitation settings in Canada. The specific objectives were to describe the sociodemographic and professional characteristics, work activities, and training of KBs.

Methods

Research design

A descriptive study design was used. We administered a cross-sectional online survey to a convenience sample of KBs working in rehabilitation institutions across Canada. The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) is available in Additional file 2. This study was approved by the McGill University Institutional Review Board (IRB Number: A02-E11-17B).

Participants and setting

KBs employed with the purpose of promoting the uptake of research into clinical practice in rehabilitation institutions, whether in clinical, educational or research institutions, across Canada, were invited to participate in the study. Eligible participants: 1. were responsible for performing one or more knowledge brokering activities as an information manager, a linking agent, a capacity builder, a facilitator, or an evaluator; 2. worked full-time or part-time in any type of rehabilitation setting (e.g., hospital, rehabilitation center, professional association, research institution, academic organization); 3. could communicate in English or French; 4. had access to the internet; and 5. consented to participate.

Recruitment strategies

Three recruitment strategies were used. First, we sent recruitment emails with the information sheet, and made follow-up phone calls to all rehabilitation institutions asking them to promote the study by sending emails to their members (see Additional file 3). Second, the recruitment team made phone calls to all public hospitals and rehabilitation centres across Canada to identify KBs working in each setting. Third, a snowball strategy was used whereby KBs identified using the first two strategies were asked to share the recruitment email with other KBs in their network. The survey was accessible to all interested participants without password-protection. All identified KBs received a personalised e-mail invitation with a 4-minute YouTube video clarifying the five roles of KBs, and describing the study objectives and eligibility criteria as well as a hyperlink to complete a consent form prior to accessing the online survey questionnaire (see English and French videos). E-mail reminders were sent to the targeted organizations and to the identified participants up to three times within a 6 weeks period. The survey closed 4 weeks after the last reminder. The data was collected from June 2018-April 2019. Confidentiality of the data was protected by assigning each participant a unique identification number; all electronic records protected by a user password.

Instrument

The online self-administrated survey was developed through brainstorming session of the research team, which included three KT experts. Questions that aimed to identify the approaches by which the role of KBs was assigned to participants were based on the ten identifications techniques developed by Valente et al. [69] used to identify opinion leaders. As previous research has indicated that KBs and opinion leaders share mutual roles and goals, minimal adaptation was required. The Role Model for Knowledge Brokering guided questions on knowledge brokering activities. [57] The online survey consisted of 20 questions (5 pages) covering three topic areas: 1) socio-demographic and professional characteristics, including how the KBs role was assigned to them (10 questions [9 close-ended questions and 1 open-ended question]); 2) KBs' work activities (5 close-ended questions with 5-10 sub-questions each, on a 5-point Likert scale from "Always" to "Never"); and 3) KBs training opportunities (5 questions [1 binary close-ended question "Yes/No" and 4 open-ended question]). Fourteen questions were mandatory to complete the survey. A professional translator translated the questions to French. Three English-speaking and three French-speaking KBs working in rehabilitation reviewed for content validity of the survey including the clarity of items, the

scaling responses, the comprehensiveness of the survey, and the technical functionality of the electronic survey. The survey was pre-tested on the first ten KBs recruited and no additional modifications were needed. The survey was mounted on the Lime Survey platform (Version 2.63.1+170305) and it took approximately 30 minutes to complete. The participants were able to review and change their answers through a Back button to review and correct their responses before submission. The Lime Survey platform provides view rates to determine the number of potential participants who logged in the website and who filled in the consent form/agreed to participate, and the PI received an email notification on every complete response (see Additional file 4).

Statistical analysis

Response frequencies and percentages were calculated for categorical variables (i.e., close-ended questions). Work activities were classified into five main roles, with a number of tasks under each role. A weighted average (WA) was calculated for each task across participants considering response options: "always=4", "usually=3", "sometimes=2", "rarely=1", and "never=0". To obtain an overall average for each role collectively, the WA was obtained by calculating the average of all tasks for each role per participant, followed by a computation of the average of average task scores across all participants. Missing data were treated by pairwise deletion when a particular data-point was missing. Pairwise deletion is the recommended method for managing missing data as it is less biased when data is missing at random. [70]

For the five open-ended questions asking about KBs' titles and training opportunities, we used a frequency count. A deductive content analysis was conducted to categorize the qualitative data into themes. Data related to KBs professional titles were categorized into 1. health professionals', 2. knowledge translation-related, and 3. administrative. Likewise, data related to KBs training opportunities were categorized into training related to 1. knowledge translation and knowledge brokering, 2. research activities, 3. organizational change, 4. communication and interpersonal abilities, and 5. technology use in KT.

Results

In total, 76 healthcare organizations in Canada (rehabilitation schools [n=19], regulatory bodies [n=20], professional associations [n=25], and research institutions [n=12])

were contacted by e-mail and subsequently by phone. In addition to these, 934 Canadian hospitals and rehabilitation centers were contacted by phone by the first author and a research assistant. Of the 475 potential participants who logged onto the survey platform, 372 agreed to participate (78% participation rate). Although 182 participants completed all sections of the survey (49% completion rate), data from 198 respondents answering at least one of the knowledge brokering activities' section of the survey were included in the final analysis (Figure 1).

Socio-demographic information

Table 1 presents the socio-demographic information of KBs. Participants were largely from Central Canada (71%), Western Canada (27%) and Eastern Canada (2%). They spoke either English (59%) or French (41%), and the majority (73%) were between the ages of 36-60 years old.

Professional Characteristics

Table 2 presents the professional characteristics of the KBs who participated. Half of the 198 participants (n=99) were clinicians, 18% (n=35) were researchers, and 13% (n=26) were managers. Of the 99 clinicians, half (n=49) were occupational therapists, 36% (n=36) were physiotherapists, 6% (n=6) were speech-language pathologists, and 8% (n=8) reported "other" (e.g., nurses, recreational therapists). More than half (56%) had over 15 years of clinical experience, 21% had 6-15 years of clinical experience, and 23% had 5 years or more. The majority of participants (n=102) reported their titles as health professionals (i.e., physical therapist, occupational therapist, speech-language pathologist), while fewer participants (n=52) had a knowledge translation-related title (i.e., knowledge broker, knowledge translation lead, knowledge mobilization specialist, research coordinator, best practice coordinator, professional practice lead, clinician champion, clinical educator), and few had administrative titles (n=39), including manager, project manager, team leader, healthcare improvement specialist, regional professional practice consultant.

Seventy-five percent (n=149) worked in clinical settings, 22% (n=43) in academic settings, and 18% (n=35) in research settings. Out of 188 participants, 94% (n=177) reported that they worked with clinicians, and 37% (n=69) and 35% (n=66) work with researchers and students, respectively. Regarding the frequency with which they performed their KBs role, more than half (56%, n=110) were part-time and, of those, 54% (n=59) were performing this

role monthly, while 32% and 15% were performing their KBs role on a weekly and daily basis respectively. Forty-four percent (n=88) worked as a KBs full-time. Concerning the participants' experience as a KBs, 74% (n=147) performed this role for ≤ 10 years, while 20% (n=40) and 6% (n=11) for 11-20 years and over 21 years respectively. Moreover, approaches by which the role of KBs was assigned to participants varied. Of the 194 participants, 57% (n=110) were hired following an application for a posted KBs job, while 45% (n=87) volunteered to perform this role as part of their existing position, and 26% (n=51) were selected by their employers.

Seventy percent of participants (66 full-time and 73 part-time) reported on their salary. Rates were ≥ 41$/hour for full-time KBs (77%, n=51) and part-time KBs (68%, n=50), 31$ - 40$/hour 17% (n=11) of full-time KBs and 25% (n=18) of part-time, and ≤ $30/hour for 6% (n=4) of full-time KBs, and 7% (n=5) of part-time KBs. Moreover, 19 KBs out of 45 (42%) thought that their salary was equal to the salary they would receive working as a clinician, 38% (n=17) thought that their salary was higher than clinicians', and 20% (n=9) thought that their salary was less than clinicians'.

Roles and tasks

Table 3 and Figure 2 present the frequency of performing the KBs' five roles as well as their corresponding tasks. The primary role of participants was linking agent (weighted average "WA"=1.84), followed by capacity builder (WA=1.76), information manager (WA=1.71), facilitator (WA=1.41), and evaluator (WA=1.32).

The most common tasks of the linking agent role were "communicating with other individuals who perform knowledge brokering activities" (WA=2.03) and "communicating with stakeholders outside your organization" (WA=2.02), followed by "identifying common goals among stakeholders" (WA=1.92). For the capacity builder role, the most common tasks were "helping others apply research evidence into clinical practice" (WA=1.98), "providing relevant information to your stakeholders" (WA=1.98), and "design strategies to address organizational barriers to change the practice" (WA=1.9). For the information manager role, the most common tasks were "access research evidence through activities such as searching research databases journals or research websites" (WA=2.4), "participate in self-directed learning activities such as attending webinars or workshops, or reading recent peer-reviewed literature" (WA=2.21), "follow the latest evidence through activities such as setting up alerts

for journals and reviewing them" (WA=1.95), "perform administrative activities such as organizing conferences, meetings, or workshops" (WA=1.88), and "develop knowledge products such as educational material, flyers, binders, and online programs" (WA=1.8), respectively. With respect to facilitator role, the most common tasks were "promote knowledge exchange among stakeholders (e.g., by supporting peer-to-peer learning)" (WA=1.96), and "facilitate workshops, follow-up sessions, individual and group discussions" (WA=1.82). Concerning the evaluator role, the most common tasks were "evaluate the impact of your knowledge brokering activities (WA=2.21), "identify opportunities for integrating evidence into practice" (WA=1.91), and "identify relevant stakeholders" (WA=1.82).

Training opportunities

Of the 198 participants, 67% (n=133) had completed graduate studies (i.e., master's, doctoral or post-doctoral degree). Only 38% (n=70) indicated having received some training to undertake or perform their KBs role. Training covered a variety of topics including knowledge translation and knowledge brokering (i.e., knowledge translation professional certificate, practicing knowledge translation, knowledge mobilization certificate), research activities (i.e., program evaluation), and communication abilities (i.e., leadership, emotional intelligence, and coaching). The most common approaches through which participants were informed about training opportunities included suggestions from a colleague/employer/manager (n=25), through online searches (n=22), and via newsletter subscriptions (n=19). Many participants (n=115) indicated needing additional training to be able to fulfill their roles. Proposed topics included knowledge translation, knowledge brokering, research topics (i.e., searching, assessing, and synthesizing evidence), organizational change strategies, communication and interpersonal abilities, and lastly skills for using technology in KT (i.e., mobile applications and video games).

Discussion

This study provides new insights on KBs' demographic and professional characteristics, work activities in the rehabilitation setting, and training opportunities. Our results indicate that a large proportion of KBs are experienced clinicians, reporting over 15 years of clinical work. Most perform their brokering activities part-time. These findings are consistent with a realist review by our team, showing that individuals who perform knowledge brokering activities are clinicians embedded within the rehabilitation settings. This is also consistent with evidence from other healthcare sectors recommending that KBs be clinicians

working in clinical settings, [19, 71] as experienced clinicians having a dual role as KBs may be more aware of their peers' needs, current practices, various clinical roles, busy schedules and caseloads. [1, 58, 72] Such extensive knowledge of their environment may help KBs tailor research evidence to working clinicians.

As in previous research, the KBs role in this study was neither official nor was it explicit. [40] Our findings showed that several titles are used to 'label' individuals performing KBs roles (e.g., physiotherapist, occupational therapist, knowledge mobilization specialist, research coordinator, professional practice lead, clinician champion, clinical educator), as knowledge brokering activities are usually embedded within the function of managers, opinion leaders, researchers, and educators. [41, 52, 73, 74] The breadth of health professionals and employment titles of KBs suggests that the KBs roles are supported by a range of individuals that incorporate knowledge brokering within their role.

Personal attributes of KBs included being positive, persuasive, entrepreneurial, proactive, enthusiastic, and self-motivated. [75] Highly motivated and enthusiastic KBs can positively influence various stakeholder groups. [1, 72] Our findings tend to support these features by showing that many KBs were proactive and self-motivated to the extent that they were willing to perform the brokering role on a voluntary basis.

Previous research has reported the main roles for KBs as linkage and exchange, [76-78] capacity-building, [3, 19, 66, 79-81] and knowledge management. [45, 76, 79] Similarly, our findings showed that the most frequent roles for KBs were linking agents, followed by capacity builder, and information manager. Specifically, at the task level, our results suggested that KBs tended to more often perform self-directed learning tasks (e.g., search for research evidence, evaluate the impact of brokering activities) compared to tasks requiring engagement with other individuals (e.g., communicating with others KBs and with stakeholders outside their organization). Self-directed learning tasks may be easier to accomplish as these depend on their own time, initiative and motivation, while the tasks requiring engagement with other individuals may be influenced by the organizational culture and constraints, which can reduce end-users' tendency to be engaged in KBs activities. This supports the need for valuing and prioritising brokering roles and activities within the organization to increase the likelihood of professional behaviour change. [40] More time-consuming tasks (e.g., develop knowledge products such as educational material, facilitate workshops and group discussions, identify

relevant stakeholders, and administrative activities such as organizing conferences) were less frequent, possibly because part-time KBs have to prioritize tasks. Lack of time appears to be a constant barrier for clinicians who perform brokering activities, [40] having to handle competing priorities and managing various tasks while meeting the responsibilities of their roles. It is possible that employers may need to liberate KBs clinical schedules so they can undertake important time-consuming activities. Another suggestion may be for KBs to collaborate with researchers and graduate students to help with some of the research-related tasks.

Although very few participants received formal training to perform brokering activities, most had higher education credentials (e.g., master's degree) and had performed the KBs role for over 10 years. As KBs activities are context-specific, [54] it seems that performing similar types of activities that address local needs for long periods of time may help KBs cumulate experience in performing the KBs role and compensate the lack of formal KBs training. Nonetheless, most participants highlighted a need for additional training to increase their knowledge and skills in several areas such as knowledge translation, knowledge brokering, research topics, organizational change strategies, communication and interpersonal abilities. The diversity of training topics identified reflects the wide range of KBs roles and highlights that brokering activities are highly responsive to the real-world environments in which KBs work. [54] Thus, training opportunities should not simply focus on exploring effective KT strategies, but they should aim to target all competencies and roles that KBs are expected to fulfill, including research skills, barriers to and strategies for organizational change, and communication skills. In addition, training of Canadian KBs should be available in both English and French, as the majority were located in central Canada (i.e., Ontario and Quebec), and advertised through diverse medium (e.g., colleagues, online announcements, newsletters of professional organisations).

Identifying the financial compensation of KBs was an important finding from this research that can serve to stimulate conversations with future employers. The majority of KBs reported receiving an hourly rate that is equal to their salary as clinicians. Taking into consideration that KBs are expert clinicians performing activities aimed at improving overall clinical practice to improve patient health, they should thus be compensated fairly. Previous research indicated that dedicating financial support for research activities can facilitate brokering activities. [40] In part, additional financial support for KBs may be possible by

encouraging collaborations between KBs and researchers in order to take advantage of funded research investigating brokering activities. [40] However, it is important for research projects to consider early on the sustainability of the KBs role for organisations to plan and maintain the KBs role in the long-term.

A number of studies are still needed to increase our knowledge about KBs and improve KBs impact on rehabilitation practices. First, there is a need to explore the relationships between KBs demographics, professional characteristics, and work-related activities with successful implementation of the KBs in specific contexts to better guide researchers, employers and managers when identifying KBs hired to perform particular roles. Second, research that explores the types, characteristic, and content of available training opportunities for KBs could help address some of their training needs. Lastly, we need to explore the barriers and the facilitators that KBs face during the brokering process.

Strengths and limitations

A major strength of this research was the use of three recruitment strategies covering numerous academic, research, and clinical institutions across Canada as well as professional and regulatory bodies. The response rate however cannot be calculated, as the denominator is unknown. Second, using an online self-administrated survey was efficient in saving time and cost, and helped to administer the survey across Canada. Third, while previous researchers have discussed the roles and activities performed by KBs in healthcare [57, 82] this study is the first study reporting on KBs' roles and activities by surveying a large number of KBs in rehabilitation across Canada, thereby increasing the generalizability of our findings. Nonetheless, this study has some limitations. First, individuals decided to participate in the survey based on self-identification. To address this limitation, we clarified the characteristics of the targeted participants through a short YouTube video attached to the invitation emails. Second, there were challenges with circulating the invitation email among members of some academic institutions due to local constraints related to research ethics, which meant that some organisations could not be included in the recruitment strategy. Third, the lower response rate to sensitive survey questions (e.g., respondents' salary) may limit the generalizability of the related results. Fourth, our results cannot be generalised to private clinical settings, as it was difficult to target all rehabilitation settings (public and private) due to limited resources and time constraints. Lastly, the survey instrument was only validated for face and content validity. The work activities section was guided by the Role Model for Knowledge Brokering, however,

more items can be generated for each role in the future to ensure covering all possible tasks in each KBs role. The items selected in this study were those perceived to be most reflective of a given role, and the total number of items included was based on maintaining a balance between content coverage and the time needed to complete the survey.

Conclusions

This research is an important first step in exploring the profile of KBs working to promote the uptake of evidence within rehabilitation contexts in Canada. Findings suggest that KBs are mostly expert clinicians who tend to perform brokering activities targeting their peers on a part-time basis and as part of their health professional position. Several titles are used interchangeably to refer to KBs, who mostly performed the role of linking agent, capacity builder, and information manager. Moreover, few participants received any formal training in performing brokering activities. There is a need to explore the available training opportunities for KBs to help in addressing their training needs. These findings provide valuable information to organisations wishing to employ KBs to help improve clinical practice, and ultimately patient health outcomes.

List of abbreviations

KT: Knowledge translation

KBs: Knowledge brokers

CHERRIES: The Checklist for Reporting Results of Internet E-Surveys

WA: Weighted-Average

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Declarations

Ethics approval and consent to participate

This study was approved by the McGill University Institutional Review Board (IRB Number: A02-E11-17B). All research participants provided written consent before completing the survey.

Consent for publication

The consent to participate in the study included all participants providing consent for publication in an unidentifiable format.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was sought for this study.

Authors' contributions

DG developed data collection tool, collected, prepared data, coded, analysed and interpreted data. SA, AT, and AB contributed to the conceptualisation of the manuscript and critically reviewed the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We wish to thank Miss Mushirah Hossenbaccus, research assistant, Le Centre Intégré Universitaire de Santé et de Services Sociaux du Centre-Ouest-de-l'Île-de-Montréal, The Centre for Interdisciplinary Research in Rehabilitation of Greater Montréal (CRIR) for her assistance with making phone calls for clinical sites in Quebec, and Mr. Ahmed Abou-Sharkh, PhD student, for recording the French version of the YouTube video, and McGill IT services for their support with the Lime Survey platform hosted by McGill University.

Fig. 1 Flowchart of the recruitment strategies

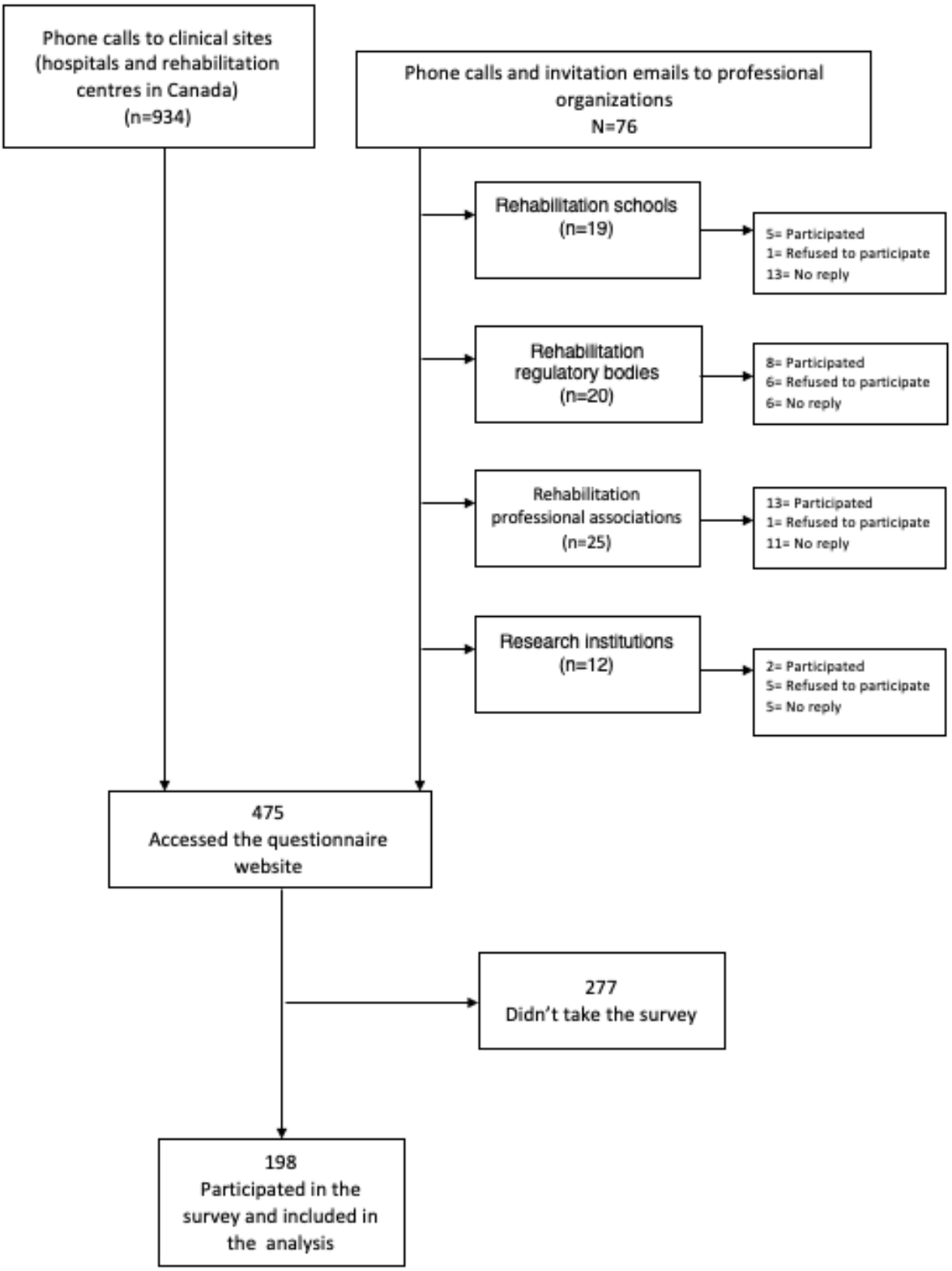

Fig. 2 The weighted-average of performing each task corresponding to each knowledge brokering role across all participants

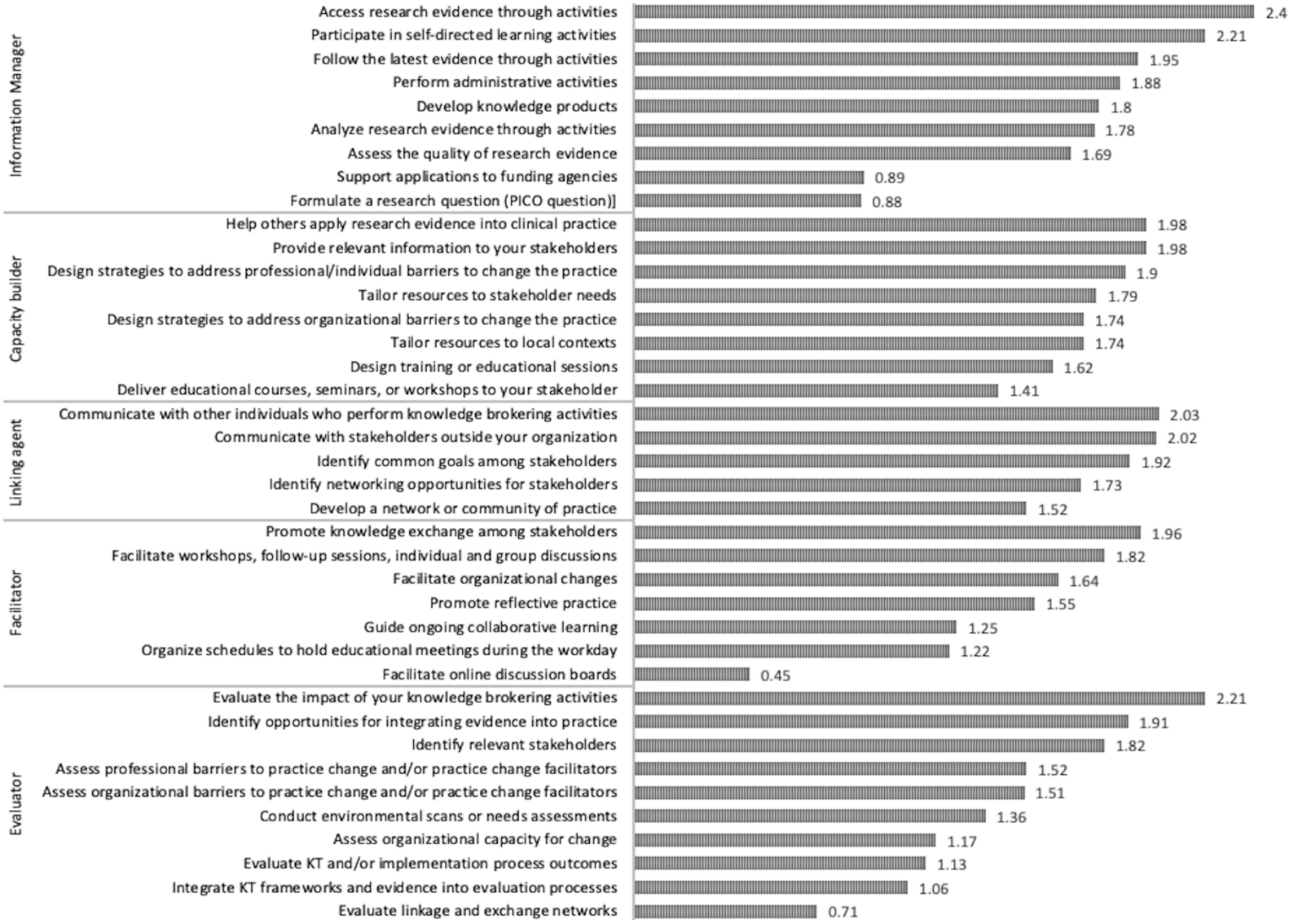

Table 1 Sociodemographic characteristics of KBs (n=198)

Characteristics	n (%)
Region	
Central	140 (71%)
Eastern	4 (2%)
Western	54 (27%)
Province	
Alberta	20 (10%)
British Columbia	20 (10%)
Manitoba	13 (7%)
New Brunswick	1(1%)
Newfoundland	1 (1%)
Nova Scotia	2 (1%)
Ontario	36 (18%)
Quebec	104 (53%)
Saskatchewan	1 (1%)
Language	
English	117 (59%)
French	81 (41%)
Age group	
Middle age (36-60)	144 (73%)
Senior (>60 years old)	10 (5%)
Young age (25-35)	44 (22%)

Table 2a Professional characteristics of KBs

Characteristics	n (%)	Total
Profession		**198**
Clinician	99 (50%)	
Manager	26 (13%)	
Researcher	35 (18%)	
other	62 (31%)	
Types of working organizations		**198**
Clinical setting	149 (75%)	
Research setting	35 (18%)	
Academic setting	43 (22%)	
Others	20 (10%)	
Experience in performing KBs activities		**198**
Beginner (≤ 10 years)	147 (74%)	
Moderate experience (11-20 years)	40 (20%)	
Experts (Over 21 years)	11 (6%)	
Educational level		**198**
Undergraduate (Diploma, Bachelor's)	65 (33%)	
Graduate (Master, Doctoral, Post-Doc)	133 (67%)	
Job status		**198**
Part-time (1 -3 days)	110 (56%)	
Full-time (4-5 days per week)	88 (44%)	
Clinical professions (*)		**99**
Physical therapists	36 (36%)	
Occupational therapists	49 (49%)	
Speech language pathologists	6 (6%)	
Others	8 (8%)	
Clinical experience (*)		**99**
Low experience (≤5 years)	23 (23%)	
Moderate (6-15 years)	21 (21%)	
Expert (≥ 16 years)	55 (56%)	
Frequency of performing KBs activities (**)		**110**
Daily	16 (15%)	
Weekly	35 (32%)	
Monthly	59 (54%)	
Payment status		**110**
Paid	66 (60%)	
Non-paid	44 (40%)	

(*) total number is 99, since this is for KBs clinicians only.

(**) total is 110, since this is for part-time KBs only.

Table 2b Professional characteristics of KBs (*)

Characteristics	n (%)	Total (*)
Starting KBs activities		**194**
Volunteered	87 (45%)	
Hired via job post	110 (57%)	
Employers selection	51 (26%)	
Colleagues selection	19 (10%)	
KT expert selection	13 (7%)	
KBs recommendation	16 (8%)	
Evaluate abilities to perform KBs activities	10 (5%)	
KBs networks		**188**
Clinician	177 (94%)	
Researchers	69 (37%)	
Students	66 (35%)	
Receiving KBs training		**182**
Didn't receive training	112 (62%)	
Received training	70 (38%)	
Salary rate for full-time KBs		**66**
31$ - 40$	11 (17%)	
≤ 30	4 (6%)	
≥ 41$	51 (77%)	
Salary rate for part-time KBs		**73**
31$ - 40$	18 (25%)	
≤ 30$	5 (7%)	
≥ 41$	50 (68%)	
KBs perception to their salary		**45**
Equal to the salary of a clinician	19 (42%)	
Less than the salary of a clinician	9 (20%)	
More than the salary of a clinician	17 (38%)	

(*) Number of respondents for each question varied.

Table 3 Activities performing the five role domains of KBs' roles and tasks

Roles (activities)	Total	Responses n (%)			Task weighted average	Role weighted average
		Usually (at least once/week)	Sometimes (at least once/month)	Rarely (at least once/ 3 months)		
Information Manager	**198**					
Access research evidence through activities such as searching research databases journals, or research websites		95 (48%)	60 (30%)	43 (22%)	2.4	
Participate in self-directed learning activities such as attending webinars or workshops, or reading recent peer reviewed literature		68 (34%)	82 (41%)	48 (24%)	2.21	
Follow the latest evidence through activities such as setting up alerts for journals and reviewing them		78 (39%)	42 (21%)	78 (39%)	1.95	
Perform administrative activities such as organizing conferences, meetings, or workshops		57 (29%)	60 (30%)	81 (41%)	1.88	1.71
Develop knowledge products such as educational material, flyers, binders, online programs, etc.		50 (25%)	61 (31%)	87 (44%)	1.8	
Analyze research evidence through activities such as summarizing and interpreting research results		48 (24%)	66 (33%)	84 (42%)	1.78	
Assess the quality of research evidence		49 (25%)	56 (28%)	93 (47%)	1.69	
Support applications to funding agencies		19 (10%)	23 (12%)	156 (79%)	0.89	
Formulate a research question (PICO question)		9 (5%)	32 (16%)	157 (79%)	0.88	
Linking agent	**197**					
Communicate with other individuals who perform knowledge brokering activities		67 (34%)	52 (26%)	78 (40%)	2.03	
Communicate with stakeholders outside your organization		65 (33%)	59 (30%)	73 (37%)	2.02	
Identify common goals among stakeholders		62 (31%)	69 (35%)	66 (34%)	1.92	1.84
Identify networking opportunities for stakeholders		53 (27%)	55 (28%)	89 (45%)	1.73	
Develop a network or community of practice		40 (20%)	48 (24%)	109 (55%)	1.52	
Capacity builder	**197**					
Help others apply research evidence into clinical practice		65 (33%)	62 (31%)	70 (36%)	1.98	
Provide relevant information to your stakeholders		64 (32%)	63 (32%)	70 (36%)	1.98	
Design strategies to address organizational barriers to change the practice		51 (26%)	66 (34%)	80 (41%)	1.9	1.76
Tailor resources to stakeholder needs		56 (28%)	62 (31%)	79 (40%)	1.79	
Design strategies to address professional/individual barriers to change the practice		62 (31%)	61 (31%)	74 (38%)	1.74	
Tailor resources to local contexts		58 (29%)	50 (25%)	89 (45%)	1.74	
Deliver educational courses, seminars, or workshops to your stakeholder		24 (12%)	56 (28%)	117 (59%)	1.41	
Facilitator	**190**					
Promote knowledge exchange among stakeholders (e.g. by supporting peer-to-peer learning)		54 (28%)	69 (36%)	67 (35%)	1.96	
Facilitate workshops, follow-up sessions, individual and group discussions		43 (23%)	65 (34%)	82 (43%)	1.82	
Facilitate organizational changes		38 (20%)	60 (32%)	92 (48%)	1.64	
Promote reflective practice such as leading discussion groups or/and peer review activities touching on clinical practices		32 (17%)	63 (33%)	95 (50%)	1.55	1.41
Guide ongoing collaborative learning		30 (16%)	44 (23%)	116 (61%)	1.25	
Organize schedules to hold educational meetings during the workday		23 (12%)	52 (27%)	115 (61%)	1.22	
Facilitate online discussion boards		6 (3%)	15 (8%)	169 (89%)	0.45	
Evaluator	**190**					
Evaluate the impact of your knowledge brokering activities		14 (7%)	42 (22%)	134 (71%)	2.21	
Identify opportunities for integrating evidence into practice		55 (29%)	65 (34%)	70 (37%)	1.91	
Identify relevant stakeholders		54 (28%)	60 (32%)	76 (40%)	1.82	
Assess professional barriers to practice change and/or practice change facilitators		29 (15%)	66 (35%)	95 (50%)	1.52	
Assess organizational barriers to practice change and/or practice change facilitators		31 (16%)	61 (32%)	98 (52%)	1.51	
Conduct environmental scans or needs assessments		21 (11%)	53 (28%)	116 (61%)	1.36	1.32
Assess organizational capacity for change		20 (11%)	49 (26%)	121 (64%)	1.17	
Evaluate KT and/or implementation process outcomes		19 (10%)	40 (21%)	131 (69%)	1.13	
Integrate KT frameworks and evidence into evaluation processes		25 (13%)	30 (16%)	135 (71%)	1.06	
Evaluate linkage and exchange networks		7 (4%)	28 (15%)	155 (82%)	0.71	

CHAPTER 6
The Integration of Manuscripts 2 and 3

6.1 Research questions of manuscripts 2 and 3

Manuscript 2:

This manuscript aimed to describe the profile of KBs working within rehabilitation settings across Canada, including the sociodemographic and professional characteristics, work activities, and training received.

Manuscript 3:

This manuscript aimed to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings.

6.2 Integration of manuscripts 2 and 3

The previous chapter (manuscript 2) described the profile of surveyed KBs (n=198) in terms of sociodemographic and professional characteristics, work activities, and training. Findings showed that KBs were mostly experienced clinicians, performing the linking agent, the capacity builder, and the information manager roles. In addition, this manuscript highlighted the lack of specialized training for KBs. Consequently, exploring factors that can promote or hinder the optimal use of those KBs within rehabilitation settings was deemed essential to further our understanding of their work environment (manuscript 3).

CHAPTER 7

Manuscript 3: Perceived Barriers and Facilitators to Using Knowledge Brokers in Canadian Rehabilitation Settings

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ABSTRACT

Background: Knowledge translation experts advocate for employing knowledge brokers (KBs) to promote the uptake of research evidence in health care settings. However, little is known about factors influencing the utilization of KBs, thereby limiting their employment within healthcare organizations. This research aimed to identify factors likely to hinder or promote the optimal use of KBs within rehabilitation settings in Canada.

Methods: Qualitative study using semi-structured telephone interviews with individuals performing KB activities in rehabilitation settings across Canada. The interview topics' guide was informed by the Consolidated Framework for Implementation Research (CFIR) and consisted of 20 questions covering five domains: characteristics of individuals, inner setting, process, outer settings, and innovation characteristics. All interviews lasted from 60 to 90 minutes, were digitally recorded, and transcribed verbatim. We conducted qualitative descriptive analysis combining deductive coding as guided by the CFIR. Two independent analysts coded and rated all interviews, then met to review, deliberate and modify the codes as appropriate. A matrix was created by listing the salient codes for each CFIR construct to identify factors (facilitators and barriers) at the individual, organisational, and process level most likely to impact the KB's success/failure.

Results: Twenty-three participants from five Canadian provinces were interviewed. At the individual level, the majority of participants reported having strong communication skills, being confident about performing KBs activities, and possessing solid clinical experience and prior research skills. At the organizational level, most respondents indicated constantly networking and engaging with clinical teams and different stakeholders and having an acceptable level of guidance from their managers. Very few participants felt that they received sufficient organizational support (i.e., clerical support, IT support). At the process level, all participants indicated needing evaluation tools to better gauge their performance, and the majority mentioned that they would benefit from having additional training tailored to their roles as KBs.

Conclusions: Individual, organisational, and process level factors likely to hinder or promote the optimal use of KBs within Canadian rehabilitation settings include skillsets and networking abilities; culture, resources, and leadership support; and the need for specific training for KBs and for evaluation tools to monitor their performance.

Keywords: Knowledge Translation, Knowledge Brokers, Rehabilitation, CFIR, Semi-structured Telephone Interviews

Contributions to the literature

- Knowledge brokers in the field of rehabilitation need to possess a number of unique features including communication skills, research skills, clinical experience, and networking and engagement abilities.

- Organizations should provide knowledge brokers with access to physical resources and open access databases as well as allow adequate time and financial support for knowledge brokers roles.

- Knowledge brokers need specialized training in brokering activities and require to evaluate their own performance.

Background

Clinical practice often fails to be optimally informed by research evidence [1]. Despite available clinical guidelines to inform practice in rehabilitation [2-8], there are persistent gaps between knowledge generation and its use in practice [9-18]. Such gaps have a negative impact on the health outcomes of individuals and communities [19] and can lead to inefficient use of limited health care resources [1, 12]. There is a growing interest in the concept of knowledge translation (KT) as a means to promote the use of research evidence into clinical practices [20].

The use of knowledge brokers (KBs) is considered as one of the promising KT strategies, [11, 21, 22] that can enhance success and sustainability of the whole KT process [23], and consequently help reduce research-practice gaps [11, 17, 24-30]. Evidence from multiple studies suggests that KBs have an impact on behaviour change [31] in many healthcare sectors [32-39], including rehabilitation [40-47]. For instance, Baskerville et al. showed that primary care practitioners who work with knowledge brokers are 2.76 (95% CI, 2.18-3.43) times more likely to adopt evidence-based guidelines [48]. According to The Canadian Health Services Research Foundation (CHSRF), KBs are defined as "one of the human forces which bring people together to build relationships, uncover needs, share ideas and evidence aiming to improve job productivity" [24]. KBs act as intermediaries between researchers who produce scientific knowledge, and clinicians and other knowledge users (decision-makers and caregivers) who apply this knowledge [11, 49-52]. They link practitioners with researchers, facilitate their interactions to better understand goals, cultures, and environmental limitations of each other's work, and allow practitioners and researchers to work collaboratively to ease evidence uptake [10, 53-55]. Glegg et al. [56] developed the Role Model for Knowledge Brokering which classifies KBs activities into five main domains: 1. information manager, 2. linking agent, 3. capacity builder, 4. facilitator, and lastly 5. evaluator. (Additional file 1 presents each role, with definitions and examples of related tasks)

One of the underlying features of a KB is being an insider. Several studies have indicated that KBs are clinicians who are typically embedded in their organization and are performing the additional role of broker in order to influence peers [21, 57-59]. However, a recent study provided new insights on the challenges and tensions experienced by KBs that can impact the effectiveness of the brokering process [60]. For example, the tensions between the different aspects of brokering (i.e., collecting information, sharing information, and adopting information) and those resulting from being positioned between individuals with

different perspectives (i.e., between clinicians and researchers). In Canada and elsewhere the interest in the utilization of KBs as a promising strategy is growing, knowledge on how the brokering role is mediated by different facilitators and barriers is limited [40-47, 61]. To date, no previous research has identified potential barriers associated with using KBs as a means to promote the uptake of research evidence in rehabilitation settings. In the absence of such knowledge, the ability of rehabilitation organizations to utilize KBs within rehabilitation settings remains limited [11, 62]. This research aimed to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings.

Methods

Research Design

The study consisted of a qualitative descriptive design [63]. Semi-structured telephone interviews were conducted with individuals who perform brokering activities in rehabilitation settings across Canada. The checklist for qualitative studies: Standards for Reporting Qualitative Research (SRQR) is available in Additional file 2.

Participants and setting

KBs who promote the uptake of research evidence in clinical practice for rehabilitation practitioners were invited to participate in the study, regardless of whether they worked in clinical, educational, or research institutions across Canada.

Eligibility Criteria

To be eligible, participants had to: 1. be responsible for translating research evidence into clinical practice in their workplace; 2. perform one or more of the five knowledge brokering activities, i.e., information manager, linking agent, capacity builder, facilitator, or evaluator in their workplace; 3. work in any type of setting (e.g., hospitals, rehabilitation centre, professional association, research institution, or academic organization) that supports or promotes translation of research evidence into rehabilitation practice; and 4. be able to communicate verbally in English or French.

Recruitment strategies

Eligible participants who had already participated in a related study [59] (n=100) were invited to participate in this current study. They received an invitation email which included an information sheet describing the study context and objectives. Adopting a convenient

sample approach, we planned to interview all interested participants. Participants were asked to follow a hyperlink attached to the invitation email to complete a consent form and to provide their availability for an interview using Microsoft Webform. A reminder was sent by e-mail every 2 weeks for 6 weeks. The recruitment process ended 2 weeks after the last reminder (i.e., at 8 weeks).

Instrument

The interview topics' guide was informed by the Consolidated Framework for Implementation Research (CFIR), which provides a pragmatic structure for determining potential factors related to the implementation process [64]. In our case, the CFIR was useful to guide various questions that cover all domains related to the KBs roles and work environment. The CFIR is composed of five major domains: characteristics of individuals, inner setting, process, outer settings, and innovation characteristics. The interview guide consisted of 20 questions covering the five CFIR domains (see Additional file 3).

The interview topic guide was developed jointly by the first author (DG) and three KT experts (AB, SA, AT) familiar with the CFIR. The interview guide was translated into French and revised for content and face validity by three English-speaking and three French-speaking KBs working in the rehabilitation field, and revisions were made accordingly. The two interview guides (English and French) were pre-tested with the first six recruited KBs (three English-speaking and three French-speaking KBs) before starting the data collection. Minor changes were made based on the feedback to generate the final version.

Procedures

Semi-structured individual interviews were conducted between February and May 2019. The first author conducted all English-language interviews, while another investigator (DZ) led the French-language interviews. A 2-hour training session with both interviewers was deigned to discuss the content of the interview guide and the structure of the interviews. Interviewers had no prior relationships with any of the participants. Informed consent was obtained before each interview. All interviews lasted from 60 to 90 minutes and were digitally recorded using the Zoom meeting platform [65], and transcribed verbatim.

Analysis

Our qualitative descriptive analysis [66] consisted of deductive coding guided by the Consolidated Framework for Implementation Research (CFIR) [64, 67] and then inductive coding to identify subthemes within CFIR domains. The process involved three steps:

Data coding

Two team members independently coded and analyzed each interview [68, 69] using a Microsoft Excel sheet to facilitate data organization, management, and coding. In order to maximize the rigour of the coding process, the study team had several meetings to discuss and review the coding scheme. The two coders compared their coding on a first transcript, resolved discrepancies, and reached consensus through discussion. The coding scheme sheet was further tested with four additional interviews. Minor modifications were made by adding pre-specified sub-codes to four questions to facilitate coding. Coders then met periodically to compare and adjudicate coding differences and achieve consensus. Three experts in qualitative research (AB, SA, AT) provided a critique of the analysis and interrogated the coding to ensure a robust and defensible coding of the data. Lastly, the coders met to review, deliberate, and modify the codes as appropriate.

Code rating

As per CFIR rating rules, the rating process was used to help elucidate the relative importance of each construct across all interviews [70]. The rating was performed for two dimensions: valence and magnitude. “Valence” refers to the construct’s influence (positive [+], negative [-], no impact [0]). Valence was considered to be positive (facilitated KBs roles), negative (hindered KBs roles), or have no impact (not affecting KBs roles). “Magnitude” refers to the extent to which the constructs were discussed. Magnitude was determined based on the level of agreement among participants, which was reached by calculating the proportion of participants who mentioned each code (i.e., few = 0-25%, some = 26-50%, many = 51-75%, most = 76-100%). Only codes that were described by two or more participants were tabulated [71] and only codes that were rated with 25% or higher were included in the study results. Salient codes were those discussed by the majority of respondents (more than 50%) [72, 73]. Two raters independently rated the codes, then met and compared their rating until consensus on all ratings was achieved.

Generate matrix and identify key constructs

Finally, a matrix identifying the factors that appeared to positively (facilitators) or negatively (barriers) impact the KBs was created by listing the salient codes for each CFIR construct.

Results

Of the 100 individuals invited to participate in the study, 23 from five Canadian provinces (Quebec [QC], Ontario [ON], Alberta [AL], British Columbia [BC], Manitoba [MB]), agreed to be interviewed. Demographic characteristics of the participants are displayed in Table 1. Tables 2 and 3 present the salient facilitators and barriers as per the CFIR themes. Figure 1 presents the salient barriers and facilitators, reported by more than 75% of participants. Additional files 3 and 4 present the descriptive analysis based on CFIR domains together with illustrative quotes.

I. Characteristics of Individuals

A. Knowledge about KBs Roles: Many participants (70%) reported that their role was mainly to seek, adapt, and share evidence within their local context. More than half (57%) of the respondents indicated that linking different groups of stakeholders was a key role, whereas others (39%) stated that implementing new practices by building individual capacities and addressing barriers for clinical practice change was an important aspect of their role.

> *"It's helping people access the right evidence at the right time in the right amount to help them address their questions and or to have supporting evidence to move forward" (MB5)*

B. Self-efficacy: Most participants (83%) felt confident about their ability to perform their KBs roles, and one quarter of participants believed that they have the skills needed to perform KBs roles, which promoted their self-confidence.

> *"I feel confident ... I am an occupational therapist ...for almost 14 years... I have a really good understanding of the clinical environment, the frontline care.... I've also spent almost 12 years being actively engaged in research activities ...so having my feet in both worlds I think gives me a lot more confidence" (AB7)*

C. Individual Identification with the Organization: About half of the participants' job evolved to include KBs roles over time (52%). In contrast, several other participants (39%) applied for a KB position.

> *"I was not identified... I created the role for myself I think it became self-identified ...I was successful in being able to sort of advocate for the importance of having a role like this" (AB7)*

D. Personal Attributes:

1. Clinical Experience: 74% of interviewees stated that they had clinical experience and of those, 10 (43%) reported that an in-depth understanding of clinical topics helps them better address the needs of their peers while performing KBs roles.

> *"A broker… somebody who is somewhat connected to the topic (clinical topic) right and understands the real-life context so that's one thing" (AB6)*

2. Research skills: Similarly, 74% of participants had formal research training (e.g., master's degree) or had taken part in research activities (65%).

> *"My training as a master student is a facilitator because I've been exposed to research so looking for info in database is easier for me than it is for a clinician" (QC9)*

3. Communication Skills: Nearly all participants (91%) stated that good communications and networking skills were essential to perform their job.

> *"I think that communication skills are probably one of my strengths" (QC12)*

4. Interpersonal attributes: Other attributes perceived as helpful to perform their KBs roles included being interested and motivated to implement the latest evidence and able to motivate others (52%), being flexible (48%), having emotional intelligence (43%), leadership skills (39%), and being a life-long leaner (26%).

> *"I had already volunteered, I was always the first one to put my hand up to be involved in a new initiative or a new project or be the chair of a city, so they had had lots of opportunities to kind of see me in action" (ON1)*

II. Inner Setting

A. Networks and Communications: Most participants (91%) had consistent networking and engagement with clinical teams and different stakeholder committees (e.g., clinical teams, professional groups and provincial groups). 61% regularly shared information of potential interest with team members (e.g., upcoming training or funding opportunities). Mostly, networking activities were performed remotely for almost all participants (91%) through email exchanges, phone calls, and online meetings (Skype, Zoom, WebEx) especially if a participant was responsible for a large organization. In-person meetings were also very common (78%).

> *"If there's a workshop coming up or a webinar that people might be interested in, a grant funding, call for research or for program development, then I would email that to everyone in our organization" (MB11)*

Almost two thirds of participants (65%) reported that they need more communication with their stakeholders, and one quarter of participants suggested using online platforms to improve communication.

> *"One thing that would improve my ability to do the KB role it certainly is more and better networking. I still find that communication from kind of provincial groups getting that information to frontline is still a barrier" (AB17)*

B. Needs of Those Served in the Organization: Almost all participants (91%) were made aware of their stakeholders' needs by questions and concerns raised by their staff. Needs were also identified through informal engagement with peers (91%), during regular staff meetings (70%), by questioning the stakeholders (43%), through receiving stakeholders' feedback and complaints (30%), or through conducting needs assessments (30%).

> *"I understand their needs based on our communications you know I hear from people every day I feel like I spend most of my day talking to people in different regards" (AB7)*

C. Implementation Climate

1. Tension for Change: One quarter of participants (26%) reported a lack of awareness of KBs roles within their organization.

> *"When it comes to clinicians or teams or other parts of the organization … they will say, well you know, why should we do what they want us to do… I keep trying to explain… I'm the messenger I'm the helper, I'll help you move forward" (ON1)*

2. Relative Priority: Twelve participants (52%) reported that performing KBs activities was not considered a high priority for the organizations.

> *"I'm always having to kind of push myself on others when they're like why are you bothering us with this kind of thing… others don't see it as a priority and because the organisation has not made it a priority" (ON1)*

3. Organizational Incentives & Rewards: Though almost all participants (96%) didn't receive any incentive, or a salary increase to perform KBs activities.

> *"Nope no we don't have any incentive program" (ON8)*

4. Goals and Feedback: KB activities performed by interviewees had several goals, such as supporting implementation of research evidence, keeping clinicians up-to-date (78%), and networking with different stakeholders and engaging clinicians (39%).

> *"Me and my team supports them [clinicians] then with actual implementation with ongoing education as well as evaluation so we can come in and do audits we come in and do training we help them treat things" (AB6)*

For most participants (78%), the goals of KBs activities were not pre-determined, however, goals were responsive to local context needs for several.

> *"I totally agree yeah it's really based on the needs of them yeah what gets identified" (AB7)*

Almost 40% of participants reported the KBs roles were not well-defined.

> *"I don't know… I haven't read a definition of knowledge brokering best book role" (MB5)*

And a similar number (35%) reported the feeling of being overwhelmed with numerous tasks.

> *"I'm trying to do a lot with not just my time… I think that's one of the challenges within my role is I'm expected to do all of those things… Mm-hmm it's a lot of work" (ON1)*

5. Organizational support: One third of interviewees (35%) received administrative support such as graphic design and clerical help, IT support, digital media, and adequate time to perform KBs activities. Eight interviewees (35%) had time to perform KBs activities, and the remaining seven had an information sharing system. However, most participants reported the

lack of financial support (78%) (i.e., financial support to attend training opportunities), lack of time (78%) (i.e., not liberating KBs or clinicians to participate in activities), and lack of administrative support (61%) were barriers.

"Limited budget that you have access to. …You know the common phrases; we have no money" (MB4)

D. Readiness for Implementation

1. Leadership Engagement: Two-thirds of participants (65%) reported receiving guidance from their managers. Several also mentioned that managers are accessible (52%), supportive (48%), and open to discussion (39%).

"My manager was great… Very supportive" (MB3)

Six participants praised their managers for liberating them to attend training opportunities, believing in KBs activities, and allowing for more KBs autonomy. Some participants (30%) complained of the lack of managers' accessibility and availability.

"I wish I had more access to her [my manager] sometimes she's a very busy woman" (AB7)

2. Available Resources: All participants had access to computers, many had office space (57%) and access to software programs (Telemedicine Skype, Zoom, SharePoint, Adobe connect, OneNote) (52%), and or conference rooms (35%).

"We have persuaded many teams to use Zoom as a way to communicate so zoom has increased our capacity to reach out to certain clinicians even patients and physicians" (QC18)

3. Access to Knowledge & Information: Most participants (78%) reported that networking with colleagues, experts, or other stakeholders (i.e., patients), and social media helped them gain information. Many also access different sources such as organizations newsletters (74%), the library databases (70%), and other online searching (52%).

"We're also involved in various communities of practice which shares information latest research clinical practice guidelines" (BC2)

Nonetheless, several expressed the need to access information resources (i.e., databases) (52%).

"It's quite hard to access evidence-based because our library services is not great…. we don't have much access to data back databases" (QC18)

III. Process

A. Planning: Eighteen participants shared that they did not receive any training on their KBs roles before starting their job. Nearly half of the participants (43%) relied on self-learning activities and searched for educational training opportunities that could help them perform the KBs role. One third of participants (35%) mentioned that their organization provided ongoing training opportunities at work, and the remaining participants (30%) said they gained their KBs knowledge and skills over time with work experience. Few participants (26%) received formal KT training (master's degree or a certificate).

"There was the opportunity to do this knowledge translation certificate at SickKids [hospital]….I did the one through Guelph… that course in knowledge translation open my eyes" (ON19)

Most participants (87%) expressed the need for additional training to improve their skills in communication, research, managing people and projects, as well as change and conflict management.

"I think I could be more effective if I add more training… training for myself in terms of hopping my skills" (ON1)

B. Engaging: Interviewees reported several factors likely to encourage their peers' involvement in KT activities, including KBs' credibility, building trust, and being seen as a source of information (48%); participants' attitude toward teammates and mutual respect (39%); providing clear explanations and justifications when implementing new evidence, favouring shared decision-making (35%); being insiders, engaged within teams, and aware of the local context needs (35%); being interested in their peers (35%), and avoiding being seen as "giving orders" (35%).

"Yes I would say... it has to do with my credibility authority and come relational interpreter relational competencies" (QC18)

C. Reflecting & Evaluating: Nearly all participants monitored their performance through different strategies, including having ongoing follow-up with their managers (96%), presenting

regular reports (83%), receiving feedback from their managers (48%), tracking productivity and meeting stakeholders' needs (35%), and meeting goals and deadlines (30%).

> *"There are reports, periodic performance reports, I think every six months" (ON8)*

Nonetheless, all participants expressed the lack of formal evaluation of their knowledge brokering performance (or an evaluation framework) and some participants (57%) agreed that a valid evaluation tool to gage their performance would be useful

> *"I feel like there must be a better way to measure. I'm just not sure what it is…. momentum plan where we said like three months six months or one-year type goals and it has anything to do with knowledge brokering" (ON16)*

IV. Outer Setting

A. Cosmopolitanism: Half of the participants (52%) were connected to professional support groups (community of practices "CoP") or provincial committees (35%) which kept KBs up-to-date.

> *"We have our community of practice and things like that that we discuss you know best practice and what is going on and what people are experiencing at their sites and work together as a team" (BC2)*

B. Peer Pressure (Peer Support)

More than half of the participants (61%) reported a need for a CoP for individuals who perform KBs activities. Nearly half of participants (43%) stated that they sometime contacted other individuals who perform KBs activities, and one third of participants didn't contact any KBs at all.

> *"It is really important to the people, the KB community of practice… that mentorship, having other knowledge brokers to talk to, like the librarian, and just having some of those structures that are in place and the support" (MB5)*

V. Innovation Characteristics

A. Innovation Source: The majority of participants (78%) reported that their organizations believe in the importance of keeping clinicians up-to-date and to support them to ensure the highest standard of care.

> *"It definitely needed a knowledge broker position… because there are so there were so many players… I think having one central person that kind of coordinated all of that was pivotal so for me" (MB3)*

B. Relative Advantage: Perceived advantages of performing KBs activities included feelings of satisfaction and completion (35%), flexibility in terms of time and place (30%), and building professional relationships and credibility (26%).

> *"That's my satisfaction, that's my incentive, that's that the reason I do the job I do, not financial" (QC12)*

C. Cost: Nineteen participants (83%) were paid through governmental funds or foundations, and over two thirds felt stable in their positions.

> *"Well I work in a hospital in Ontario, it is publicly funded through the lens from the Ministry of Health" (ON1)*

Discussion

This study aimed to identify factors likely to hinder or promote the optimal use of KBs within the Canadian rehabilitation settings. Our findings showed that factors common to the five different Canadian provinces likely to influence KBs roles are mainly associated with three levels: individual, organizational, and process level.

Individual level

Each broker in the present study was unique in terms of their personal attributes and the particular skills required for their position in their local context. Prior research has suggested exploring which of these attributes and skills are most likely to support and enhance KBs efforts in knowledge translation [74, 75]. Our findings address this gap by showing that having certain attributes and skillsets (i.e., clinical experiences, understanding of local context demands, communication and research skills, and involvement in research activities) was viewed as favourably impacting the performance of KBs. Cultivating these features may help to ensure the success of the KT process. These findings are consistent with those from a realist review [58] and a national survey [59] undertaken by our team, showing that KBs are often clinicians embedded within the organization with over 15 years of clinical experience. Likewise, previous research reported that positive traits of KBs include professional competencies [76-78], experiential knowledge [76], and communication skills [79]. This emphasized that KBs success does not only lie in what they do, but also in who they are [80].

Our findings also indicated that personal attributes that are common traits of KBs included motivation and flexibility, having emotional intelligence and leadership skills, as well

as intellectual curiosity and analytic skills. This is also in line with previous research suggesting that KBs are enthusiastic, agreeable, friendly, flexible, positive, persuasive, entrepreneurial, proactive, comfortable working in a dynamic environment, and open-minded [81, 82]. Interestingly, our findings showed that many participants were self-motivated to get involved in brokering activities voluntarily; these findings are also consistent with another study [59], showing that many KBs volunteered to perform this role. For several participating KBs, and consistent with the scoping review by Bonawitz et al [81], the feeling of satisfaction was a sufficient motivator and reward for continuing to perform these types of activities, even in the absence of organizational incentives. A recent mixed method study also showed that ownership, persuasiveness, and grit may all contribute to the one's ability to drive the KT process [80].

Together, those skills and personal attributes appear to provide KBs with the required self-confidence and credibility among their teams, thereby reducing resistance to behavioural change. This is supported by prior research indicating that KBs tend to be trusted, accountable, respected individuals who have credibility among their teams [31, 75, 83]. These individuals appear to be influential among various stakeholder groups [84, 85] because of their positive attitude which facilitates the knowledge sharing process and drives behavior change within an organization. These identified skills and attributes need to be considered by employers and KT researchers when selecting individuals to play the KB roles within their organizations.

Another preferred feature of KBs was that of insider (i.e., working in the same setting as team members) as it appeared to facilitate networking and engagement in brokering activities and increase the KBs awareness of the local context needs and the desired change. Our findings are consistent with research indicating that brokering activities are highly responsive to the context in which they occur [75], and that KBs should work within the given clinical setting [21, 57] as this raises awareness of their peers' needs, schedules, clinical roles, caseloads, current practices, and past experiences [84-86]. Findings from this study showed that working in a different building or city was perceived as a barrier to constant involvement. Bonawitz et al. [80] have indicated that the physical presence at the point of change may contribute to an individual's ability to drive the desired change. Applying multiple facilitation methods (i.e., interactive discussion combined with online resources and multiple technology methods) [56, 85, 87, 88] was reasonable compensation for KBs working remotely to promote

485 the success of the KBs roles. In general, our findings at the individual level can be used to
486 select more effective KBs to enhance the KT process.
487
488 *Organizational level*
489 Recognizing that knowledge brokering involves interactions between various types of
490 stakeholders, it is important to consider the social determinants of brokering activities [74].
491 Our findings showed that networking and engagement with different stakeholders was seen as
492 an essential element of the brokering activities since constant networking helped KBs to be
493 aware of stakeholders' needs. Also, ongoing conversations among KBs and their peers seem
494 to have a number of advantages at the inner setting level when communicating with clinical
495 teams and managers (e.g., decreasing the resistance to change and providing the informal
496 evaluation for KBs activities) and at the outer settings level when communicating with
497 professional and provincial groups (e.g., facilitating the accessibility to information). The
498 existing literature [89-93] and a recent mixed-method study [94] showed that by building
499 relationships with knowledge users Canadian KBs' help their peers to gain access to research
500 evidence that can inform or improve their practices. Previous research also emphasized the
501 importance of interpersonal communication as a substantial element in knowledge brokering;
502 communication acts as a foundation to build relationships of trust between KBs and their
503 working teams [10, 54, 76, 90, 95]. Emphasising strong communication skills and networking
504 abilities needs to be highlighted as essential elements in KBs' job requirement in the future.
505
506 Organizational support (access to resources, administrative, technical, and financial
507 support) can positively influence the initiation and sustainability of the KBs role within an
508 organization [31, 74, 81, 84-86, 96]. Indeed, our findings suggest that several forms of
509 organizational support can impact the success of KBs roles. For instance, providing access to
510 a library, databases, and subscribing to relevant newsletters, along with providing IT support,
511 clerical support, virtual communication tools, physical space "offices and conference rooms"),
512 and allowing adequate time for KBs activities (i.e., liberating individuals to perform KBs
513 activities and liberating clinicians to participate in KBs activities) were deemed important by
514 participants.
515
516 Our findings also highlighted a lack of financial support for KBs activities (i.e., budget
517 for developing KBs resources and attending conferences). Previous research has reported that
518 dedicating financial support for brokering activities clearly facilitates these activities [84-86,

96, 97]. One solution might be to work in collaborations with researchers and graduate students, [59] taking advantage of funded research investigating brokering activities [97]. Prior research also emphasized that organizations should value and prioritise brokering activities as well as enhance the awareness of the KBs role to positively impact their function [97]. This was reflected in the views of our participants who raised issues related to the organizations' limited awareness of KBs, unclear or poorly defined KBs roles, a lack of prioritizing of brokering activities, absence of initial or ongoing training for KBs, and the need for a reward system for brokering activities.

Our findings highlight that the impact of knowledge brokering activities is a shared responsibility between KBs and their organizations, as devoting time, allowing facilities for communication, and dedicating financial support all seem to positively impact the KBs' roles

Brokering process

Our findings highlighted the lack of training for KBs, which has also been reported elsewhere [58, 59]. Despite this, KBs seem to be keenly aware of expected roles and targeted goals (e.g., supporting the implementation of research evidence, keeping clinicians up-to-date, and networking with different stakeholders), suggesting that KBs activities are highly responsive to the local context [75]. Previous research also indicated that cumulated experience for KBs may balance the lack of KBs-related training [59]. One important finding not previously reported in the literature is the lack of awareness of existing KBs-related training opportunities; this may explain why most KBs depended on self-directed learning as well as on-job learning, despite their need for formal KB training [59]. There is a need to increase the KBs' awareness of the existing training opportunities and increase the accessibility of those training through integrating virtual learning approaches to access a greater number of KBs.

This research exposed substantial needs for strengthening the KB role and its impact on practice change and research. First, the need for standard evaluation tools to evaluate KBs performance; this was consistent with findings from Newman et al. [94], that have emphasized the lack of evaluation for KBs practices, and even if it happened, it was informal. Although the literature on program evaluation has grown substantially in the past decade [98-100], that has not been adapted and adopted for evaluating KBs performance and practices. Dobbins et al. [101] recently suggested that KT researchers need to develop concrete and actionable indicators and tools to measure KBs practices. To this end, the outcomes-focused knowledge

translation framework [102] may be adapted to evaluate KBs performance. This framework was proposed as a means to conceptualize how knowledge seekers can access and utilize information while receiving real-time feedback data about the outcomes [102]. The real-time feedback component fits well with the nature of the brokering process and constant networking of KBs with stakeholders. We encourage KBs to integrate evaluative frameworks into their practices in order to assess their impact by appropriate outcome measures. Determining objectives, activities, and outcomes specific to knowledge brokering might help in evaluating the effectiveness of knowledge brokering roles [94]. Second, participants suggested creating a provincial or national community of practice (CoP) for KBs to promote networking and information exchange among KBs and avoid work duplications. A CoP provides a vehicle to connect a group of individuals with a shared concern who might not otherwise have the opportunity to interact, share knowledge, and identify solutions to common problems [103, 104]. Recent technological and social networking advancements facilitates the creation of numerous virtual CoPs, which allow connecting individuals from varying disciplines, contexts, and geographical locations [104].

Future research

As personal attributes (characteristics and skills) seems to be essential to the success of KBs' role [74], well-designed studies quantifying the impact of those attributes on KBs performance would be useful [74, 81]. Second, interventions to help improve on these attributes and skills should be developed and tested [81]. Third, an environmental scan that identifies and describe the existing educational training opportunities for KBs would be beneficial. Fourth, there is a need for developing an evaluation framework and tool to monitor KBs performance. Lastly, establishing a national COP for KBs working in rehabilitation and evaluating its impact may be a way to help KBs network and stay abreast of the latest development in their field.

Strengths and limitations

This research provides new insights into the brokering activities from a range of rehabilitation settings in Canada, and into the facilitators and barriers they encounter when performing brokering activities. The data analysed were consistently blinded during coding and applying ratings to constructs, which increased the trustworthiness of the study's finding. Moreover, quantifying the CFIR domains to determine the magnitude of each theme across participants increases the trustworthy of our interpretation. In addition, our sample size was consistent with previous studies employing the CFIR [105-108], and participants came from

diverse professions, educational levels, and age groups. Nonetheless, our study is not without limitations. First, our participants were from five Canadian provinces only, of which nearly half were from Quebec. Further research exploring barriers and facilitators among KBs in other provinces would be needed. Second, this study was restricted to rehabilitation professionals, limiting the generalizability of our findings to other healthcare sectors. Third, we did not reach data saturation for all the CFIR domains (tension to change, relative priority, learning climate), and few of the CFIR domains (evidence strength and quality, adaptability, trialability, complexity) were not explored as they were deemed to be of low pertinence to the KBs roles.

Conclusion

The novelty of this study centers around capturing potential barriers and facilitators to the optimal use of KBs within rehabilitation settings in Canada. Key individual determinants identified by participants included communication skills, clinical experience, and research skills. Organizational determinants included allowing a consistent networking and engagement with relevant stakeholders to promote the awareness of local needs, and enhancing the accessibility to physical (i.e., computers) and informational resources (i.e., latest research evidence). Strategies aiming to overcome barriers such as limited time and financial support to perform KBs roles should be considered. Key process level determinants were providing KBs training and utilizing evaluative tools for KBs performance. These finding may be useful to the organizations currently employing KBs to help improve their work productivity.

Acknowledgments: We thank *Dr Diana Zidarov* for interviewing French speaking participants, *Mr. Julien Bachir, Ms. Kalee Belanger*, and *Ms. Melanie Christine Baniña* for helping analyze the data.

Availability of data and materials

Some of the data generated or analyzed during this study are included in this published article. Additional data (generated and analyzed) are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Ethical approval was obtained from the McGill University Institutional Review Board (Study Number A05-E25-18B). Participants were informed of the purpose of the research and their

rights as participants to voluntary participation, anonymity, and confidentiality. Written consent was obtained from all participants.

Consent for publication

Not Applicable

Competing interests

The authors declare that they have no competing interest.

Funding

No funding was sought for this study.

Authors' contributions

DG developed data collection tool, collected, prepared data, coded, analysed, and interpreted data. SA, AT, and AB contributed to the conceptualisation of the manuscript and critically reviewed the manuscript. All authors have read and approved the final manuscript.

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Figure 1 Salient barriers and facilitators (more than 75%) according to themes back to the CFIR

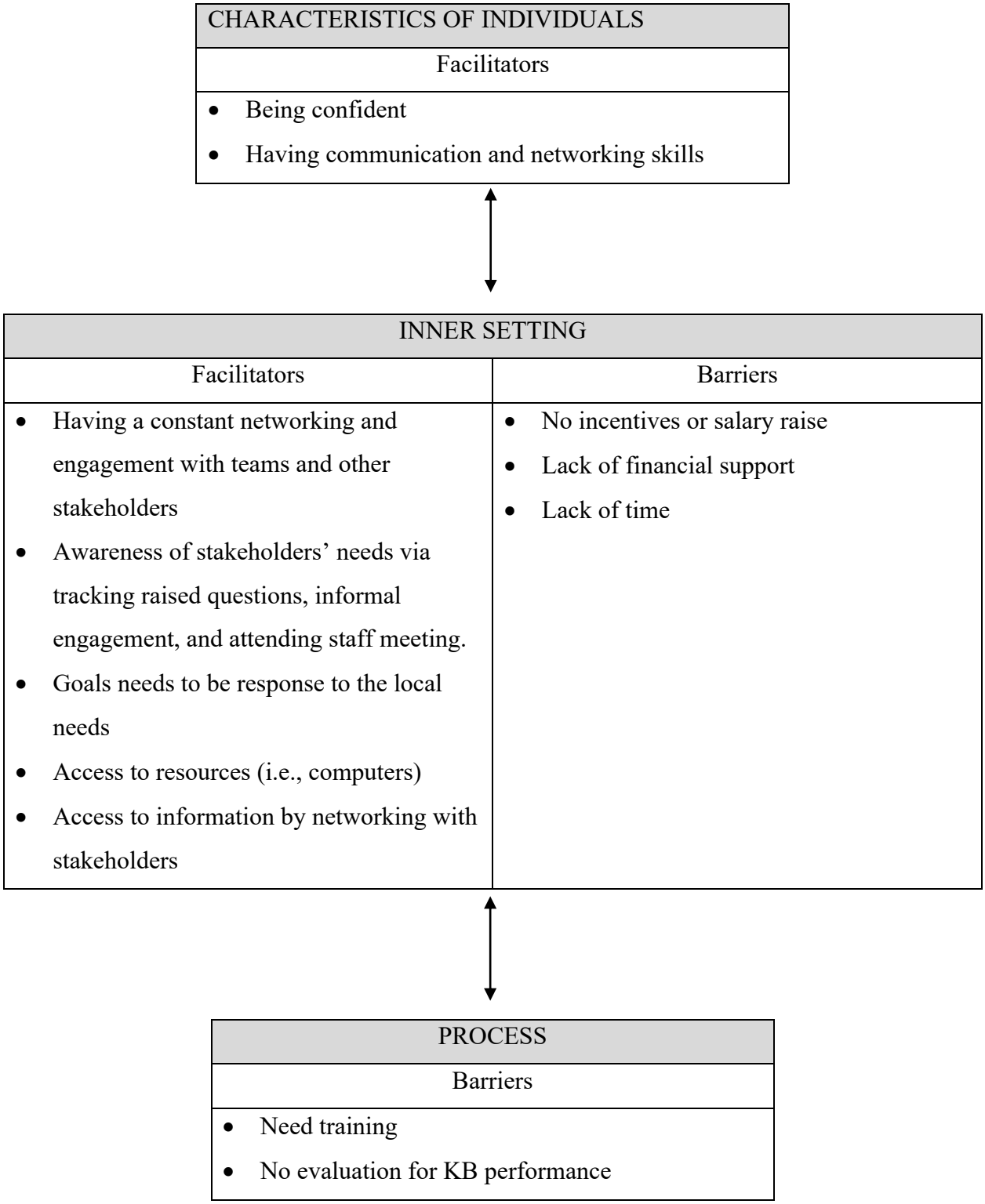

Table 1 Demographic characteristics of the participants

Participants' characteristics	N (%)
Language	
• English	17 (74%)
• French	6 (26%)
Province	
• Quebec	10 (43%)
• Ontario	4 (17%)
• Alberta	3 (13%)
• British Columbia	3 (13%)
• Manitoba	3 (13%)
Age	
• ≤ 40 years old	12 (52%)
• 41-60 years old	10 (43%)
• > 60 years old	1 (4%)
Gender	
• Female	22 (96%)
• Male	1 (4%)
Profession	
• Clinician	11 (48%)
• Administrator	7 (30%)
• Manager	5 (22%)
Educational level	
• Bachelor's	4 (17%)
• Master	17 (74%)
• Doctoral	2 (9%)
Job-status	
• On a full-time basis (4-5 days per week)	9 (39%)
• On a part-time basis (1 -3 days)	14 (61%)

Tables 2 Salient facilitators according to themes based on the CFIR

CFIR constructs (Specific themes)	N (%)
CHARACTERISTICS OF INDIVIDUALS	
Self-efficacy to perform KB roles	
• Feel confident	19 (83%)
Personal Attributes	
• Having communication and networking skills	21 (91%)
• Having clinical experience	17 (74%)
• Having graduate studies (i.e., master's degree)	17 (74%)
• Being interested and involved in research activities	15 (65%)
• Being motivated	12 (52%)
INNER SETTING	
Networks & Communications	
• Having a constant networking and engagement with teams and other stakeholders	21 (91%)
• Sharing relevant information	14 (61%)
Needs of Those Served in the organization	
• Awareness of needs via raised questions and concerns	21 (91%)
• Awareness of needs via informal engagement	21 (91%)
• Awareness of needs via attending periodical staff meetings	16 (70%)
Implementation Climate	
• Goals are responsive to needs (not pre-determined goals)	18 (78%)
Readiness for Implementation	
1. Leadership Engagement:	
• Providing guidance	15 (65%)
• Accessible and available manager	12 (52%)
2. Available Resources:	
• Having access to computers	23 (100)
• Having offices	13 (57%)
• Networking programs	12 (52%)
3. Access to Knowledge & Information:	
• Networking with various stakeholders	18 (78%)

• Subscription to journals and newsletters	17 (74%)
• Having access to library (i.e., journal databases)	16 (70%)
• Online searching	12 (52%)
OUTER SETTING	
Cosmopolitanism	
• Connected to professional support groups (i.e., community of practices)	12 (52%)
INNOVATION CHARACTERISTICS	
Cost	
• Feel stable in positions	16 (70%)

Tables 3 Salient barriers according to themes based on the CFIR

CFIR constructs (specific themes)	N (%)
INNER SETTING	
Networks & Communications	
Need more communication with stakeholders	15 (65%)
Implementation Climate	
No incentives or salary raise	22 (96%)
Lack of financial support	18 (78%)
Lack of time	18 (78%)
Not liberating time for KBs activities	14 (61%)
Lack of administrative support	14 (61%)
Not considered KBs activities as a priority	12 (52%)
Readiness for Implementation	
Need access to information (i.e., databases)	12 (52%)
PROCESS	
Planning	
Need training	20 (87%)
Not receiving KBs training	18 (78%)
Reflecting & Evaluating	
No evaluation for KBs performance	23 (100%)
Need to evaluate KBs performance	13 (57%)
OUTER SETTING	
Peer Pressure	
Need to contact other KBs (i.e., COP)	14 (61%)

CHAPTER 8
The Integration of Manuscripts 3 and 4

8.1 Research questions of manuscripts 3 and 4

Manuscript 3:

This manuscript aimed to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings.

Manuscript 4:

This manuscript aimed to identify and describe current educational training opportunities (ETO) for KBs in Canada and to explore whether these programs meet the competencies needed for the KBs' roles.

8.2 Integration of manuscripts 3 and 4

The previous chapter (manuscript 3) identified factors likely to influence KBs roles at three levels: individual, organizational, and process. Both chapter 5 (manuscript 2) and chapter 7 (manuscript 3) highlighted the lack of KBs training as well as the lack of KBs' awareness of the available training opportunities. Consequently, there was a need to identify and describe current educational training opportunities (ETO) for KBs in Canada and to explore whether these programs meet the competencies needed for the KBs' roles (manuscript 4).

CHAPTER 9

Manuscript 4: A Nationwide Environmental Scan of Knowledge Brokers Training

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ABSTRACT

Introduction: Knowledge brokers (KBs) can promote the uptake of best practice guidelines in rehabilitation. Although many institutions offer training opportunities to healthcare professionals who wish to undertake KBs roles, the characteristics and content of those educational training opportunities (ETO) are currently unknown. This study aimed to describe the characteristics and content of ETO available to the rehabilitation professionals in Canada and determine whether the ETO meets the competencies expected of the KBs roles.

Methods: We conducted a Canada-wide environmental scan to identify ETO using three strategies: online search, phone calls, and snowball. To be included in the study, ETO had to be offered to rehabilitation professionals in Canada and be targeting KBs competencies and/or roles. We mapped each of the content to the KBs competencies (knowledge and skills) within the five roles of KBs: information manager, linking agent, capacity builder, facilitator, and evaluator.

Results: A total of 51 ETO offered in three Canadian provinces; British Columbia, Ontario, and Quebec, were included in the analysis. For KBs competencies, 76% of ETO equipped attendees with research skills, 55% with knowledge brokering skills, and 53% with knowledge on implementation science. For KBs roles, over 60% of ETO supported attendees to in performing the capacity builder role and 39% the evaluator role.

Conclusion: Findings suggest that ETO focused primarily on preparing participants with the research and knowledge brokering skills required to perform the capacity builder and evaluator roles. Comprehensive educational training covering all KBs roles and competencies are needed.

Keywords

Knowledge Translation, Knowledge Brokering, Training Opportunities, Environmental Scan, Rehabilitation

BACKGROUND

The availability of evidence in different rehabilitation sectors,[1-8] and its adoption in clinical practice remains an ongoing challenge for decision-makers and practitioners.[9,10 11-15] Persistent gaps between knowledge generation and its use in practice have a potential negative impact on the health outcomes of individuals and communities.[16] Knowledge translation (KT) is a field that aims to promote the uptake of research evidence in healthcare systems.[17] Evaluations of the relative effectiveness of different KT interventions in improving professional practice[18-24] have shown that the use of intermediary individuals[25,26] was associated with the highest improvement, with up to a 12% change in practitioners' behavior[18,27] in many healthcare sectors,[28-38] including rehabilitation.[39-46] Intermediary individuals who facilitate knowledge exchange between producers and users of knowledge are called brokers or knowledge brokers.[47]

Knowledge brokers (KBs) are defined as "one of the human forces which bring people together to build relationships, uncover needs, share ideas and evidence aiming to improve job productivity".[48] They facilitate the interactions and collaborations between practitioners and researchers to support evidence uptake into practice.[25,49-52] The roles played by KBs are central to the KT process.[53,54] Recent literature has identified roles for KBs as well as a set of competencies believed to be core to the KT process. Glegg et al.[55] proposed the *Role Model for Knowledge Brokering* which outlines the role domains of knowledge brokering in healthcare. This model consists of five role domains, including information manager, linking agent, capacity builder, facilitator, and evaluator. (Appendix 1 describes each role in detail). Mallidou et al.[56] reported on the core competencies, divided into knowledge and skills: requisite knowledge includes having an understanding of the context, research process, and KT processes, and awareness of the availability and diversity of evidence[56]); skills include interpersonal skills,[56] research skills,[48,56] communication skills, and mediation skills,[48] and knowledge brokering skills[56,57]). Appendix 2 describes each type of KBs skills in detail.

Our recent survey among 198 KBs working in rehabilitation sites indicated that almost two-thirds of respondents reported having received insufficient training to perform their brokering roles. As a result, they relied on their accumulated experience over time to perform these roles.[58] In a parallel study,[59] we interviewed 23 rehabilitation KBs to identify factors that hinder or promote the optimal use of KBs. Knowledge brokers were not always aware of the existing KBs-related training, which partly explained why several KBs depended on 'on the-

job' learning. Previous research[47,55] also highlighted the need for comprehensive training programs for KBs to perform their roles.

The overall aim of this research was to identify and describe current educational training opportunities for KBs in Canada, and to explore whether these programs meet the competencies needed for the KBs roles. Specifically, we aimed to: 1. describe the characteristics of the educational training opportunities (location, duration, frequency, format, target audience, and fees); 2. describe the features of the syllabi (types of knowledge, skills, roles, learning strategies, and assessment methods used); and 3. determine whether the educational training opportunities meet the competencies related to the five roles of KBs.

Identifying existing educational training opportunities and exploring the characteristics of these opportunities across Canada would help 1. revise existing KBs programs and/or guide the development of a comprehensive KBs training program; 2. increase KBs awareness of the available training opportunities; and 3. inform developers of the training programs of the suitability of available training opportunities for actual required KBs roles.

METHODS

Ethical Approval

This study was exempted from ethical approval

Research Design

A Canada-wide environmental scan was conducted to identify existing educational training opportunities (ETO) for KBs. Environmental scans gather basic descriptive information to provide evidence-based solutions to health care issues.[60] To be eligible, 1. ETO had to be offered, but not restricted, to rehabilitation professionals or graduate students enlisted in a rehabilitation program; 2. the content needed to cover one or more of the KBs roles, knowledge, or skills; and 3. ETO's syllabus had to provide the training objectives, course outlines, and/or expected outcomes of the training.

Recruitment strategies

Three consecutive recruitment strategies were used. First, the project leader searched the websites of all rehabilitation organizations in Canada to determine if ETO were offered and determine training eligibility. An invitation to participate was sent to 106 organizations;

rehabilitation schools (n=18), regulatory bodies (n=16), professional associations (n=24), research institutions (n=38), and KT communities of practices (n=10). Second, follow-up phone calls were made to non-respondent organizations asking if a KBs training opportunity was offered. Organizations offering ETO were asked to provide the contact information of individuals responsible for the ETO so we could contact them by phone or email. Non-respondent instructors received follow-up e-mails every 2 weeks for 6 weeks or up to a maximum of three reminders. Third, a snowball strategy was used asking respondents if they were aware of any other similar ETO we should consider. (Appendix 3: List of invited organizations) Course instructors of eligible ETO who agreed to participate were asked to sign a consent form and share their course syllabus.

Data collection

A data extraction sheet was developed and adapted from Harden's comprehensive framework[61], which proposes 10 questions to guide curriculum development. This valid and reliable tool used by universities worldwide helps with the planning of lectures, courses or complete curricula.[62,63] We adapted six questions from Harden's comprehensive framework[61]: those that explored the course's objectives, content, educational strategies, teaching methods, assessment tools, educational climate. The rest of the questions (4 questions) were unrelated to the scope of our research. Additional questions concerning the course's characteristics were added to our data extraction sheet. The final data extraction table included the following seven categories: 1. administrative characteristics; 2. course title; 3. course objectives; 4. topics; 5. expected outcomes; 6. learning strategies; and 7. assessment methods. We piloted the data extraction sheet on a sample of 10 syllabi. Two independent reviewers extracted the data from each course syllabus and/or organization website where available and resolved extraction discrepancies through discussion. Each course instructor was asked to validate the extracted information related to his/her course if they had not completed the data extraction sheet themselves.

Data analysis

A qualitative content analysis was conducted, followed by quantitative numerical analysis for each ETO' syllabus and contents.

Qualitative content analysis

The ETO syllabi and contents were first classified into three categories (administrative characteristics, learning features, assessment methods). Each category was then organized into sub-categories deductively. A. administrative characteristics (province, institution/ organization, duration, frequency, format, target audience, and fees); B. learning features that included details related to the reading materials, didactic lectures, small group discussions, problem-based learning scenarios, online pre-recorded lectures, coaching and consultation, self-reflection activities, online support, and long term support; and C. assessment methods that included project presentation, individual assignments, group assignments, class participation, student presentations, self-assessments, and reflections on reading material.

The ETO content included a number of items which displayed the objectives, outlines, or outcomes (i.e., by the end of the ETO, attendees should learn how to formulate a review question). A priority was given to the analysis of items displayed in the outlines, since outlines tend to give more details about the content than they do about outcomes. The training objectives were considered in the event that outlines or outcomes were unavailable or insufficiently described. Each content item was categorized into a) type of KBs knowledge (knowledge on KT science, knowledge on research evidence, knowledge on brokering roles); b) skills (research skills, communication skills, mediation, knowledge brokering skills); and c) roles, based on the Role Model for Knowledge Brokering (capacity builder, evaluator, linking agent, facilitator, information manager).[55]

Quantitative numerical analysis

Descriptive statistics (frequencies and percentages) were computed for each category and sub-category of the ETO syllabi and contents.

Mapping of the KBs roles and competences: To create a formative matrix, items were labeled based on the Role Model for Knowledge Brokering using the following labels: “M” = information manager, “L” = linking agent, “C” = capacity builder, “F” = facilitator, “E” = evaluator, or “N” = no specific role. Then, the same items were labeled based on the competencies using the following labels: “1” = KT-related knowledge, “2” = Evidence-based related knowledge, “3” = KBs knowledge, “4” = Research skills: “5” = KBs skills, “6” = Communication skills, “7” = Mediation skills. The frequency of each label was calculated within each ETO to show the weight of the label in each (e.g., E4*3 means that a training

opportunity included 3 items “label *3” that provided participants with research skills “label 4” in order to perform an evaluator role “label E”). In addition, a descriptive analysis was done (counts and frequencies) for each label to explore the weight of each label across all eligible ETO.

RESULTS

Of the 84 identified ETO, 51 met the eligibility criteria. Of those, 21 (41%) were reviewed and confirmed by the instructor(s) who deliver(s) the training. Instructors of the remaining 30 (59%) ETO could not be reached (Figure 1). Details of these ETO (province, organization, course title, format, duration, frequency, audience, and fee) are provided in Table 1.

Analysis of the syllabi for each educational training opportunity

Administrative characteristics

Table 2 presents the administrative characteristics of the ETO by province. Educational training opportunities were offered in British Columbia (n=21, 41%), Ontario (n=20, 39%), and Quebec (n=10, 20%). In British Columbia, ETO were mainly offered by regional groups (i.e., Fraser Health Authority) (n=17, 81%), while fewer ETO were offered by universities (n=3, 14%) and KT institutions (n=1, 5%). In Ontario, ETO were offered by universities (n=10, 50%), clinical sites (n=6, 30%), and KT institutions (n=4, 20%) compared to Quebec where ETO were mainly offered by universities (n=8, 80%). Only 2 (20%) were offered by KT institutions. Nearly 40% (n=20) of the ETO were delivered over a semester, 37% (n=19) in one day (ranged from 1-7 hours of training), 20% (n=10) over two days or a week, and 4% (n=2) over 6 months or more. More than half (n=30) of the training opportunities were available once per year, while others were available twice per year (n=2, 4%), once every two years (n=2, 4%), on demand (n=2, 4%), or three times per year (n=1, 2%). Fourteen had missing information. Training opportunities were generally delivered in-person (n=37, 73%) or online (n=13, 15%), and one was missing; and were open to healthcare professionals (n=38, 75%), including rehabilitation professionals, or to graduate students only (n=13, 25%). The cost of most training courses/workshops in Ontario was between $500 and $5000 (n=15, 29%). Those in Quebec were commonly based on university tuition costs (n=8, 16%), and those in British Columbia were sponsored by regional groups (i.e., Fraser Health Authority) at no charge for attendees (n=17, 33%).

Learning strategies

Learning strategies included reading material (KT literature and resources) (n=17, 33%), didactic lectures (n=15, 29%), and small group discussions (n=13, 25%). Other learning strategies included problem-based learning (i.e., case studies) (n=9, 18%), pre-recorded presentations (i.e., online modules, pre-recorded webinars, video presentations, or videos featuring experts) (n=9, 18%), providing coaching and consultation with a faculty member or an expert (n=8, 16%), and self-reflection activities (i.e., exercises with answer keys) (n=8, 16%). Only four ETO (8%) used online collaborative platforms (i.e., online discussion boards) and one used long-term support (2%) (one year of support after the training). We could not capture the learning strategies for 22 ETO due to poor reporting on organizations' websites.

Assessment methods

Nearly a third of the assessment methods consisted of project presentations (n=16) (i.e., developing a KT plan, implementation action plan, communication plan, evaluation plan, writing a KT grant proposal or a systematic review protocol), one quarter used individual assignments (n=13), and the remaining were class participation (n=10, 20%). Other assessment methods included in-class student presentations (n=7, 14%), self-assessment (i.e., quizzes) (n=6, 12%), reflection on reading material (n=5, 10%), and group assignments (n=4, 8%) were less common. However, because of the poor reporting we failed to extract the assessment methods of 26 ETO.

Analysis of the educational training opportunities' contents

Types of KBs competences

Types of knowledge: Over half (n=27, 53%) of the ETO provided foundational knowledge on KT frameworks, models and theories. Fewer courses (n=7, 14%) addressed topics such as characteristics of research evidence, evidence-based practice, and evidence-based decision-making. Only two courses (4%) provided information on the various roles of KBs.

Types of skills: More than three quarters (n=39, 76%) of the training opportunities aimed to equip attendees with research skills including how to formulate a research question, search for and appraise research evidence and information on research designs, data collection methods, and developing a publication plan. Over half of the ETO (n=28, 55%) aimed to develop knowledge brokering skills, such as developing a KT plan, tailoring KT interventions,

designing a training session, adapting clinical practice recommendations, addressing contextual barriers, sustaining organization changes, and writing the end-of-grant KT section in grant applications. Eight ETO (16%) provided training on communication skills including how to create a communication plan, tailor key messages for end users, share ideas, using different channels of communication, develop poster and oral presentations, and prepare supporting arguments. Five ETO (10%) provided attendees with mediation skills (e.g., identifying KT partners, considering stakeholder perspectives, engaging the media, and creating the linkage with government policy makers).

Types of KBs roles

Nearly two thirds (n=32, 63%) of the ETO prepared the attendees for a *capacity builder* role; this consisted of applying/adapting research results to the local context, selecting/tailor effective implementation strategies, developing knowledge sharing products, sustaining change, preparing grant applications. Several training opportunities (n=20, 39%) prepared attendees for the *evaluator* role, which includes determining the applicability of research findings, measuring knowledge/practice gaps, evaluating the impact of KT interventions, and measuring outcomes of the KT process. Fewer training opportunities (n=10, 20%) prepared the attendees to play the *linking agent* role, such as building an understanding of different stakeholder perspectives, using plain language to disseminate research evidence, developing linkage with government policy makers. Seven ETO (14%) prepared the attendees to play a *facilitator* role (e.g., creating a communication plan by using communication strategies for reaching multiple audiences, and facilitating engaging training sessions). A similar number (n=7, 14%) prepared the attendees to play an *information manager* role (e.g., interpreting research results to clinical practice, creating strategies to package evidence in a way that makes it accessible and relevant to users, and being engaged with qualitative and quantitative methods used to acquire and share knowledge).

Mapping the KBs roles in respect of KBs competences

Table 3 presents the mapping of the KBs roles to the KBs competences of each ETO. In total, 421 items were available for analysis, whether from ETO outlines, outcomes, or objectives. Mapping KBs roles to KBs competences across those items suggested that the largest number of items focused on providing attendees with research skills “label=N4” (n=147, 34.92%) and background knowledge about KT frameworks, models and theories “label=N1” (n=66, 15.68%) without targeting a specific KBs role. However, fewer items aimed

to provide knowledge brokering skills to help attendees in their capacity builder role "label=C5" (n=59, 14.01%) or to employ research skills to perform an evaluator role "label=E4" (n=39, 9.26%). There was less focus on communication skills to perform a facilitator role "label=F6" (n=17, 4.04%), demonstrating knowledge about implementation science to prepare attendees to perform an evaluator role "label=E1" (n=16, 3.80%), equipping attendees with knowledge brokering skills that may qualify them to play the evaluator role "label=E5" (n=14, 3.33%), or employing research skills to perform information manager role "label=M4" (n=13, 3.09%).

DISCUSSION

This environmental scan was the first to specifically target KBs educational training opportunities in Canada, providing new insights on the nature of those opportunities. Many ETO were excluded from this study as they were no longer being offered. This lack of sustainability of ETO may prevent clinicians from accessing much-needed training. A collaboration between professional groups (i.e., professional associations), KT institutions (i.e., KT Canada), and clinical sites can bring together instructors with various perspectives and experiences and improve the sustainability of ETO

ETO characteristics

Findings showed that the ETO are concentrated in three Canadian provinces (Ontario, Quebec, and British Columbia). Previous research has found variations in the density of rehabilitation professionals in different Canadian provinces,[64] with a greater density in areas with academic centres compared to rural and remote areas.[65-68] The concentration of ETO in these three provinces seems to reflect the presence of larger number of rehabilitation professions and academic settings in those areas and provinces.

Rehabilitation clinicians in British Columbia have several ETO options to choose from, with most sponsored by regional groups (i.e., Fraser Health Authority and Vancouver Costal Health). In contrast, ETO in Ontario and Quebec were offered mainly in universities, which came with significant tuition cost. The lack of available financial support for KBs training was also highlighted by a recent study conducted by our team.[59] Several researchers have emphasized the importance of dedicating a part of professional development funding to KBs who require additional training as this can greatly impact the success of brokering activities[27,47,52,56,69-72] and positively influence the initiation and the sustainability of the KBs

roles[52,70-72] One solution might be to offer KBs the possibility of attending online courses available in some provinces.

KBs competences

The ETO were rather similar in their primary focus on certain types of KBs competencies. Regarding *knowledge*, the emphasis appears to be on knowledge of KT science, followed by knowledge of different sources of evidence. This finding is consistent with previous studies that found overlap between KT competencies and research competencies,[56,73,74] suggesting that KT competencies encompass more than research competencies in terms of understanding the local context where the KT processes take place. However, a major gap was found in ETO on providing knowledge about the different KBs-related roles (the five main brokering roles). There may be two reasons for this gap. First, there is a lack of knowledge and awareness of the five brokering roles by individuals who are already performing these roles.[47] Our recent survey[58] found that individuals tend to identify themselves by their health profession rather than label themselves as KBs, even when performing brokering roles as their primary jobs (i.e., managers, opinion leaders, researchers, and educators).[48,75-77] Increasing clinicians' awareness about the types of brokering roles may help them self-identify as KBs, which may encourage them to seek opportunities to improve their KBs competencies. Second, the role model of knowledge brokering[55] is a fairly new model developed in 2016, and it might not yet be used or taught in ETO or other KT training activities. Given its value in addressing/describing the different roles and expected tasks for each, organizations that plan and deliver ETO may wish to consider integrating this model in their training for KBs working in healthcare.

Regarding *KBs skills*, the ETO appears to focus primarily on preparing participants to develop research skills, followed by knowledge brokering skills. These findings are consistent with previous studies having shown that university courses on KT focus primarily on research skills. This highlights the overlap between research skills and KT skills.[56,73,74] However, it is important to emphasise the shortage of ETO that equip participants with communication and mediation skills. Developers of ETO may have deliberately omitted those skills because KBs tend to naturally possess basic communications and networking skills.[59,78] Those types of skills seem to be related to other interpersonal attributes that KBs have (i.e., enthusiastic,[56,70,72,79,80] proactive,[56,80] motivated,[56,79,80] positive,[56,79,80] persuasive,[56,79,80] entrepreneurial,[56,80]

friendly,[56,80] open-minded,[56,80,81] having emotional intelligence[56,69,80,82-84] and intellectual curiosity,[56,80] and actively working to engage their peers[79]).

KBs roles

None of the ETO we reviewed covered all the *five roles of KBs*. The main focus of ETO was on preparing attendees for the capacity builder role, followed by the evaluator role. Focusing on the capacity builder role aligns well with the KBs responsibilities, given that being a capacity builder was one of the most frequent roles among KBs in two recent studies undertaken by our team[58,79] and with previous research as well.[26,85-89] In contrast, the focus on the evaluator role is unlike previous research, which found this to be among the least common.[58] The lack of training targeting the linking agent and information manager roles is also inconsistent with the required roles of KBs. Previous research has indicated that the linkage agent[90-92] and information manager[54,85,90] were key KBs roles. For example, in our survey of 198 KBs across Canada,[58] tasks related to the linking agent role (such as networking with various stakeholders outside the organization) and tasks related to the information manager role (such as accessing research evidence) were KBs' most common tasks. Several studies have also emphasized the ongoing networking as an important element in knowledge brokering.[49,51,59,86,93,94] Similarly, few ETO prepared participants for a facilitator role, although it was rated as the third role (out of five) in importance in terms of task frequency.[58]

Mapping KBs competencies and roles

The mapping process provided an informative portrait on what existing ETO covered and pointed to a number of gaps in those trainings. The primary focus of included ETO was on developing knowledge brokering skills to fulfill the capacity builder role, and the second main focus was on research skills needed to perform the evaluator role. The use of research skills in evaluative activities seems to be valued by ETO developers, but not frequently performed by KBs.[58,79] Given that the majority of KBs didn't receive any KBs-related training, this may be because of a lack of KBs competence on how to employ research skills to fulfill the evaluator role.[58,59] On the other hand, ETO developers paid less attention to the other types of competency-role combinations, for example, developing communication skills to fulfill the facilitator role, developing mediation skills to fulfill the linking agent role, and providing knowledge and skills related to the information manager role.

These findings provide insight to future ETO developers on what the main elements of KBs training should be. Based on our results, a comprehensive ETO for KBs should provide background knowledge on all five knowledge brokering roles to provide participants with deep insights into the possible requirements and responsibilities of the KBs. Providing knowledge on sources of evidence and the basic KT processes and frameworks is an important foundation for the KBs. However, in terms of skills, research skills are essential for most of the brokering roles, especially for the evaluator and information manager roles. Knowledge brokering skills are vital for the capacity building role, while, the need for communication and mediation skills could be based on participants' needs given that many KBs already naturally possess those skills. Considering that by definition, KBs are 'one of the human forces in the KT process',[48] a comprehensive training program that addresses the knowledge and skills necessary to perform the five possible roles of KBs, combined with the needed resources, may significantly promote the progression and the sustainability of the KT process.

FUTURE RESEARCH

Our findings suggest a number of avenues for future research. First, there is a need to further explore the reasons for the lack of sustainability of many ETO related to KBs. Second, creating a mutual platform that links all KT organizations/institutions that offer free online short-duration ETO such as webinars, and provide a description of those ETO can increase KBs awareness of and accessibility to the ETO. This will allow KBs to get training from anywhere and the flexibility to view training anytime. Third, offering an overview on KBs roles and skills within the rehabilitation programs as an elective course for those who are potentially interested in performing these types of roles after graduation may be a way forward.

STRENGTHS AND LIMITATIONS

The main strengths of this research are the number of ETO identified by our comprehensive search strategies that could be used to monitor organizations that are currently providing ETO or could do so in the future. In addition, the Role Domains Model for Knowledge Brokering framework guiding the ETO content analysis allowed us to assess the suitability of those trainings to the KBs roles. Although, we targeted ETO offered to rehabilitation clinicians, many ETO were not limited to rehabilitation clinicians, but were also offered to other healthcare professionals. Nonetheless, this study also has some limitations. First, despite using three recruitment strategies, we likely missed existing ETO and the total number of the ETO (i.e., denominator) in this field is unknown. Second, the unavailability of

ETO' full descriptions, either for content (outlines, expected outcomes, and objectives) or syllabus (learning strategies and assessment methods) prevented us from providing a detailed description of each. In addition, several instructors could not be reached, and consequently, not all ETO could be validated. Importantly, as the characteristics and content of the ETO are expected to evolve over time, these may have changed since we collected the information. Lastly, findings of this research reported mainly the characteristics of ETO in Canada; these findings may not be applicable to KBs in other countries and/or healthcare systems.

CONCLUSION

Our findings provided an understanding of how clinicians may be better prepared to be KBs. Findings suggest that the focus of the ETO was on equipping participants with research skills and knowledge brokering skills to perform capacity builder and evaluator roles. However, significant gaps observed in ETO included not providing training on communication and mediation skills, and preparing participants for the manager, linking agent, and facilitator roles. Further, ETO are currently available in the larger provinces only (Ontario, Quebec, British Columbia). Comprehensive and accessible educational training programs covering all KBs roles and competences are needed.

LESSONS FOR PRACTICE

- The main focus of educational training opportunities was on equipping participants with research and knowledge brokering skills to perform capacity builder and evaluator roles.
- Significant gaps were found in providing training on communication and mediation skills, and in preparing participants for the manager, linking agent, and facilitator roles.
- Comprehensive and accessible educational training opportunities covering all knowledge brokers roles and competences are needed.

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FIGURE 1

Flowchart of educational training opportunities for knowledge brokers in Canada

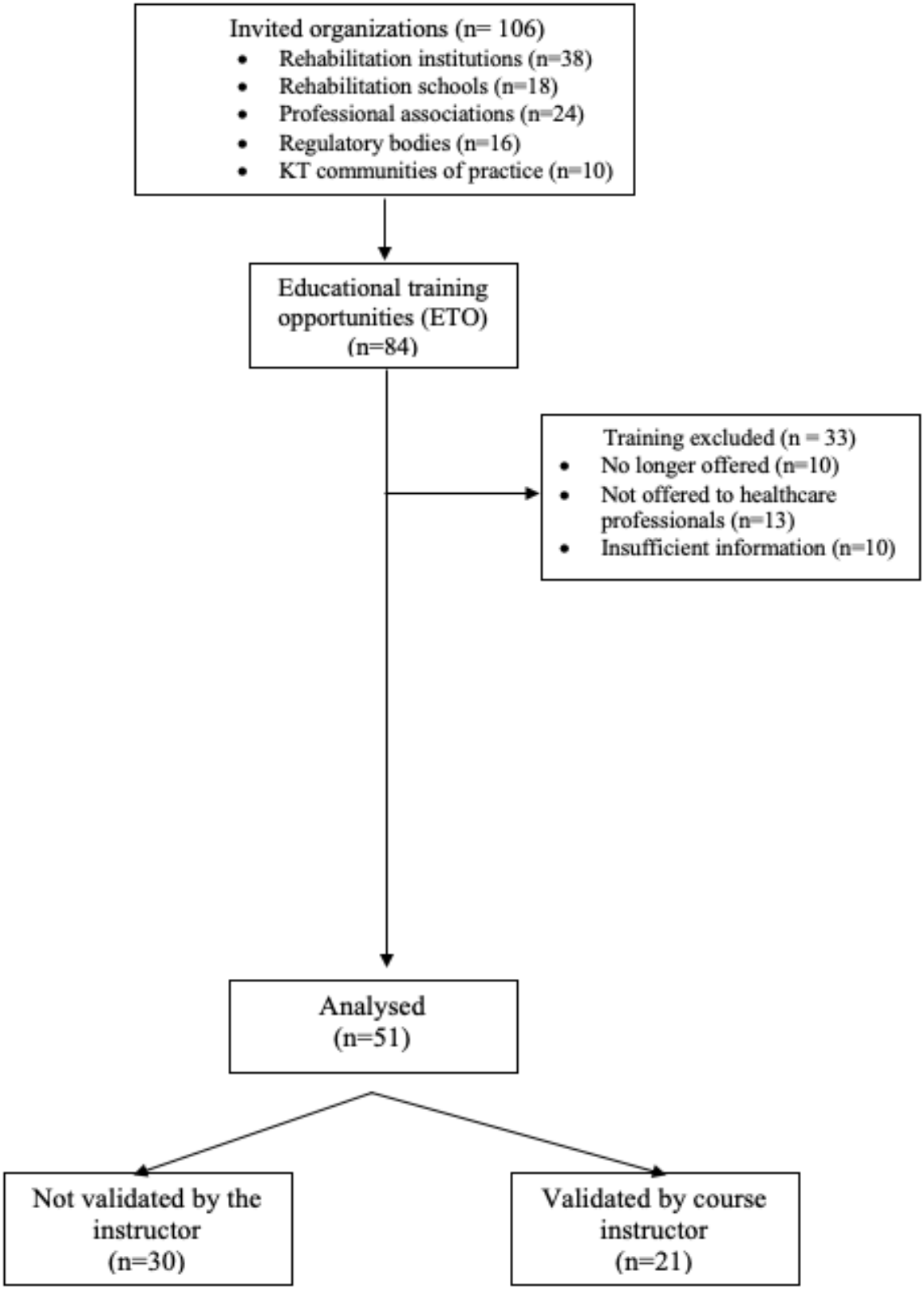

TABLE 1

The educational training opportunities for knowledge brokers in Canada

ID	Province	Organization	Course	Format	Duration	Frequency	Audience	Fee
1	ON	The Hospital for Sick Children	Knowledge Translation Professional Certificate	In-person	1 week	3 times/year	Clinicians	$2,300.00
2	ON	The Hospital for Sick Children	Specialist Knowledge Translation Training (SKTT™)	In-person	2 days	Missing	Clinicians	$700.00
3	ON	St. Michael's Hospital	Practicing Knowledge Translation	In-person	2 months	once/year	Clinicians	$2,850.00
4	ON	St. Michael's Hospital	Foundations of Knowledge Translation	online	2 months	once/year	Clinicians	$700.00
5	ON	St. Michael's Hospital	End of Grant Knowledge Translation	online	2 months	twice/year	Clinicians	$475.00
6	ON	St. Michael's Hospital	Systematic Review Online Course	online	3 months	Missing	Clinicians	$1,800.00
7	ON	University of Guelph	Processes of knowledge translation and dissemination	online	2 months	Missing	Clinicians	$995.00
8	ON	University of Guelph	Building capacity to understand and use relevant evidence	online	2 months	Missing	Clinicians	$995.00
9	ON	University of Guelph	Transforming Knowledge into Action	online	2 months	Missing	Clinicians	$995.00
10	ON	University of Ottawa	Behavioral and cognitive theories for knowledge translation	In-person	3 days	Missing	Clinicians	Missing
11	ON	University of Toronto	Methods in Practices & Contexts	In-person	3 months	Missing	Graduate studies	University fee
12	ON	University of Toronto	Projects in Translational Research (TR)	In-person	3 months	Missing	Graduate studies	University fee
13	ON	University of Toronto	Rhetoric of Science	In-person	3 months	Missing	Graduate studies	University fee
14	ON	McMaster University	Evidence-informed Decision-Making Workshop	In-person	5 days	Once/year	Clinicians	$1,500.00
15	ON	McMaster University	EBCP Workshop: How to Teach Stream Specifics	In-person	4 days	Missing	Clinicians	$2,800.00

16	ON	McMaster University	EBCP Workshop: Improve Practice Stream Specifics	In-person	4 days	Missing	Clinicians	$2,800.00
17	ON	National Collaborating Centre for Methods and Tools	Knowledge Broker Mentoring Program	In-person	18 months	once/2 years	Clinicians	$5,000.00
18	ON	National Collaborating Centre for Methods and Tools	Evidence-informed Decision Making for Public Health Online Learning Modules	online	2 days	Missing	Clinicians	$200.00
19	ON	Mental Health Commission of Canada	SPARK Training Program	In-person	2.5 day.	twice/year	Clinicians	$1,165.00
20	ON	KTECOP	Visual Communication Toolkit	In-person	2 hours	Missing	Clinicians	Missing
21	QC	McGill University	Knowledge Translation in Rehabilitation	In-person	3 months	Once/year	Graduate studies	University fee
22	QC	McGill University	Knowledge Synthesis EPIB-675	In-person	3 months	Once/year	Graduate studies	University fee
23	QC	Université Laval	Revues systématiques et guides de pratique clinique	In-person	3 months	Once/year	Graduate studies	University fee
24	QC	Université Laval	Séminaire de recherche I EPM-8004	In-person	3 months	Once/year	Graduate studies	University fee
25	QC	Université Laval	Séminaire de recherche II EPM-8005	In-person	3 months	Once/year	Graduate studies	University fee
26	QC	Université Laval	Transfert et application des connaissances en nutrition	online	3 months	Once/2 years	Graduate studies	University fee
27	QC	University of Montreal	Connaissances et innovations en santé	In-person	6 days	Once/year	Graduate studies	University fee
28	QC	University of Montreal	Transfert des connaissances REA-6012	In-person	3 months	Once/year	Graduate studies	University fee
29	QC	National Collaborating Centre for Healthy Public Policy	A Framework for Analyzing Public Policies	online	1 day	on demand	Clinicians	Free
30	QC	National Collaborating Centre for Healthy Public Policy	Health Impact Assessment, step by step	online	5 hours	on demand	Clinicians	Free

31	BC	University of British Columbia	From Knowledge to Action in Population Health	In-person	3 months	Once/year	Graduate studies	University fee
32	BC	University of British Columbia	Rehabilitation Theory	In-person	3 months	Once/year	Graduate studies	University fee
33	BC	University of Victoria	Health Services Program Monitoring and Evaluation	online	3 months	Once/year	Clinicians	$1,400.00
34	BC	Michael Smith foundation	Train-The-Trainer Workshop	In-person	3 days	Missing	Clinicians	$498.00
35	BC	Vancouver Coastal Health	Knowledge Translation Challenge	Missing	6 months	Once/year	Clinicians	Free
36	BC	Fraser Health Authority	Disseminating Your Research Results	In-person	3 hours	Once/year	Clinicians	Free
37	BC	Fraser Health Authority	Qualitative Designs for Research and Evaluation	In-person	3 hours	Once/year	Clinicians	Free
38	BC	Fraser Health Authority	Conducting Evaluation for Decision Making	In-person	7 hours	Once/year	Clinicians	Free
39	BC	Fraser Health Authority	Logic Models and Indicators	In-person	4 hours	Once/year	Clinicians	Free
40	BC	Fraser Health Authority	How to Get Your Work Published	In-person	3 hours	Once/year	Clinicians	Free
41	BC	Fraser Health Authority	Best Practices in Retrospective Chart Review for Research	In-person	3 hours	Once/year	Clinicians	Free
42	BC	Fraser Health Authority	Everyday Evidence-Based Practice	In-person	3 hours	Once/year	Clinicians	Free
43	BC	Fraser Health Authority	Focus Groups and Interviews	In-person	7 hours	Once/year	Clinicians	Free
44	BC	Fraser Health Authority	Analyzing Research Data Using Excel	In-person	7 hours	Once/year	Clinicians	Free
45	BC	Fraser Health Authority	Accessing Health Data	In-person	3 hours	Once/year	Clinicians	Free
46	BC	Fraser Health Authority	Get Ready to Do Research: Roadmap and Supports	online	2 hours	Once/year	Clinicians	Free
47	BC	Fraser Health Authority	Finding Funding for Your Research or Evaluation Project	online	1.5 hours	Once/year	Clinicians	Free
48	BC	Fraser Health Authority	The Research Process in 9 Steps	In-person	3 hours	Once/year	Clinicians	Free
49	BC	Fraser Health Authority	Critical Appraisal of Journal Articles	In-person	3 hours	Once/year	Clinicians	Free
50	BC	Fraser Health Authority	Designing Quantitative Research and Evaluation Projects	In-person	7 hours	Once/year	Clinicians	Free
51	BC	Fraser Health Authority	Survey and Questionnaire Design	In-person	7 hours	Once/year	Clinicians	Free

Abbreviations: ON: Ontario, QC: Quebec, BC: British Columbia, KTECOP: The Canadian Knowledge Transfer and Exchange Community of Practice.

TABLE 2

The administrative characteristics of the educational training opportunities for knowledge brokers in respect of location (province)

	Ontario	Quebec	British Columbia	(N, %)
Educational training opportunities	20 (39%)	10 (20%)	21 (41%)	Total= 51
Duration				
One semester (two or three months)	10 (20%)	7 (14%)	3 (6%)	20 (39%)
One day or less	1 (2%)	2 (4%)	16 (31%)	19 (37%)
Two days up to one week	8 (16%)	1 (2%)	1 (2%)	10 (20%)
Six months or more	1 (2%)	0	1 (2%)	2 (4%)
Frequency				
Once/year	3 (6%)	7 (14%)	20 (39%)	30 (59%)
Twice/year	2 (4%)	0	0	2 (4%)
Once/2 years	1 (2%)	1 (2%)	0	2 (4%)
On demand	0	2 (4%)	0	2 (4%)
Three times/year	1 (2%)	0	0	1 (2%)
Missing				14 (27%)
Format				
In-person	13 (25%)	7 (14%)	17 (33%)	37 (73%)
Online	7 (14%)	3 (6%)	3 (6%)	13 (25%)
Missing				1 (2%)
Target audience				
Healthcare professionals	17 (33%)	2 (4%)	19 (37%)	38 (75%)
Graduates	3 (6%)	8 (16%)	2 (4%)	13 (25%)
Fees				
Free	0	2 (4%)	17 (33%)	19 (37%)
University fees	3 (6%)	8 (16%)	2 (4%)	13 (25%)
$500 or less	2 (4%)	0	1 (2%)	3 (6%)
$501 - $1000	5 (10%)	0	0	5 (10%)
$ 1001 - $2000	3 (6%)	0	1 (2%)	4 (8%)
More than $2000	5 (10%)	0	0	5 (10%)
Missing				2 (4%)

TABLE 3.

Mapping the competences and the roles of knowledge brokers of each training opportunity

	Competences						
	Knowledge			Skills			
ID	1. KT science	2. Evidence	3. HAs'roles	4. Research	5. KT products	6. Communication	7. Mediation
1	N1*3 C1*1			E4*1	C5*1		L7*5
2	N1*2				C5*1 L5*1 F5*1		
3	N1*1			N4*1 E4*3	C5*6 E5*2		
4	N1*6	N2*4		E4*4	C5*5 E5*2		
5	N1*5			E4*5	C5*2 E5*2	F6*3 L6*4	E7*1
6				N4*5			
7	N1*1			N4*2 E4*2	C5*2		
8	N1*1			E4*2	C5*1	F6*1	L7*1
9	E1*1			E4*1	C5*4		
10	N1*6 E1*2				C5*2		
11	N1*1			M4*2 C4*1	E5*1		
12	C1*1			L4*1 E4*1			
13						F6*11	
14	N1*1			N4*24 M*7 E4*1	C5*2		
15				N4*2	C5*1		
16				N4*2			
17		N2*1		N4*2 M4*1	C5*1		
18				N4*4 E4*1	C5*1 E5*1		
19	N1*1		L3*1		C5*2 E5*1	F6*1	
20					C5*2	F6*1	
21	N1*13 E1*4	N2*2	N3*1	N4*5 E4*11	C5*5 E5*1		
22				N4*25	C5*1 E5*3		
23				N4*1	C5*2		
24				N4*7			
25				N4*6			
26	N1*2	N2*2		N4*2	C5*3		
27	N1*2	M2*1			C5*2	L6*1	
28	N1*2				C5*2		
29	N1*4						
30	N1*2 E1*1			N4*4 E4*1	C5*1		
31	N1*3				N5*1 L5*1 C5*3	C6*1	
32	N1*2	N2*2		N4*2			
33	N1*2 E1*1			N4*3 M4*1 E4*2	C5*1 E5*1		E7*1
34	N1*1 C1*1				C5*4 F5*2		
35	E1*1			E4*1	C5*1		L7*1
36						C6*3	
37				N4*4			
38	N1*1 C1*1 E1*4						
39	N1*4 E1*1			E4*2	C5*1		
40				N4*4			
41				N4*3			
42		N2*1		N4*3			
43				N4*4			
44				N4*9			
45				N4*1 M4*2			
46	E1*1			N4*2 C4*1 E4*1			
47				C4*1 L4*2	M5*1		
48				N4*3			
49				N4*3			
50				N4*8			
51				N4*6			

Roles
N= No specific role
M= Information manager
C= Capacity builder
L= Linking agent
F= Facilitator
E= Evaluator

CHAPTER 10
Overall Conclusion

The overall objective of this thesis was to advance the knowledge base about knowledge brokers (KBs) in order to optimize their role in promoting the uptake of research evidence into rehabilitation clinical practice. The four studies provide valuable knowledge on the characteristics of KBs in Canada in terms of geographical locations, KBs titles, sociodemographic and professional characteristics, roles and activities, available training opportunities, and required organizational support. The results of the studies also contribute evidence to the factors that influence the impact of the KBs role. As such, each study contributed knowledge that will guide the development of KBs training that can equip potential KBs with the required skills for the KB roles. Table 1 provides a summary of the findings from all four studies dressing a portrait of KBs. The following section is a summary of each study.

The first study reported on the results of a realist review that aimed to highlight the differences and similarities between opinion leaders (OLs) and knowledge (KBs) with respect to context, mechanism and outcomes, as well as describe the common patterns of OLs and KBs by creating a context-mechanism-outcomes (CMO) configuration. Common features between OLs and KBs included 1) being embedded within the organization (i.e. practitioners performing KT activities as "insiders" in their clinical settings); 2) are practitioners working in their own setting;[1-3] 3) have several attributes including interpersonal skills, clinical experience, communication skills, mediation skills, and research skills, in different degrees based on the required goals; 4) use educational meetings as an active KT intervention; however, they utilize other types of KT interventions depending on their ability to adopt those interventions; and lastly, 5) can have an impact on all types of professional outcomes (e.g. behaviour, attitude, and knowledge) at varying degrees, despite employing different mechanisms to influence the targeted audiences. This study also drew separate portraits of OLs and KBs with respect to their CMO configuration. Opinion leaders appear to have superior clinical skills (known as experts), and remarkable communication and mediation skills compared to KBs. However, KBs generally have greater research skills compared than OLs. Overall, KBs were shown to perform a wider range of brokering roles and utilize more diversified KT interventions than OLs. The findings from this realist review may help guide KT researchers and employers to better align the required brokering roles with the necessary skills, and the appropriate KT interventions to maximize the impact of OLs and KBs.

The second study reported on the results of a descriptive study aimed at describing the profile of KBs including the sociodemographic and professional characteristics, work activities (i.e. roles and tasks), and training of those working within rehabilitation settings in Canada. One hundred and ninety-eight KBs across Canada participated in an online survey. Our results indicate that KBs were mostly experienced clinicians, with over 15 years of clinical work, who for the most part perform their brokering activities part-time. Several titles are used to refer to individuals who perform the KB roles, as brokering activities are usually embedded within the functions of managers, opinion leaders, researchers, and educators.[4-7] The study highlighted that the linking agent role was the most frequent role performed by KBs, followed by the capacity builder, and the information manager. In term of tasks corresponding to each role, KBs tended to more often perform self-directed learning tasks than tasks requiring engagement with other individuals. Although most KBs had higher education credentials (e.g. Master's degree) and over 10 years of experience as KBs, very few participants had received formal training to perform brokering activities. Most of KBs have reported a need for additional training to increase their knowledge and skills in knowledge brokering roles. Lastly, the majority of KBs are receiving an hourly rate that is equal to their salary as clinicians. The findings from this descriptive study may guide employers to better identify the potential KBs in their organizations (i.e. by being aware of KBs' characteristics), recognize the types of roles and tasks that KBs tend to perform, and provide insight on the expected salary for KBs. This study also informs policy-makers about the lack of training for KBs; this may guide them to dedicate resources to support KBs training.

The third study consisted of a qualitative descriptive study informed by the CFIR that aimed to identify the factors likely to promote or hinder the optimal use of KBs within rehabilitation settings. Our findings showed that the factors likely to influence KBs roles are mainly associated with three levels: individual, organizational, and process. At the *individual level*, having certain skillsets (e.g. clinical experiences, understanding of local context demands, communication and research skills, and leadership skills) was viewed as favourably impacting the performance of KBs. Personal attributes such as motivation, flexibility, emotional intelligence and involvement in research activities were common in participating KBs. Being an insider (i.e. working in the same setting as team members) appeared to facilitate networking and engagement in brokering activities and increase the KBs awareness of the local context needs and the desired change. At the *organizational level,* our findings showed that networking and engagement with different stakeholders was an essential element of the

brokering activities. Networking seemed to have a number of advantages at the inner setting when communicating with clinical teams and managers and at the outer setting when communicating with professional and provincial groups. This study also suggested that several forms of organizational support could impact the success of KBs roles. Providing access to a library and scholarly databases and subscribing to relevant newsletters, providing IT support, clerical support, virtual communication tools, physical space, and allowing adequate time for KBs activities were deemed important for KBs. Lastly, our findings highlighted a lack of financial support for KBs activities and lack of awareness of KBs roles in the organizations. At the *brokering process level*, our findings highlighted the lack of training for KBs, plus the lack of participants' awareness of the existing KBs-related trainings; this maybe explain why most of KBs depended on self-learning as well as on-job learning, despite their need for KBs training.[8] This study also highlighted the need for standard evaluation tools to evaluate KBs performance and the need for creating a provincial or national community of practice (CoP) for KBs to promote networking and information exchange among KBs and to avoid work duplications.

The fourth study reported on the results of a descriptive study (an environmental scan) that aimed to identify and describe current educational training opportunities (ETO) for KBs in Canada and to explore whether these programs meet the competencies needed for the KBs roles. ETO were mainly found in three Canadian provinces (Ontario, Quebec, and British Columbia). Most ETO in British Columbia are sponsored by regional groups, whereas ETO in Ontario and Quebec were offered mainly in universities, which came with significant tuition costs. The findings provided an informative portrait of what content is covered by existing ETO and pointed to a number of gaps in training. The primary focus of included ETO was on developing knowledge brokering skills to fulfill the capacity builder role. The second focus was on research skills needed to perform the evaluator role. ETO developers paid less attention to the other types of competency-role combinations, namely developing communication skills to fulfill the facilitator role, developing mediation skills to fulfill the linking agent role, and providing knowledge and skills related to the information manager role. These findings provide insights for future ETO developers on what the main elements of KBs training should be.

In summary, this dissertation has contributed to our understating of the intricacies related to this vital role of KBs in promoting the uptake of research evidence in the rehabilitation sector in Canada. This dissertation expands our knowledge of KBs in term of

characteristics (sociodemographic and professional), roles and activities, influencing factors, and training opportunities. Maximizing our knowledge of KBs in the Canadian context can enhance the ability of health care organizations to utilize KBs as one widely adopted KT strategy that can improve clinical practice outcomes.[9]

10.1 Implications of the results

Findings of this thesis have important implications for many stakeholders, including KBs, policy-makers, KT institutions, and employers. As such, each study provides knowledge that will help guide different stakeholders to better utilize KBs and maximize their impact on promoting the use of research evidence in healthcare settings. The following section presents the findings that contribute to many stakeholders collectively, then presents the findings that were found to be useful for each group of stakeholders.

First, this thesis has highlighted a number of desirable features for KBs (study 1 and 3) that can help those who plan to perform brokering activities within their organization (knowledge brokers level). It is preferable for individuals who are interested in performing brokering roles to 1) be an expert clinician; 2) be an insider; and 3) perform brokering activities part-time alongside their clinical work. In addition, those individuals should possess or aim to improve their interpersonal skills and their communication skills. These features should also be considered by employers (employers' level), when they identify individuals who can perform brokering activities in their organizations. This will increase the likelihood of identifying appropriate individuals to whom they can assign brokering roles.

Second, for individuals who are interested in starting a KBs career (knowledge brokers level), findings from this thesis suggest they can consider performing brokering roles on a voluntary basis in order to gain experience and become aware of their local sites' needs (studies 2 and 3). This suggestion can also guide employers (employer level) in identifying those individuals who are already performing and motivated to take on the KBs roles voluntarily, to provide opportunities to strengthen and sustain their contributions as a KB.

Third, this thesis can raise awareness of different stakeholders (whether the employers, the policy makers, or the KBs themselves) regarding the various roles and tasks that KBs can perform (information manager, capacity builder, linking agent, facilitator, and evaluator) (study 2).

10.1.1 Knowledge brokers level

This thesis is a first step in understanding training characteristics, content, and location offered to KBs (study 4). Although the quality and relevance of these training opportunities should be formally assessed, this list of training opportunities offers a start for those who would like to seek KB-related training and promote the KBs' awareness of the available training opportunities.

10.1.2 Policy-makers level

Findings from this thesis suggests that KBs tend to perform self-directed tasks over tasks requiring engagement with other individuals. Valuing and prioritizing KB roles within the organization could increase employees' engagement in proposed brokering activities, and consequently, encourage KBs to perform more activities that require employees' engagement. Valuing KBs roles can take several forms in an organization, including: 1) dedicating sufficient time for KBs to perform their role (e.g. by liberating their clinical caseload if they are clinicians); 2) providing financial support for developing KT products and attending conferences; 3) providing administrative support (e.g. clerical support) for KBs to be more efficient; 4) allowing access to evidence via different databases; 5) creating opportunities for networking with different stakeholders; 6) encouraging clinical teams to get involved in brokering activities; and lastly, 7) developing a provincial or national Community of Practice for KBs in rehabilitation to promote networking and information exchange among KBs and avoid work duplications.

Based on the results from this research, we suggest that policy-makers create a collaborative platform through which KBs across Canada can attend free online ETO delivered by regional groups (e.g. Fraser Health Authority and Vancouver Coastal Health). Free participation can be a practical solution to address the cost-related barrier for KBs located in other provinces. Another suggestion is to dedicate professional development funding to KBs wanting additional training as this can positively impact the success of brokering activities.

10.1.3 KT institutional level

This thesis can provide guidance to leaders of KT programs and/or KT institutions when developing future ETO on what the main elements of KBs training should be (studies 1, 2, 3, and 4). This thesis also emphasized that KT institutions that offer KB-related training need to better advertise their training opportunities among professional associations and provincial

groups in order to reach the target participants (studies 2 and 3). Lastly, the lack of sustainability of ETO may prevent clinicians from accessing much-needed training (study 4). Thus, collaboration and shared understanding between professional groups, KT institutions, and clinical sites could help improve the number and the sustainability of ETO offered across Canada, and bring together highly qualified instructors with various perspectives and experiences.

10.1.4 Employers level

This thesis informs employers of the available ETO for their potential KBs to take if there is an organizational need for someone to play the role of a KB. Findings from study 4 provide the necessary information related to the ETO characteristics (i.e. location, format, duration, frequency, content, and cost). These findings can guide employers to decide where, when, and how each ETO can be taken by their employees as well as guide employers in term of liberating schedules and clinical workload, and providing the adequate financial support to employees taking those ETO.

10.2 Strengths and limitations

10.2.1 Strengths

10.2.1.1 Recruitments strategies

For studies 2 and 4, a major strength was the use of three recruitment strategies to reach participants, and ETO covering various rehabilitation organizations, including academic institutions, research institutions, clinical sites, professional associations and regulatory bodies across Canada. Important efforts were made in order to reach all rehabilitation institutions across Canada (e.g., hospitals, rehabilitation centers, universities, professional bodies, regulatory boarders, KT institutions). Using this recruitment strategy, we successfully reached 475 participants, of whom 198 participated in the survey (study 2). We identified 84 ETO, of which 51 could be included in the analysis (study 4).

10.2.1.2 Methodological strengths

Each study used a rigorous methodological approach to address the research objectives. In study 1, a comprehensive search strategy was adopted, which was validated by an expert health-science librarian to capture all relevant records for the realist review. An additional strength is the use of rigorous theoretical frameworks to analyze and interpret the data. The Role Domains Model for Knowledge Brokering framework[10] served to analyse the KBs roles

and activities (studies 1 and 2) and to classify the content of ETO (study 4). The Consolidated Framework for Implementation Research (CFIR)[11] was used to analyze the barriers and the facilitators facing KBs in the work environment (study 3). Lastly, the use of the Harden's comprehensive framework[12] was adopted in developing the data collection sheet of ETO (study 4).

10.2.1.3 Optimising reach and representativeness

It is worth noting that data for the four thesis studies were collected using online platforms: the literature searches in different databases (study 1); email invitations to participate in the online survey (study 2); email invitations to participate in interviews on Zoom (study 2); and online searches of institutions offering ETO to KBs in Canada, followed by emails to contact ETO instructors to validate findings (study 4). Exploiting online platforms and virtual communication tools in conducting research activities are promising strategies for future research, especially in the current pandemic crisis (COVID-19). This approach also allowed us to include a broader group of KBs across Canada, increasing the generalizability of our results.

10.2.2 Limitations

Aside from the limitations discussed in the relevant chapters, additional limitations of this thesis should be mentioned.

10.2.2.1 Recruitment limitations

Many individuals who perform brokering activities do not have the title of "knowledge broker", which likely affected the recruitment of targeted participants. In order to overcome this limitation, a short video was created with a link inserted in the invitation emails in an attempt to clarify the roles of potential KBs participants (studies 2 and 3). Further, this thesis was restricted to KBs who work in the rehabilitation field in Canada. As such, findings cannot be taken as evidence for the other healthcare disciplines, or for other countries.

10.2.2.2 Methodological limitations

The realist review (study 1) aimed to highlight the differences and similarities between OLs and KBs with respect to context, mechanism and outcomes as well as describe their common patterns (i.e. COM configuration). Although, the relative effectiveness of the OLs and KBs on the different types of professional outcomes (e.g., knowledge, attitude, and behaviour)

is relevant, we did not conduct a meta-analysis as it was not part of the research question. Ongoing research should evaluate effectiveness of OLs and KBs to generate evidence on the processes by which OLs and KBs can have the greatest impact.

10.2.2.3 Feasibility limitations

The cross-sectional online survey (study 2) was developed to capture the personal and professional characteristics, work activities, and training opportunities for KBs. The survey would have been more informative if it had also captured the different types of skills that KBs have. Considerations aiming to restrict survey completion time to no more than 30 minutes prevented us from adding these additional questions.

In the fourth study, an environmental scan was used to identify and describe current educational training opportunities (ETO) for KBs in Canada. The data were extracted from organizations' websites, which at times lacked important details and contained outdated information. Conducting interviews among ETO developers (i.e., course instructors) could have allowed us to obtain missing information regarding the ETOs' content or syllabus. Unfortunately, these approaches were not feasible because of time limitations and the limited availability of French-speaking interviewers.

10.3 Future considerations

10.3.1 Measuring tools and frameworks

A number of instruments and models of knowledge brokering could be considered in future research. First, as the personal attributes (characteristics and skills) seems to have an impact on the success of KBs roles,[13] valid and reliable tools that can measure KBs attributes would help researchers estimate the magnitude of these attributes, and more accurately identify individuals capable of performing brokering activities. Second, there is a need to develop an evaluation framework and related measuring tool to evaluate and monitor KBs performance over time in order to identify effective strategies employed within each role to maximize their impact on healthcare systems. Identifying indicators to measure KBs success/failure would be important as those indicators can act as motivators for KBs to improve their performance.

10.3.2 Interventions and Platforms

This thesis proposes some useful interventions that can promote the impact of KBs in healthcare systems. First, a comprehensive educational intervention designed to improve KBs

attributes should be developed and tested in order to improve their performance. Second, establishing a national CoP for KBs working in rehabilitation may be a way to help KBs network and stay abreast of the latest developments in their field. Third, creating a mutual platform that links all KT organizations/institutions that offer free online short-duration ETO (i.e., webinars) in order to increase KBs' awareness of and accessibility to the ETO. Lastly, offering an overview of KBs roles and skills within the rehabilitation programs as an elective course for those who are potentially interested in performing these types of roles after graduation may be a way forward.

10.3.3 Future research

The Role Domains Model for Knowledge Brokering[10] was developed in 2016 to help plan and implement knowledge brokering activities, partly explaining why this model has not been widely utilized to date, despite its usefulness in reporting KBs roles and activities. Adopting the Role Domains Model for Knowledge Brokering[10] should be considered in future studies as it provides a useful scaffold for the practice and training of KBs working in healthcare.

A review of existing instruments with strong psychometric properties that assess KBs' competencies would serve to identify whether there is a need to develop new instruments. In addition, well-designed studies that examine the impact of KBs' attributes on KBs' performance would be useful in maximizing our understanding of the association between KBs characteristics and their performance, which consequently advances the utilization of KBs as one of the promising KT strategies.

Qualitative studies (i.e., interviews) conducted among ETO developers could be used to explore the reasons for the lack of sustainability of many ETO related to KBs; addressing those reasons will promote the sustainability of ETO in the future. Lastly, economic evaluation across various healthcare disciplines is needed for policy-makers and employers to decide to invest in KBs as a cost-effective strategy to promote the uptake of research findings in healthcare systems and improve patient health outcomes.

10.4 Conclusion

In conclusion, this thesis has contributed unique and original knowledge regarding the KBs working in rehabilitation sector in Canada. The four studies conducted in this thesis have

addressed various research gaps related to KBs. I was able to: (i) differentiate between OLs and KBs in rehabilitation sectors; (ii) draw an informative portrait for KBs in term of sociodemographic and professional characteristics, and roles and activities; (iii) identify barriers and facilitators to the use of KBs within rehabilitation settings; and (iv) identify the available training opportunities for KBs in Canada with describing the characteristics of those trainings.

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Table 1: Summary findings from all four manuscripts dressing a portrait of KBs

Category	Description	Manuscript
1. Location		
	The second and fourth manuscripts provided an initial estimation of the geographical location of KBs across Canada. In the second manuscript, it was found that most of KBs located in Central Canada (Ontario and Quebec), followed by Western Canada (British Columbia and Alberta). Besides, the fourth manuscript indicated that most of the ETO were located in Ontario, Quebec, and British Columbia. In rehabilitation, knowledge brokering activities are more popular in those three provinces (Ontario, Quebec, British Columbia), while more work is needed to introduce and purvey the concept of knowledge brokering to other Canadian provinces.	2 & 4
2. Title		
	The second manuscript reported that several titles are used to 'label' individuals performing knowledge brokering roles (e.g., knowledge mobilization specialist, research coordinator, professional practice lead, clinician champion, clinical educator). Knowledge brokering may be an umbrella term for all types of activities that aim to promote the utilization of research evidence, regardless of the title of those individuals; those brokering activities are embedded within the function of managers, opinion leaders, researchers, and educators.[1-4]	2
3. Personal attributes and skillsets		
3.1 Interpersonal attributes		
	Findings from the first and the third manuscripts indicated that KBs should possesses or acquire certain types of interpersonal skills to increase the likelihood of a favourable impact on targeted stakeholders. These interpersonal skills included being positive, enthusiastic, creative, persuasive, motivated, trusted, flexible, willing to share knowledge, accessible to colleagues, and able to set realistic expectations; having emotional intelligence, leadership skills, intellectual curiosity, and analytic skills; and understanding of local context demands). Those findings were consistent with previous research.[5-10]	1 & 3
	A common feature of KBs highlighted in the first three manuscripts is their willingness to perform the knowledge brokering activities voluntarily (without being paid/compensated), in the absence of work obligations to play these brokering roles.	1, 2 & 3
	The third manuscript revealed that the feeling of satisfaction and completion was an adequate motivation to drive KBs to continue performing this role, even in the absence of organizational incentives. This feature was also consistent with previous research that described KBs as self-motivated individuals.[8]	3

3.2 Communication skills	
Results from the four studies were consistent in highlighting the importance of having communication and networking skills for KBs, which is also supported by other previous researches.[11-17]	1, 2, 3 & 4
The third manuscript identified networking ability as an essential element of the brokering activities. Advantages of owning strong networking and communication skills include raising KBs' awareness of stakeholders' needs, facilitating the access to information from professional and provincial groups, decreasing stakeholders' resistance to change, and receiving feedback (as informal evaluation) for KBs' performance.	3
3.3 Clinical skills	
The first three manuscripts were consistent on emphasizing the importance of having clinical experience for KBs, or at least a clinical background on the topic they are preforming brokering on.	1, 2, & 3
The second manuscript indicated that a large portion of KBs are expert clinicians with over 15 years of clinical experience. Owning clinical knowledge and experience was also reported as a positive trait for KBs by previous literature.[13,18-21]	2
3.4 Research skills	
The first three manuscripts indicated that having research skills is a preferable feature for KBs.	1, 2, & 3
The first manuscript referred that research skills were required if KBs will be responsible for seeking, appraising, and synthesizing evidence.	1
The second and the third manuscripts showed that most of the participated KBs have research skills that came from prior or ongoing higher education credentials (e.g., master's degree).	2 & 3
3.5 Being insider	
The first three manuscripts concurred that being insider "as internal KB" embedded within the organization is a feature that offers several advantages such as promoting KBs' awareness of local context's needs, schedules, caseloads, current knowledge, and past experiences.[5-7] Being an insider also facilitates the engagement of relevant stakeholders' in brokering activities and promote their openness toward the desired change. This feature was supported by prior research in other healthcare sectors.[20,21] In contrast, working remotely was perceived by KBs as a barrier for being constantly involved (third manuscript).	1, 2, & 3
4. Knowledge Brokering roles and activities	
The first two manuscripts have classified the KBs roles based on the Role Domains Model for Knowledge Brokering,[22] which was developed in 2016 to plan and implement knowledge brokering activities (information manager, capacity builder, linking agent, facilitator, and evaluator).	1 & 2

Although, the different types of KBs roles have been previously described,[14,18,21,23-29] the second manuscript deepened our knowledge about the frequency of each activity within each role. Findings suggested that KBs tended to more often perform self-directed tasks than those requiring engagement with other individuals, as accomplishing of those tasks depends on other individuals' initiative and motivation.	2
The third manuscript highlighted the need to evaluate KBs activities through standard evaluation tools for KBs' performance and outcomes.	3
5. KBs Training	
5.1 Training features	
The fourth manuscript showed that there are approximately 51 educational training opportunities (ETO) for KBs in Canada. The primary focus of those ETO was mainly on preparing participants to perform the capacity builder role by developing their knowledge brokering skills. Another focus was on preparing participants to perform the evaluator role by developing their research skills, while less attention was devoted to other types of KBs roles and skills. This manuscript provided informative suggestions on the core elements of a comprehensive KBs training opportunity. ETO should provide background knowledge on all the five knowledge brokering roles in order to give the participants an insight on their possible job requirements and responsibilities, and cover the different sources of evidence, and the basic KT prosses and frameworks. In addition, research skills are considered essential for most of the brokering roles, especially for evaluator and information manager roles. Brokering skills are substantial for a capacity-building role. While the focus on equipping participants with communication and mediation skills could be based on participants' needs since many KBs already have those kinds of skills naturally embedded in their personality.	4
5.2 Lack of training	
The second and the third manuscripts showed that very few KBs received formal training to perform brokering activities, but most had higher education credentials (e.g., master's degree).	2 & 3
The third manuscript highlighted the lack of participants awareness of the existing KB-related training opportunities; possibly explaining why most of KBs depended on self-learning as well as on-job learning. Providing financial support and protected time for KBs training could help address training gaps.[30]	3
The second and the third manuscripts also reported that most of KBs expressed the need for additional training to increase their knowledge and skills related to their brokering roles. Creating a national community of practice for KBs was raised as a need for keeping KBs up-to-dated.	2 & 3

6. Organizational constraints	
6.1 Lack of time	
The second and the third manuscripts provided new insights on the lack of the time dedicated for KBs activities within organizations.	2 & 3
The second manuscript indicated that most of KBs performed their brokering activities part-time, and not surprisingly, time-consuming tasks were less frequently accomplished. These findings brought up the lack of time as one of the organizational constraints for KBs.	2
The third manuscript highlighted the need for these organisations to allow adequate time for KBs activities.	3
6.2 Financial support	
The first three manuscripts were consistent in reporting the financial constraints as barriers for KBs activities; findings from previous research also praised that dedicating financial support for KBs activities facilitates their role.[5-7,31,32]	1, 2, & 3
6.3 Organizational culture	
The second and the third manuscripts provided insight into the impact of organizational culture on the KBs activities. The second manuscript showed that KBs do not often perform tasks that requiring other individuals' engagement, since the organizational culture may reduce the end-users' tendency to be engaged in KBs activities. The same was highlighted in the third manuscript when participants raised issues related to low organization's awareness of KBs; unclear or poorly defined KBs roles; not prioritizing brokering activities; the lack of initial or ongoing training for KBs; and the need for a more rewarding system for brokering activities. Previous research also emphasized the need for valuing and prioritising brokering roles within the organization to increase the likelihood of professional behaviour change.[30,32]	2 & 3
6.4 Accessibility to evidence	
The third manuscript has uniquely highlighted the importance of allowing access to a library and database as sources of information that can facilitate the KBs activities. Accessibility to resources can positively influence the initiation and the sustainability of the KBs roles within the organization.[5-8,12,31,33]	3

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APPENDICES

Appendices of Chapter 1

Appendix 1: Types of KT interventions

The following section provides definitions of different types of professional KT interventions based on the taxonomy developed by The Cochrane Effective Practice and Organization of Care (EPOC Taxonomy)[1]:

a) Distribution of educational materials: Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications. The materials may have been delivered personally or through mass mailings. It may include video trainer without facilitation.

b) Educational meetings: Health care providers who have participated in conferences, lectures, workshops or traineeships. Facilitator present. Educational programmes, interprofessional education (IPE), continuing medical education (CME), problem-based learning (PBL).

c) Local consensus processes: Inclusion of participating providers in discussion to ensure that they agreed that the chosen clinical problem was important and the approach to managing the problem was appropriate.

d) Educational outreach visits: Use of a trained person who met with providers in their practice settings to give information with the intent of changing the provider's practice. The information given may have included feedback on the performance of the provider(s). Includes academic detailing.

e) Local opinion leaders: Use of providers nominated by their colleagues as 'educationally influential'. The investigators must have explicitly stated that their colleagues identified the opinion leaders.

f) Patient mediated interventions: New clinical information (not previously available) collected directly from patients and given to the provider e.g. depression scores from an instrument. Facilitated relay of clinical information to clinicians.

g) Audit and feedback: Any summary of clinical performance of health care over a specified period of time. The summary may also have included recommendations for clinical action. The information may have been obtained from medical records, computerised databases, or observations from patients. Providing feedback to teams/peers, prescribing profiling.

h) Reminders: Patient- or encounter-specific information, provided verbally, on paper or on a computer screen, which is designed or intended to prompt a health professional to recall information. This would usually be encountered through their general education; in the medical records or through interactions with peers, and so remind them to perform or avoid some action to aid individual patient care. Computer-aided decision support system – drug dosage (CDSS) and computer physician order entry (CPOE) are included.

i) Tailored [Formerly called Marketing]: Use of personal interviewing, group discussion ('focus groups'), or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers.

j) Mass media: Varied use of communication that reached great numbers of people including television, radio, newspapers, posters, leaflets, and booklets, alone or in conjunction with other interventions; targeted at the population level.

k) Other: Other categories to be agreed in consultation with the EPOC editorial team.

Appendices of Chapter 3

Appendix 1: Search Strategy

A. Ovid Medline database

1 exp Translational Medical Research/ or "Diffusion of Innovation"/ or Information Dissemination/ or Health Knowledge, Attitudes, Practice/
2 exp Practice Guidelines as Topic/ or Practice Guideline/ or Continuing education/
3 (KT adj1 (intervention or interventions or plan or plans or policy or policies or strategy or strategies)).mp.
4 ((knowledge or research or information or evidence or science or finding*) adj1 (translation or transfer or exchange or action or practice or decision or implementation or management or dissemination or application or share or sharing or uptake or utili?ation or mobile?ation or integration or communication or adoption or diffusion or brokering or creation)).mp.
5 (knowledge to action or research to practice or diffusion of innovations or scale up or translational research or translation of research findings or implementation or continuing education or organi*ational innovation or complex intervention or behavio*r change intervention* or "technology transfer").mp.
6 ((Continuing adj2 professional adj2 development) or (implementation adj2 science)).mp.
7 (intervention? adj2 (complex or education or multifacet* or multi-facet* or organi?ation* or tailor* or target* or interdisciplin* or multi-disciplin* or multidiscipline* or evidence-based or evidence-driven)).mp.
8 1 or 2 or 3 or 4 or 5 or 6 or 7
9 Physical Therapy Modalities/
10 "Physical Therapy (Specialty)"/
11 Cardiac rehabilitation.mp. or Cardiac Rehabilitation/
12 Lung Diseases, Obstructive/ or Pulmonary Disease, Chronic Obstructive/ or pulmonary rehabilitation.mp.
13 Cerebral Palsy/ or Pediatrics/ or pediatric rehabilitation.mp. or Disabled Children/
14 neurological rehabilitation.mp. or Neurological Rehabilitation/ or Stroke Rehabilitation/
15 Exercise Therapy.mp. or exp Exercise Therapy/
16 Manipulation, Chiropractic/ or Chiropractic/
17 Mobilization.mp.
18 exp Osteopathic Medicine/
19 Osteopathic.mp. or Manipulation, Osteopathic/ or Osteopathic Physicians/ or Osteopathic Medicine/
20 "Physical and Rehabilitation Medicine"/
21 (physical therap* or physiotherap*).mp.
22 Occupational therapy/ or occupational therap*.mp.
23 Chiropract*.tw.
24 Chiroprax*.tw.
25 Chiropractic.mp.
26 OMT.mp.
27 Osteopath*.ti,ab.
28 (Osteopath* adj1 manipulat$).mp.
29 Manual therap*.mp.
30 Sport* therap*.mp.
31 Sport physician*.mp.

32 Sports medicine/
33 Massage therap*.mp.
34 kinesiolog*.mp.
35 Physiatr*.mp.
36 Physical medicine.mp.
37 (physical adj2 medicine).mp.
38 Rehabilitation medicine.mp.
39 Orthoped*.mp.
40 Orthopaed*.mp.
41 Orthopod*.mp.
42 Doctor of Podiatric Medicine.mp.
43 Podiatr*.mp.
44 Chiropod*.mp.
45 Hand therap*.mp.
46 Foot therap*.mp.
47 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46
48 exp Leadership/ or Professional role/ or Interprofessional relations/
49 (Brokerag* or Linking agent or Change agent* or Change agenc* or Capacity builder* or knowledge conduit or Knowledge bridge* or Opinion leader* or Champion*).mp,kw.
50 ((knowledge or research or information or evidence or science or findings) adj1 (go-between or intermediar* or liaison or manager* mediator* or navigator* or officer* or translator* or broker* or facilitator* or leader* or champion*)).mp,kw.
51 (Mediator* adj1 exchange*).mp,kw.
52 (opinion adj1 leadership).mp,kw.
53 or/48-52
54 8 and 47 and 53

B. Embase database

1 exp Translational Research/ or Information Dissemination/ or Attitudes to health/
2 exp Practice Guidelines/ or Health care planning/ or Knowledge Management/ or Continuing education/
3 (KT adj1 (intervention or interventions or plan or plans or policy or policies or strategy or strategies or uptake)).mp.
4 ((knowledge or research or information or evidence or science or finding*) adj1 (translation or transfer or exchange or action or practice or decision or implementation or management or dissemination or application or share or sharing or uptake or utili?ation or mobile?ation or integration or communication or adoption or diffusion or brokering or creation)).mp.
5 (knowledge to action or research to practice or diffusion of innovations or scale up or translational research or translation of research findings or implementation or continuing education or organi*ational innovation or complex intervention or behavio*r change intervention* or "technology transfer").mp.
6 ((Continuing adj2 professional adj2 development) or (implementation adj2 science)).mp.
7 (intervention? adj2 (complex or education or multifacet* or multi-facet* or organi?ation* or tailor* or target* or interdisciplin* or multi-disciplin* or multidiscipline* or team* or evidence or evidence-based or evidence-driven)).mp.
8 1 or 2 or 3 or 4 or 5 or 6 or 7
9 Physiotherapy/

10 Heart rehabilitation.mp. or heart rehabilitation/
11 pulmonary rehabilitation.mp. or chronic obstructive lung disease/ or pulmonary rehabilitation/
12 pediatric rehabilitation.mp. or cerebral palsy/ or pediatric rehabilitation/ or pediatrics/
13 Neurological Rehabilitation.mp. or neurorehabilitation/
14 osteopathic manipulation/ or chiropractic manipulation/ or musculoskeletal manipulation/ or spine manipulation/ or orthopedic manipulation/
15 Mobilization.mp.
16 osteopathic medicine/ or Osteopathic.mp. or osteopathic manipulation/ or osteopathic physician/
17 Exercise Therapy.mp. or kinesiotherapy/
18 (physical therap* or physiotherap*).mp.
19 Occupational therapy/ or occupational therap*.mp.
20 Chiropract*.tw.
21 Chiroprax*.tw.
22 Chiropractic.mp.
23 OMT.mp.
24 Osteopath*.ti,ab.
25 (Osteopath* adj1 manipulat$).mp.
26 Manual therap*.mp.
27 Sport* therap*.mp.
28 Sport physician*.mp.
29 Sports medicine/
30 Massage therap*.mp.
31 kinesiolog*.mp.
32 Physiatr*.mp.
33 Physical medicine.mp.
34 (physical adj2 medicine).mp.
35 Rehabilitation medicine.mp.
36 Orthoped*.mp.
37 Orthopaed*.mp.
38 Orthopod*.mp.
39 Doctor of Podiatric Medicine.mp.
40 Podiatr*.mp.
41 Chiropod*.mp.
42 Hand therap*.mp.
43 Foot therap*.mp.
44 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43
45 exp Leadership/ or Professional standard/ or professional practice/
46 (Brokerag* or Linking agent or Change agent* or Change agenc* or Capacity builder* or knowledge conduit or Knowledge bridge* or Opinion leader* or Champion*).mp,kw.
47 ((knowledge* or research* or information* or evidence* or science or findings) adj1 (go-between* or intermediar* or liaison* or manager* mediator* or navigator* or officer* or translator* or broker* or facilitator* or leader or leaders or champion*)).mp,kw.
48 (Mediator* adj1 exchange*).mp,kw.
49 (opinion adj1 leadership).mp,kw.
50 45 or 46 or 47 or 48 or 49
51 8 and 44 and 50

C. PsycINFO database

1 Exp Interdisciplinary Research/ or Medical Education/ or Scientific Communication/ or Information Dissemination/ or Health Attitudes/
2 Exp Evidence Based Practice/ or Treatment Guidelines/ or Knowledge Management/ or Continuing education/
3 (KT adj1 (intervention or interventions or plan or plans or policy or policies or strategy or strategies or uptake)).mp.
4 ((knowledge or research or information or evidence or science or finding*) adj1 (translation or transfer or exchange or action or practice or decision or implementation or management or dissemination or application or share or sharing or uptake or utili?ation or mobile?ation or integration or communication or adoption or diffusion or brokering or creation)).mp.
5 (knowledge to action or research to practice or diffusion of innovations or scale up or translational research or translation of research findings or implementation or continuing education or organi*ational innovation or complex intervention or behavio*r change intervention* or "technology transfer").mp.
6 ((Continuing adj2 professional adj2 development) or (implementation adj2 science)).mp.
7 (intervention? adj2 (complex or education or multifacet* or multi-facet* or organi?ation* or tailor* or target* or interdisciplin* or multi-disciplin* or multidiscipline* or team* or evidence or evidence-based or evidence-driven)).mp.
8 1 or 2 or 3 or 4 or 5 or 6 or 7
9 exp Physical Therapy/ or Rehabilitation/ or Neurorehabilitation/
10 Mobilization.mp.
11 exp Osteopathic Medicine/
12 (physical therap* or physiotherap*).mp.
13 Occupational therapy/ or occupational therap*.mp.
14 Chiropract*.tw.
15 Chiroprax*.tw.
16 Chiropractic.mp.
17 OMT.mp.
18 Osteopath*.ti,ab.
19 (Osteopath* adj1 manipulat$).mp.
20 Manual therap*.mp.
21 Sport* therap*.mp.
22 Sport physician*.mp.
23 Sports medicine/
24 Massage therap*.mp.
25 kinesiolog*.mp.
26 Physiatr*.mp.
27 Physical medicine.mp.
28 (physical adj2 medicine).mp.
29 Rehabilitation medicine.mp.
30 Orthoped*.mp.
31 Orthopaed*.mp.
32 Orthopod*.mp.
33 Doctor of Podiatric Medicine.mp.
34 Podiatr*.mp.
35 Chiropod*.mp.
36 Hand therap*.mp.
37 Foot therap*.mp.

38 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37
39 exp Leadership/ or Professional role/ or Professional Development/
40 (Brokerag* or Linking agent or Change agent* or Change agenc* or Capacity builder* or knowledge conduit or Knowledge bridge* or Opinion leader* or Champion*).mp.
41 ((knowledge* or research* or information* or evidence* or science or findings) adj2 (go-between* or intermediar* or liaison* or manager* mediator* or navigator* or officer* or translator* or broker* or facilitator* or leader or leaders or champion*)).mp.
42 (Mediator* adj2 exchange*).mp.
43 (opinion adj2 leadership).mp.
44 39 or 40 or 41 or 42 or 43
45 8 and 38 and 44

D. CINAHL database

1 (MM "Attitude to Health") OR (MM "Practice Guidelines") OR (MM "Professional Practice, Research-Based") OR (MM "Professional Practice, TheORy-Based") OR (MM "Continuing Education Providers") OR (MM "Education, Medical, Continuing") OR (MM "Diffusion of Innovation") OR "Diffusion of Innovation"
2 TI ((KT N1 intervention*) OR (KT N1 plan*) OR (KT N1 policy) OR (KT N1 policies) OR (KT N1 strateg*))
3 AB ((KT N1 intervention*) OR (KT N1 plan*) OR (KT N1 policy) OR (KT N1 policies) OR (KT N1 strateg*))
4 TI ((knowledge N1 translation) OR (knowledge N1 transfer) OR (knowledge N1 exchange) OR (knowledge N1 action) OR (knowledge N1 practice) OR (knowledge N1 decision) OR (knowledge N1 implementation) OR (knowledge N1 management) OR (knowledge N1 dissemination) OR (knowledge N1 application) OR (knowledge N1 share) OR (knowledge N1 sharing) OR (knowledge N1 uptake) OR (knowledge N1 utili?ation) OR (knowledge N1 mobile?ation) OR (knowledge N1 integration) OR (knowledge N1 communication) OR (knowledge N1 adoption) OR (knowledge N1 diffusion) OR (knowledge N1 brokering) OR (knowledge N1 creation) OR (research N1 translation) OR (research N1 transfer) OR (research N1 exchange) OR (research N1action) OR (research N1 practice) OR (research N1 decision) OR (research N1 implementation) OR (research N1 management) OR (research N1 dissemination) OR (research N1 application) OR (research N1 share) OR (research N1 sharing) OR (research N1 uptake) OR (research N1 utili?ation) OR (research N1 mobile?ation) OR (research N1 integration) OR (research N1 communication) OR (research N1 adoption) OR (research N1 diffusion) OR (research N1 brokering) OR (research N1 creation) OR (infORmation N1 translation) OR (infORmation N1 transfer) OR (infORmation N1 exchange) OR (infORmation N1 action) OR (infORmation N1 practice) OR (infORmation N1 decision) OR (infORmation N1 implementation) OR (infORmation N1 management) OR (infORmation N1 dissemination) OR (infORmation N1 application) OR (infORmation N1 share) OR (infORmation N1 sharing) OR (infORmation N1 uptake) OR (infORmation N1 utili?ation) OR (infORmation N1 mobile?ation) OR (infORmation N1 integration) OR (infORmation N1 communication) OR (infORmation N1 adoption) OR (infORmation N1 diffusion) OR (infORmation N1 brokering) OR (infORmation N1 creation) OR (evidence N1 translation) OR (evidence N1 transfer) OR (evidence N1 exchange) OR (evidence N1 action) OR (evidence N1 practice) OR (evidence N1 decision) OR (evidence N1 implementation) OR (evidence N1 management) OR (evidence N1 dissemination) OR (evidence N1 application) OR (evidence N1 share) OR (evidence N1 sharing) OR (evidence N1 uptake) OR (evidence N1 utili?ation) OR (evidence N1 mobile?ation) OR

(evidence N1 integration) OR (evidence N1 communication) OR (evidence N1 adoption) OR (evidence N1 diffusion) OR (evidence N1 brokering) OR (evidence N1 creation) OR (science N1 translation) OR (science N1 transfer) OR (science N1 exchange) OR (science N1 action) OR (science N1 practice) OR (science N1 decision) OR (science N1 implementation) OR (science N1 management) OR (science N1 dissemination) OR (science N1 application) OR (science N1 share) OR (science N1 sharing) OR (science N1 uptake) OR (science N1 utili?ation) OR (science N1 mobile?ation) OR (science N1 integration) OR (science N1 communication) OR (science N1 adoption) OR (science N1 diffusion) OR (science N1 brokering) OR (science N1 creation) OR (finding* N1 translation) OR (finding* N1 transfer) OR (finding* N1 exchange) OR (finding* N1 action) OR (finding* N1 practice) OR (finding* N1 decision) OR (finding* N1 implementation) OR (finding* N1 management) OR (finding* N1 dissemination) OR (finding* N1 application) OR (finding* N1 share) OR (finding* N1 sharing) OR (finding* N1 uptake) OR (finding* N1 utili?ation) OR (finding* N1 mobile?ation) OR (finding* N1 integration) OR (finding* N1 communication) OR (finding* N1 adoption) OR (finding* N1 diffusion) OR (finding* N1 brokering) OR (finding* N1 creation))

5 AB ((knowledge N1 translation) OR (knowledge N1 transfer) OR (knowledge N1 exchange) OR (knowledge N1 action) OR (knowledge N1 practice) OR (knowledge N1 decision) OR (knowledge N1 implementation) OR (knowledge N1 management) OR (knowledge N1 dissemination) OR (knowledge N1 application) OR (knowledge N1 share) OR (knowledge N1 sharing) OR (knowledge N1 uptake) OR (knowledge N1 utili?ation) OR (knowledge N1 mobile?ation) OR (knowledge N1 integration) OR (knowledge N1 communication) OR (knowledge N1 adoption) OR (knowledge N1 diffusion) OR (knowledge N1 brokering) OR (knowledge N1 creation) OR (research N1 translation) OR (research N1 transfer) OR (research N1 exchange) OR (research N1action) OR (research N1 practice) OR (research N1 decision) OR (research N1 implementation) OR (research N1 management) OR (research N1 dissemination) OR (research N1 application) OR (research N1 share) OR (research N1 sharing) OR (research N1 uptake) OR (research N1 utili?ation) OR (research N1 mobile?ation) OR (research N1 integration) OR (research N1 communication) OR (research N1 adoption) OR (research N1 diffusion) OR (research N1 brokering) OR (research N1 creation) OR (infORmation N1 translation) OR (infORmation N1 transfer) OR (infORmation N1 exchange) OR (infORmation N1 action) OR (infORmation N1 practice) OR (infORmation N1 decision) OR (infORmation N1 implementation) OR (infORmation N1 management) OR (infORmation N1 dissemination) OR (infORmation N1 application) OR (infORmation N1 share) OR (infORmation N1 sharing) OR (infORmation N1 uptake) OR (infORmation N1 utili?ation) OR (infORmation N1 mobile?ation) OR (infORmation N1 integration) OR (infORmation N1 communication) OR (infORmation N1 adoption) OR (infORmation N1 diffusion) OR (infORmation N1 brokering) OR (infORmation N1 creation) OR (evidence N1 translation) OR (evidence N1 transfer) OR (evidence N1 exchange) OR (evidence N1 action) OR (evidence N1 practice) OR (evidence N1 decision) OR (evidence N1 implementation) OR (evidence N1 management) OR (evidence N1 dissemination) OR (evidence N1 application) OR (evidence N1 share) OR (evidence N1 sharing) OR (evidence N1 uptake) OR (evidence N1 utili?ation) OR (evidence N1 mobile?ation) OR (evidence N1 integration) OR (evidence N1 communication) OR (evidence N1 adoption) OR (evidence N1 diffusion) OR (evidence N1 brokering) OR (evidence N1 creation) OR (science N1 translation) OR (science N1 transfer) OR (science N1 exchange) OR (science N1 action) OR (science N1 practice) OR (science N1 decision) OR (science N1 implementation) OR (science N1 management) OR (science N1 dissemination) OR (science N1 application) OR (science N1 share) OR (science N1 sharing) OR (science N1

uptake) OR (science N1 utili?ation) OR (science N1 mobile?ation) OR (science N1 integration) OR (science N1 communication) OR (science N1 adoption) OR (science N1 diffusion) OR (science N1 brokering) OR (science N1 creation) OR (finding* N1 translation) OR (finding* N1 transfer) OR (finding* N1 exchange) OR (finding* N1 action) OR (finding* N1 practice) OR (finding* N1 decision) OR (finding* N1 implementation) OR (finding* N1 management) OR (finding* N1 dissemination) OR (finding* N1 application) OR (finding* N1 share) OR (finding* N1 sharing) OR (finding* N1 uptake) OR (finding* N1 utili?ation) OR (finding* N1 mobile?ation) OR (finding* N1 integration) OR (finding* N1 communication) OR (finding* N1 adoption) OR (finding* N1 diffusion) OR (finding* N1 brokering) OR (finding* N1 creation))

6 TI ((knowledge to action) OR (implementation) OR (research to practice) OR (diffusion of innovations) OR (scale up) OR (translational research) OR (translation of research findings) OR (continuing education) OR (ORgani*ational innovation) OR (complex intervention) OR (behavio*r change intervention*) OR (technology transfer)) OR AB ((knowledge to action) OR (implementation) OR (research to practice) OR (diffusion of innovations) OR (scale up) OR (translational research) OR (translation of research findings) OR (continuing education) OR (ORgani*ational innovation) OR (complex intervention) OR (behavio*r change intervention*) OR (technology transfer))

7 TI ((Continuing N2 professional N2 development) OR (implementation N2 science)) OR AB ((Continuing N2 professional N2 development) OR (implementation N2 science))

8 TI ((intervention? N2 complex) OR (intervention? N2 education*) OR (intervention? N2 multifacet*) OR (intervention? N2 multi-facet*) OR (intervention? N2 ORgani?ation*) OR (intervention? N2 tailOR*) OR (intervention? N2 target*) OR (intervention? N2 interdisciplin*) OR (intervention? N2 multi-disciplin*) OR (intervention? N2 multidiscipline*) OR (intervention? N2 evidence-based) OR (intervention? N2 evidence-driven)) OR AB ((intervention? N2 complex) OR (intervention? N2 education*) OR (intervention? N2 multifacet*) OR (intervention? N2 multi-facet*) OR (intervention? N2 ORgani?ation*) OR (intervention? N2 tailOR*) OR (intervention? N2 target*) OR (intervention? N2 interdisciplin*) OR (intervention? N2 multi-disciplin*) OR (intervention? N2 multidiscipline*) OR (intervention? N2 evidence-based) OR (intervention? N2 evidence-driven))

9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

10 (MH "Rehabilitation+") OR (MH "Occupational Therapy+") OR (MH "Occupational Therap*") OR (MH "Physical Therapy+") OR (MH "Physical Therap*") OR (MH "Manipulation, Chiropractic") OR (MH "Manual Therapy") OR (MH "Manipulation, ORthopedic") OR (MH "Chiropract*") OR (MH "Osteopathic Medicine") OR (MH "Manipulation, Osteopathic") OR (MH "Osteopaths") OR (MH "Physicians, SpORts Team") OR (MH "SpORts Medicine") OR (MH "Exercise Physiolog*") OR (MH "Therapeutic Exercise*") OR (MH "Massage Therap*") OR (MH "Kinesiolog*")

11 (MH "Physical Medicine") OR (MH "Physical Therapist Attitudes") OR (MH "Occupational Therapist Attitudes") OR (MH "Occupational Medicine") OR (MH "Hand Therapy") OR (MH "Foot Therapy") OR (MH "Podiatry Practice") OR (MH "Podiatr*") OR (MH "Rehabilitation, Cardiac+") OR (MH "Rehabilitation, Pulmonary+") OR (MH "Rehabilitation, Pediatric") OR (MH “neurological rehabilitation")

12 (MM "Joint Mobilization") OR "mobilization"

13 (MM "Manipulation, ORthopedic") OR (MM "Manipulation, Chiropractic") OR (MM "Manipulation, Osteopathic") OR "Manipulation"

14 "(physical N3 medicine)" OR (MM "Physical Medicine")

15 10 or 11 or 12 or 13 or 14

16 (MH "Leadership") OR (MH "Professional practice") OR (MH "Professional role") OR (MH "Interprofessional relations")
17 TI (MediatOR* N1 exchange*) OR AB (MediatOR* N1 exchange*)
18 TI (opinion N1 leadership) OR AB (opinion N1 leadership)
19 TI (Brokerag* OR Linking agent OR Change agent* OR Change agenc* OR Capacity builder* OR knowledge conduit OR Knowledge bridge* OR Opinion leader* OR Champion*) OR AB (Brokerag* OR Linking agent OR Change agent* OR Change agenc* OR Capacity builder* OR knowledge conduit OR Knowledge bridge* OR Opinion leader* OR Champion*)
20 TI ((knowledge N1 go-between) OR (knowledge N1 intermediar*) OR (knowledge N1 liaison) OR (knowledge N1 manager*) OR (knowledge N1 mediatOR*) OR (knowledge N1 navigatOR*) OR (knowledge N1 officer*) OR (knowledge N1 translatOR*) OR (knowledge N1 broker*) OR (knowledge N1 facilitatOR*) OR (knowledge N1 leader*) OR (knowledge N1 champion*) OR (research N1 go-between) OR (research N1 intermediar*) OR (research N1 liaison) OR (research N1 manager*) OR (research N1 mediatOR*) OR (research N1 navigatOR*) OR (research N1 officer*) OR (research N1 translatOR*) OR (research N1 broker*) OR (research N1 facilitatOR*) OR (research N1 leader*) OR (research N1 champion*) OR (infORmation N1 go-between) OR (infORmation N1 intermediar*) OR (infORmation N1 liaison) OR (infORmation N1 manager*) OR (infORmation N1 mediatOR*) OR (infORmation N1 navigatOR*) OR (infORmation N1 officer*) OR (infORmation N1 translatOR*) OR (infORmation N1 broker*) OR (infORmation N1 facilitatOR*) OR (infORmation N1 leader*) OR (infORmation N1 champion*) OR (evidence N1 go-between) OR (evidence N1 intermediar*) OR (evidence N1 liaison) OR (evidence N1 manager*) OR (evidence N1 mediatOR*) OR (evidence N1 navigatOR*) OR (evidence N1 officer*) OR (evidence N1 translatOR*) OR (evidence N1 broker*) OR (evidence N1 facilitatOR*) OR (evidence N1 leader*) OR (evidence N1 champion*) OR (science N1 go-between) OR (science N1 intermediar*) OR (science N1 liaison) OR (science N1 manager*) OR (science N1 mediatOR*) OR (science N1 navigatOR*) OR (science N1 officer*) OR (science N1 translatOR*) OR (science N1 broker*) OR (science N1 facilitatOR*) OR (science N1 leader*) OR (science N1 champion*) OR (findings N1 go-between) OR (findings N1 intermediar*) OR (findings N1 liaison) OR (findings N1 manager*) OR (findings N1 mediatOR*) OR (findings N1 navigatOR*) OR (findings N1 officer*) OR (findings N1 translatOR*) OR (findings N1 broker*) OR (findings N1 facilitatOR*) OR (findings N1 leader*) OR (findings N1 champion*))
21 AB ((knowledge N1 go-between) OR (knowledge N1 intermediar*) OR (knowledge N1 liaison) OR (knowledge N1 manager*) OR (knowledge N1 mediatOR*) OR (knowledge N1 navigatOR*) OR (knowledge N1 officer*) OR (knowledge N1 translatOR*) OR (knowledge N1 broker*) OR (knowledge N1 facilitatOR*) OR (knowledge N1 leader*) OR (knowledge N1 champion*) OR (research N1 go-between) OR (research N1 intermediar*) OR (research N1 liaison) OR (research N1 manager*) OR (research N1 mediatOR*) OR (research N1 navigatOR*) OR (research N1 officer*) OR (research N1 translatOR*) OR (research N1 broker*) OR (research N1 facilitatOR*) OR (research N1 leader*) OR (research N1 champion*) OR (infORmation N1 go-between) OR (infORmation N1 intermediar*) OR (infORmation N1 liaison) OR (infORmation N1 manager*) OR (infORmation N1 mediatOR*) OR (infORmation N1 navigatOR*) OR (infORmation N1 officer*) OR (infORmation N1 translatOR*) OR (infORmation N1 broker*) OR (infORmation N1 facilitatOR*) OR (infORmation N1 leader*) OR (infORmation N1 champion*) OR (evidence N1 go-between) OR (evidence N1 intermediar*) OR (evidence N1 liaison) OR (evidence N1 manager*) OR (evidence N1

mediatOR*) OR (evidence N1 navigatOR*) OR (evidence N1 officer*) OR (evidence N1 translatOR*) OR (evidence N1 broker*) OR (evidence N1 facilitatOR*) OR (evidence N1 leader*) OR (evidence N1 champion*) OR (science N1 go-between) OR (science N1 intermediar*) OR (science N1 liaison) OR (science N1 manager*) OR (science N1 mediatOR*) OR (science N1 navigatOR*) OR (science N1 officer*) OR (science N1 translatOR*) OR (science N1 broker*) OR (science N1 facilitatOR*) OR (science N1 leader*) OR (science N1 champion*) OR (findings N1 go-between) OR (findings N1 intermediar*) OR (findings N1 liaison) OR (findings N1 manager*) OR (findings N1 mediatOR*) OR (findings N1 navigatOR*) OR (findings N1 officer*) OR (findings N1 translatOR*) OR (findings N1 broker*) OR (findings N1 facilitatOR*) OR (findings N1 leader*) OR (findings N1 champion*))

22 16 or 17 or 18 or 19 or 20 or 21

23 9 and 15 and 22

E. Cochrane database

1 (KT NEAR/1 intervention*):ti,ab or (KT NEAR/1 plan*):ti,ab or (KT NEAR/1 policy):ti,ab or (KT NEAR/1 policies):ti,ab or (KT NEAR/1 strateg*):ti,ab

2 (knowledge NEAR/1 translation):ti,ab or (knowledge NEAR/1 transfer):ti,ab or (knowledge NEAR/1 exchange):ti,ab or (knowledge NEAR/1 action):ti,ab or (knowledge NEAR/1 practice):ti,ab or (knowledge NEAR/1 decision):ti,ab or (knowledge NEAR/1 implementation):ti,ab or (knowledge NEAR/1 management):ti,ab or (knowledge NEAR/1 dissemination):ti,ab or (knowledge NEAR/1 application):ti,ab or (knowledge NEAR/1 share):ti,ab or (knowledge NEAR/1 sharing):ti,ab or (knowledge NEAR/1 uptake):ti,ab or (knowledge NEAR/1 utili?ation):ti,ab or (knowledge NEAR/1 mobile?ation):ti,ab or (knowledge NEAR/1 integration):ti,ab or (knowledge NEAR/1 communication):ti,ab or (knowledge NEAR/1 adoption):ti,ab or (knowledge NEAR/1 diffusion):ti,ab or (knowledge NEAR/1 brokering):ti,ab or (knowledge NEAR/1 creation):ti,ab or (research NEAR/1 translation):ti,ab or (research NEAR/1 transfer):ti,ab or (research NEAR/1 exchange):ti,ab or (research NEAR/1action):ti,ab or (research NEAR/1 practice):ti,ab or (research NEAR/1 decision):ti,ab or (research NEAR/1 implementation):ti,ab or (research NEAR/1 management):ti,ab or (research NEAR/1 dissemination):ti,ab or (research NEAR/1 application):ti,ab or (research NEAR/1 share):ti,ab or (research NEAR/1 sharing):ti,ab or (research NEAR/1 uptake):ti,ab or (research NEAR/1 utili?ation):ti,ab or (research NEAR/1 mobile?ation):ti,ab or (research NEAR/1 integration):ti,ab or (research NEAR/1 communication):ti,ab or (research NEAR/1 adoption):ti,ab or (research NEAR/1 diffusion):ti,ab or (research NEAR/1 brokering):ti,ab or (research NEAR/1 creation):ti,ab or (information NEAR/1 translation):ti,ab or (information NEAR/1 transfer):ti,ab or (information NEAR/1 exchange):ti,ab or (information NEAR/1 action):ti,ab or (information NEAR/1 practice):ti,ab or (information NEAR/1 decision):ti,ab or (information NEAR/1 implementation):ti,ab or (information NEAR/1 management):ti,ab or (information NEAR/1 dissemination):ti,ab or (information NEAR/1 application):ti,ab or (information NEAR/1 share):ti,ab or (information NEAR/1 sharing):ti,ab or (information NEAR/1 uptake):ti,ab or (information NEAR/1 utili?ation):ti,ab or (information NEAR/1 mobile?ation):ti,ab or (information NEAR/1 integration):ti,ab or (information NEAR/1 communication):ti,ab or (information NEAR/1 adoption):ti,ab or (information NEAR/1 diffusion):ti,ab or (information NEAR/1 brokering):ti,ab or (information NEAR/1 creation):ti,ab or (evidence NEAR/1 translation):ti,ab or (evidence NEAR/1 transfer):ti,ab or (evidence NEAR/1 exchange):ti,ab or (evidence NEAR/1 action):ti,ab or (evidence NEAR/1 practice):ti,ab or (evidence NEAR/1 decision):ti,ab or (evidence NEAR/1 implementation):ti,ab or (evidence NEAR/1 management):ti,ab or

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3 (knowledge to action):ti,ab or (implementation):ti,ab or (research to practice):ti,ab or (diffusion of innovations):ti,ab or (scale up):ti,ab or (translational research):ti,ab or (translation of research findings):ti,ab or (continuing education):ti,ab or (organi*ational innovation):ti,ab or (complex intervention):ti,ab or (behavio*r change intervention*):ti,ab or (technology transfer):ti,ab

4 (Continuing NEAR/2 professional NEAR/2 development):ti,ab or (implementation NEAR/2 science):ti,ab

5 (intervention? NEAR/1 complex):ti,ab or (intervention? NEAR/1 education*):ti,ab or (intervention? NEAR/1 multifacet*):ti,ab or (intervention? NEAR/1 multi-facet*):ti,ab or (intervention? NEAR/1 organi?ation*):ti,ab or (intervention? NEAR/1 tailor*):ti,ab or (intervention? NEAR/1 target*):ti,ab or (intervention? NEAR/1 interdisciplin*):ti,ab or (intervention? NEAR/1 multi-disciplin*):ti,ab or (intervention? NEAR/1 multidiscipline*):ti,ab or (intervention? NEAR/1 evidence-based):ti,ab or (intervention? NEAR/1 evidence-driven):ti,ab

5 1 or 2 or 3 or 4 or 5

6 Physical Therapy Modalities

7 "Physical Therapy (Specialty)"

8 "physical therapy procedure"

9 physical therap* or physiotherap*

10 occupational therap*

11 Manipulation, Chiropractic

12 chiropract*:ti,ab

13 Osteopathic Medicine:ti,ab

14 Manipulation, Osteopathic

15 Mobilization:ti,ab

16 OMT:ti,ab
17 Osteopathic Physician*:ti,ab
18 Osteopathic Medicine*:ti,ab
19 Osteopath*:ti,ab
20 manual therap*:ti,ab
21 athletic therap*:ti,ab
22 sport* therap*:ti,ab
23 sport physician*:ti,ab
24 (Sport* near/2 (medicine or therap*)):ti,ab
25 Exercise physiolog*:ti,ab
26 Exercise Therap*:ti,ab
27 kinesiolog*:ti,ab
28 Physiatr*:ti,ab
29 Physical and Rehabilitation Medicine:ti,ab
30 Physical medicine:ti,ab
31 (physical near/3 medicine):ti,ab
32 rehabilitation medicine:ti,ab
33 orthoped*:ti,ab
34 orthopaed*:ti,ab
35 Podiatr*:ti,ab
36 hand therap*:ti,ab
37 foot therap*:ti,ab
38 Chiropod*:ti,ab
39 "cardiac rehabilitation"
40 "pediatric rehabilitation"
41 "neurological rehabilitation"
42 "pulmonary rehabilitation"
43 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42
44 (Mediator* NEAR/1 exchange*):ti,ab or (opinion NEAR/1 leadership):ti,ab
45 (Brokerag*):ti,ab or (Linking agent):ti,ab or (Change agent*):ti,ab or (Change agenc*):ti,ab or (Capacity builder*):ti,ab or (knowledge conduit):ti,ab or (Knowledge bridge*):ti,ab or (Opinion leader*):ti,ab or (Champion*):ti,ab
46 (knowledge NEAR/1 go-between):ti,ab or (knowledge NEAR/1 intermediar*):ti,ab or (knowledge NEAR/1 liaison):ti,ab or (knowledge NEAR/1 manager*):ti,ab or (knowledge NEAR/1 mediator*):ti,ab or (knowledge NEAR/1 navigator*):ti,ab or (knowledge NEAR/1 officer*):ti,ab or (knowledge NEAR/1 translator*):ti,ab or (knowledge NEAR/1 broker*):ti,ab or (knowledge NEAR/1 facilitator*):ti,ab or (knowledge NEAR/1 leader*):ti,ab or (knowledge NEAR/1 champion*):ti,ab or (research NEAR/1 go-between):ti,ab or (research NEAR/1 intermediar*):ti,ab or (research NEAR/1 liaison):ti,ab or (research NEAR/1 manager*):ti,ab or (research NEAR/1 mediator*):ti,ab or (research NEAR/1 navigator*):ti,ab or (research NEAR/1 officer*):ti,ab or (research NEAR/1 translator*):ti,ab or (research NEAR/1 broker*):ti,ab or (research NEAR/1 facilitator*):ti,ab or (research NEAR/1 leader*):ti,ab or (research NEAR/1 champion*):ti,ab or (information NEAR/1 go-between):ti,ab or (information NEAR/1 intermediar*):ti,ab or (information NEAR/1 liaison):ti,ab or (information NEAR/1 manager*):ti,ab or (information NEAR/1 mediator*):ti,ab or (information NEAR/1 navigator*):ti,ab or (information NEAR/1 officer*):ti,ab or (information NEAR/1 translator*):ti,ab or (information NEAR/1 broker*):ti,ab or (information NEAR/1

facilitator*):ti,ab or (information NEAR/1 leader*):ti,ab or (information NEAR/1 champion*):ti,ab or (evidence NEAR/1 go-between):ti,ab or (evidence NEAR/1 intermediar*):ti,ab or (evidence NEAR/1 liaison):ti,ab or (evidence NEAR/1 manager*):ti,ab or (evidence NEAR/1 mediator*):ti,ab or (evidence NEAR/1 navigator*):ti,ab or (evidence NEAR/1 officer*):ti,ab or (evidence NEAR/1 translator*):ti,ab or (evidence NEAR/1 broker*):ti,ab or (evidence NEAR/1 facilitator*):ti,ab or (evidence NEAR/1 leader*):ti,ab or (evidence NEAR/1 champion*):ti,ab or (science NEAR/1 go-between):ti,ab or (science NEAR/1 intermediar*):ti,ab or (science NEAR/1 liaison):ti,ab or (science NEAR/1 manager*):ti,ab or (science NEAR/1 mediator*):ti,ab or (science NEAR/1 navigator*):ti,ab or (science NEAR/1 officer*):ti,ab or (science NEAR/1 translator*):ti,ab or (science NEAR/1 broker*):ti,ab or (science NEAR/1 facilitator*):ti,ab or (science NEAR/1 leader*):ti,ab or (science NEAR/1 champion*):ti,ab or (findings NEAR/1 go-between):ti,ab or (findings NEAR/1 intermediar*):ti,ab or (findings NEAR/1 liaison):ti,ab or (findings NEAR/1 manager*):ti,ab or (findings NEAR/1 mediator*):ti,ab or (findings NEAR/1 navigator*):ti,ab or (findings NEAR/1 officer*):ti,ab or (findings NEAR/1 translator*):ti,ab or (findings NEAR/1 broker*):ti,ab or (findings NEAR/1 facilitator*):ti,ab or (findings NEAR/1 leader*):ti,ab or (findings NEAR/1 champion*):ti,ab

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Appendix 2: Types of KT interventions

The following section provides definitions of different types of professional KT interventions based on the taxonomy developed by The Cochrane Effective Practice and Organization of Care (EPOC Taxonomy) [1]:

Type of Professional interventions

a) Distribution of educational materials: Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audio-visual materials and electronic publications. The materials may have been delivered personally or through mass mailings. It may include video trainer without facilitation.

b) Educational meetings: Health care providers who have participated in conferences, lectures, workshops or traineeships. Facilitator present. Educational programmes, interprofessional education (IPE), continuing medical education (CME), problem-based learning (PBL).

c) Local consensus processes: Inclusion of participating providers in discussion to ensure that they agreed that the chosen clinical problem was important and the approach to managing the problem was appropriate.

d) Educational outreach visits: Use of a trained person who met with providers in their practice settings to give information with the intent of changing the provider's practice. The information given may have included feedback on the performance of the provider(s). Includes academic detailing.

e) Local opinion leaders: Use of providers nominated by their colleagues as 'educationally influential'. The investigators must have explicitly stated that their colleagues identified the opinion leaders.

f) Patient mediated interventions: New clinical information (not previously available) collected directly from patients and given to the provider e.g. depression scores from an instrument. Facilitated relay of clinical information to clinicians.

g) Audit and feedback: Any summary of clinical performance of health care over a specified period of time. The summary may also have included recommendations for clinical action. The information may have been obtained from medical records, computerised databases, or observations from patients. Providing feedback to teams/peers, prescribing profiling.

h) Reminders: Patient- or encounter-specific information, provided verbally, on paper or on a computer screen, which is designed or intended to prompt a health professional to recall information. This would usually be encountered through their general education; in the medical records or through interactions with peers, and so remind them to perform or avoid some action to aid individual patient care. Computer-aided decision support system – drug dosage (CDSS) and computer physician order entry (CPOE) are included.

i) Tailored [Formerly called Marketing]: Use of personal interviewing, group discussion ('focus groups'), or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers.

j) Mass media: Varied use of communication that reached great numbers of people including television, radio, newspapers, posters, leaflets, and booklets, alone or in conjunction with other interventions; targeted at the population level.

k) Other: Other categories to be agreed in consultation with the EPOC editorial team

Appendix 3: Examples of different types of OLs'/KBs' skills reported in the included studies

Types of skills	Opinion Leaders (OLs)	Knowledge brokers (KBs)
Clinical skills	OLs were described as clinical experts,[2-7] who adopting advanced practices,[8,9] and having the ability to deliver clinical information to their colleagues.[2-4]	KBs typically had an adequate clinical background related to the topic in which they performed brokering activities.[10-18]
Interpersonal skills	OLs were described as being accessible to their colleagues[7,19] and willing to share knowledge and teach their peers since they act as a role model for their peers.[5]	KBs were described as being positive, enthusiastic, creative, accessible to their colleagues[10,11,14], persuasive[16], a motivator, trusted, and appreciative of continuing education[13], and able to set realistic expectations[17].
Research skills	OLs were responsible for developing guideline recommendations for use in their clinical settings,[5,7] and for addressing some research topics during educational sessions.[2,3]	KBs often participate in synthesizing evidence, develop resources, and adapt KT interventions to their clinical and organizational contexts.[10-12,14]
Communication skills	OLs have the ability to demonstrate knowledge and justify rationales.[2,3,5,7]	KBs have communication skills (written and oral).[10-12,14,16]
Mediation skills	OLs were responsible for organizing educational seminars,[5] acting as liaisons between frontline staff and study teams.[7]	KBs were responsible for initiating contacts, engaging relevant stakeholders.[10-12,14]

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Additional Files of Chapter 5

Additional file 1:The Role Model for Knowledge Brokering

According to a recently created Role Domains of Knowledge Brokering model, KBs can play one or all of these following role: 1) Information Manager, 2) Linking agent, 3) Capacity builder, 4) Facilitator, and 5) Evaluator. This following table presents some of the KBs activities that can be done in their workplace.

Role Domains	Definition	Example of activities
Information manager	KBs seeking and sharing relevant health research, as well as context-specific knowledge, possessing an understanding of less formal contextual evidence across settings that can be important to exchange with stakeholders to inform decision-making processes, delivering key information to specific audiences in ways that will best promote its uptake, improving access to evidence in the clinical setting through academic affiliations and collaborations.	• Seek, promote access to, appraise, organize, and share relevant health research and context-specific knowledge (e.g., culture, processes, and barriers).
Linking agent	KBs' ability to connect and foster trust and relationships among people with shared interests, and facilitate "shared agendas", link researchers and clinicians, decision makers, and/or other key stakeholders can expedite the process of KT by creating opportunities for knowledge exchange, facilitate the creation of networks of individuals or groups with overlapping interests and promote understanding about other members' local contexts.	• Connect and foster trust and relationships between people with overlapping interests (e.g., researchers and decision makers) • Coordinate interaction between stakeholders to cultivate 'shared agendas' and information sharing. • Foster engagement in the research process. • Connect with a network of knowledge brokers.
Capacity builder	Development of positive attitudes toward evidence, as well as skills, establishing a common language among stakeholders as well as providing education and mentoring in the clinical setting on both research skills and how to apply research. KBs can enhance organizational capacity for research use by targeting individual or organization barriers to change including promoting positive attitudes toward evidence and developing structures and	• Build the knowledge and the skills required to access, appraise, and apply evidence. • Address barriers to change (e.g., individuals and organizational) • Enable communication across sectors through the development of a common language. • Increase capacity for research by leverage network connections.

	supports for individuals within those organizations. The connections of the KBs can also enhance capacity for research by expanding participant recruitment potential and enhancing funding competitiveness by bringing together a strong team with a common vision.	
Facilitator	Guidance and support of knowledge users to find ways to integrate knowledge about research, as well as context, collaboration to address identified knowledge or skill gaps, promoting inter-professional knowledge exchange, and fostering a cultural shift within an organization to enhance the valuing of research evidence. This role also includes highlighting the scientific and tacit knowledge from the worlds of the researchers and their stakeholders to inform the design of robust, clinically relevant research in addition to engaging stakeholders, and fostering problem-solving throughout the research process.	• Guide or support evidence-informed practice processes to assist knowledge users to integrate research, contextual and experiential knowledge into clinical decision making or research processes. • Improve attitudes toward research use. • Enhance the clinical applicability of research.
Evaluator	Evaluation of the context, of the processes, and outcomes of KT at the research and clinical levels, and of the KBs own knowledge brokering performance.	• Assess the local context to inform knowledge brokering activities. • Integrate KT frameworks and evidence into evaluation processes. • Evaluate linkage and exchange networks. • Evaluate knowledge brokering activities and outcomes.

Additional file 2: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	Checklist Item	Explanation	Reporting status
Design			
	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Line 84-85 Line 91-98
IRB (Institutional Review Board) approval and informed consent process			
	IRB approval	Mention whether the study has been approved by an IRB.	Line 87-88
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Line 109-110
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Line 113-114
Development and pre-testing			
	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Line 117-128
Recruitment process and description of the sample having access to the questionnaire			
	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Line 106-107
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Line 100-106
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	Line 100-106
Survey administration			
	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Line 134-135
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	N/A
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Voluntary
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No incentives
	Time/Date	In what timeframe were the data collected?	Line 112-113
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	N/A
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.	N/A
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Line 123-128
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Line 123
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JAVAScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say", and selection of one response option should be enforced.	Line 128-129
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	Line 135-137

Response rates			
	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	Line 137-139
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary.	N/A
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	Line 168
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	Line 169
Preventing multiple entries from the same individual			
	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	N/A
	Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Analysis			
	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Line 149-150
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined.	N/A
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Line 145-149

Additional file 3: The invitation email and the information sheet

Email title: If you are interested in translating research evidence into practice, please join us/ Si vous êtes intéressé à traduire la resultes des recherches en pratique, nous joindre SVP

Dear colleague,
As you know, Knowledge Broker (KB) positions have recently been recently created to facilitate the uptake of evidence-based practice.

Note: if you prefer to explore the study's objectives and benefits by video instead of reading, please follow this hyperlink (https://www.youtube.com/watch?v=TbgG8LYBatQ)

Little is known about people who work as KB in the rehabilitation field, so there is a need to know more about them by determining their number and collect some information about their profile; this will contribute to developing this profession.

As you are performing one or more of knowledge brokering activities in your workplace, you are being invited to participate in our research project. **Our study is the first Canada-wide survey that aims to describe the profile of Knowledge Brokers (personal and professional characteristics, roles and activities, and training) working to promote the uptake of evidence within rehabilitation field in Canada.** Results from this research will provide important information for researchers who aim to employ KBs in their future in KT trails in rehabilitation, for employers who intend to employ KBs to facilitate the use of research evidence in rehabilitation settings, and for KBs themselves by informing them about their expected roles and tasks that they can perform to better achieve the targeted outcomes.

If you are interested, please follow the hyperlink below:
https://surveys.mcgill.ca/ls/928428?lang=en

This will direct you to fill out the consent form, and fill out an online survey that will ask you about your profile. The survey should take approximately 30 min. You will be inform of the study's findings after the completion of the study.

This study is being conducted by McGill University. The research team would very much appreciate your input in this work.

If you have any questions or concerns, please do not hesitate to contact Dr. André Bussières at andre.bussieres@mcgill.ca or dina.gaid@mail.mcgill.ca

Thank you for supporting rehabilitation research

The Information Sheet

"The profile of knowledge brokers in the rehabilitation field across Canada"

Principal study Investigator:
Dr. André Bussières, DC, PhD, Assistant Professor,School of Physical and Occupational Therapy, Faculty of Medicine, McGill University

1. **Introduction:**
You are being asked to participate in this survey because as you are performing one or more of the knowledge brokering activities. Please read this 'Information Sheet and Consent Form' carefully and ask as many questions as you like before deciding whether to participate in this research study. Participation in this study is voluntary. You are free to refuse to participate. For more information of knowledge brokering activities, please watch the survey's video (link attached to the invitation email.

2. Background:
The field of knowledge translation (KT) promotes the use of evidence-based practices (EBP) in healthcare. KT experts advocate for the use of active KT interventions to improve professional practice change in health care settings including the use of knowledge brokers (KBs). Currently, there is a paucity of data related to the work and occupations of Canadian KBs, limiting the ability of health care organizations to deploy KBs effectively in rehabilitation settings. The aim of this study is to describe the personal and professional characteristics, roles and activities, and training of KBs working to promote the uptake of research evidence across Canadian rehabilitation settings.

3. Methods:
Descriptive study using a cross-sectional online survey that will be administered to KBs working in rehabilitation across Canada. The survey will cover three topic areas: demographic information, roles and activities, prior training.

4. Analyses:
Descriptive statistics (response frequencies, percentages, means, and range) will be used for the close-ended questions that ask about socio-demographic, professional characteristics, roles and activities of the participants, and prior training. A deductive content analysis will be used for open-ended questions.

5. Benefits of the Study:
Your participation in this survey will provide important information for **researchers** who aim to utilize KBs in their future in KT trails in rehabilitation, for **employers** who intend to employ KBs to facilitate the use of research evidence in rehabilitation settings, and for **KBs themselves** by informing them about their expected roles and tasks that they can perform to better achieve the targeted outcomes.

6. Confidentiality:
No identifying information will be reported in any publications, reports or presentations. Confidentiality of the data will be protected by assigning each participant such as yourself a unique identification number replacing the name and the registration number of care providers and using that number on all data about participation. Only the principal investigator of the study will access your data. All electronic records will be stored at the administrative Services Building of McGill University and protected by a user password. The study data retention is for 7 years after which time the data will be destroyed.

7. Compensation:
No compensation will be provided.

8. Questions about the Study:
A. If you have any questions or concerns, please contact Dr. André Bussières at andre.bussieres@mcgill.ca.
B. If you have any questions about your rights as a research participant, please contact Ilde Lepore, McGill IRB Ethics Officer, by email: ilde.lepore@mcgill.ca or by phone: 514-398-8302
The McGill University Institutional Review Board (IRB) has reviewed this study. The IRB considers the ethical aspects of all research studies involving human subjects at McGill University.

Additional file 4: The consent form and the survey

Consent to participate in this survey

We would like you to be aware of the following information, should you choose to participate:

Participation in this research is entirely voluntary and you are free to withdraw at any time, without penalty.

Your identity will remain confidential and no identifying information will ever be reported. When reporting our findings, no personal identifiers will be included.

As per University requirement, all the data will be destroyed 7 years after the completion of the study.

I am aware that I am being asked to participate in a research study that seeks to explore the role of Knowledge Brokers (KBs) within public rehabilitation settings in Canada. I have read this consent form. I have been informed of the purpose of this study and I am aware of the study procedures, and the risks and benefits of taking part in it. I have asked any questions I may have had, and these were answered satisfactorily. I have been informed that participation in this study is voluntary and that I can withdraw from this study at any time, without giving a reason. I agree to take part in this research study. I do not give up any of my legal rights by signing this consent form.

Do you agree to participate in this study?

o Yes (this choice allows the participant to begin the survey)
o No

The Survey

Section I: Socio-demographic information

1. In which province do you work? (*)
o Ontario
o Quebec
o British Columbia
o Alberta
o Manitoba
o Saskatchewan
o Nova Scotia
o New Brunswick
o Newfoundland and Labrador
o Prince Edward Island
o Northwest Territories
o Nunavut
o Yukon

2. Your age: (*)
o 25 - 35
o 36 - 60
o More than 60 years old

3. You are a: (*)
o Clinician
o Researcher
o Manager
o Other (please specify):

If you indicated that you are a clinician, which of the following professions do you belong to?
o Physical Therapy
o Occupational Therapy
o Chiropractic
o Nursing
o Speech language pathology
o Other (please specify):

If you indicated that you are a clinician, how many years have you spent in clinical practice as a healthcare provider?
o Less than one year
o ≤5 years
o 6-15 years
o ≥ 16 years

4. Education-Highest level obtained: (*)
o Undergraduate (Diploma, Bachelor's)
o Graduate (Master, Doctoral, Post-Doc)

5. In what type of organization do you currently work? (*)
o Clinical setting
o Research setting
o University or academic setting
o Other (please specify):

6. How did you start your knowledge brokering activities? (*)
o I volunteered to perform brokering activities
o I became responsible for knowledge brokering activities after I was hired (e.g. you applied for this job)
o My employer (clinic manager/head of department) selected me
o One or more of my colleagues recommended me
o Knowledge Translation expert(s) recommended me
o Someone who already performs knowledge brokering activities recommended me
o I was selected based on a questionnaire which I filled out to me to evaluate my ability to perform these activities
o Other (please specify):

7. What is your job title? ---------- (*)

The following questions ask about your current job status (part-time/fulltime) and your salary rate. Since there are no prior estimates of the income of individuals who perform knowledge brokering activities in Canada, we would appreciate it if you would share these details. This information can help us estimate the level of investment in knowledge brokering activities when it comes to supporting evidence-based practice in the field of rehabilitation in Canada.

8. How often do you perform your main knowledge brokering activities? (*)
o On a full-time basis (4-5 days per week)
o On a part-time basis (1 -3 days)

If you work full-time as a knowledge broker, what is your hourly rate ($)? (optional question)
o ≤ 30
o 31$ - 40$
o ≥ 41$

If you are a clinician who performs knowledge brokering activities, what is your hourly rate ($)? (optional question)
o Less than the salary of a clinician
o Equal to the salary of a clinician

o More than the salary of a clinician

If you work part-time, how frequently do you perform knowledge brokering activities?
o On a daily basis
o On a weekly basis
o On a monthly basis

Do you get compensated for your knowledge brokering activities?
o Yes
o No

If you answered yes, what is your hourly rate ($)?
o ≤ 30
o 31$ - 40$
o ≥ 41$

9. How many years have you been performing knowledge brokering (*)
activities?
o Beginner (≤ 10 years)
o Moderate experience (11-20 years)
o Experts (Over 21 years)

Please describe your primary network (i.e., people who are in direct contact with you on a weekly or monthly basis).

10. What is the profession of the majority of colleagues you work with?
o Clinicians
o Researchers
o Students
o Other (please specify):

Section II: Your work activities:

This section provides a list of expected activities that you might perform at work; this list of activities was created based on the research literature pertaining to knowledge brokering. We would appreciate it if you could share details about your activities so that we might develop a better understanding of the roles and activities of KBs in rehabilitation in Canada.

Please indicate how frequently you perform each of the following activities:

11. Information manager role: (*)

Activity	Always (Three or more times per week)	Usually (At least once per week)	Sometimes (Once per week to once per month)	Rarely (Once every three months, or less)	Never (You never did it)
a. Formulate a research question (PICO question)	○	○	○	○	○
b. Access research evidence through activities such as searching research databases journals, or research websites	○	○	○	○	○
c. Analyze research evidence through activities such as summarizing and interpreting research results	○	○	○	○	○
d. Assess the quality of research evidence	○	○	○	○	○
e. Develop knowledge products such as educational material, flyers, binders, online programs, etc.	○	○	○	○	○
f. Follow the latest evidence through activities such as setting up alerts for journals and reviewing them	○	○	○	○	○
g. Participate in self- directed learning activities such as attending webinars or workshops, or reading recent peer reviewed literature	○	○	○	○	○
h. Perform administrative activities such as organizing conferences, meetings, or workshops	○	○	○	○	○
i. Support applications to funding agencies	○	○	○	○	○

12. A Linking agent role: (*)

Activity	Always (Three or more times per week)	Usually (At least once per week)	Sometimes (Once per week to once per month)	Rarely (Once every three months, or less)	Never (You never did it)
a. Identify networking opportunities for stakeholders	○	○	○	○	○
b. Identify common goals among stakeholders	○	○	○	○	○
c. Develop a network or community of practice	○	○	○	○	○
d. Communicate with stakeholders outside your organization, such as administrators, board members, community members, patients, caregivers, other health care professionals, education staff and government staff, or others	○	○	○	○	○
e. Communicate with other individuals who perform knowledge brokering activities	○	○	○	○	○

13. A Capacity builder role: (*)

Activity	Always (Three or more times per week)	Usually (At least once per week)	Sometimes (Once per week to once per month)	Rarely (Once every three months, or less)	Never (You never did it)
a. Help others apply research evidence into clinical practice (e.g. coach health care providers or teams in implementing evidence based practice)	○	○	○	○	○
b. Design strategies to address professional/individual barriers to change the practice	○	○	○	○	○
c. Design strategies to address organizational barriers to change the practice	○	○	○	○	○

d. Design training or educational sessions	○	○	○	○	○
e. Tailor resources to stakeholder needs	○	○	○	○	○
f. Tailor resources to local contexts	○	○	○	○	○
g. Deliver educational courses, seminars, or workshops to your stakeholders	○	○	○	○	○
h. Provide relevant information to your stakeholders such as articles, evidence based materials, or useful websites	○	○	○	○	○

14. A Facilitator role (*)

Activity	Always (Three or more times per week)	Usually (At least once per week)	Sometimes (Once per week to once per month)	Rarely (Once every three months, or less)	Never (You never did it)
a. Facilitate workshops, follow-up sessions, individual and group discussions	○	○	○	○	○
b. Promote knowledge exchange among stakeholders (e.g. by supporting peer-to-peer learning)	○	○	○	○	○
c. Promote reflective practice such as leading discussion groups or/and peer review activities touching on clinical practices	○	○	○	○	○
d. Facilitate organizational changes	○	○	○	○	○
e. Facilitate online discussion boards	○	○	○	○	○
f. Guide ongoing collaborative learning	○	○	○	○	○
g. Organize schedules to hold educational meetings during the workday	○	○	○	○	○

15. An evaluator role (*)

Activity	Always (Three or more times per week)	Usually (At least once per week)	Sometimes (Once per week to once per month)	Rarely (Once every three months, or less)	Never (You never did it)
a. Conduct environmental scans or needs assessments	○	○	○	○	○
b. Assess professional barriers to practice change and/or practice change facilitators	○	○	○	○	○
c. Assess organizational barriers to practice change and/or practice change facilitators	○	○	○	○	○
d. Assess organizational capacity for change	○	○	○	○	○
e. Identify opportunities for integrating evidence into practice	○	○	○	○	○
f. Identify relevant stakeholders	○	○	○	○	○
g. Evaluate KT and/or implementation process outcomes	○	○	○	○	○
h. Integrate KT frameworks and evidence into evaluation processes	○	○	○	○	○
i. Evaluate linkage and exchange networks	○	○	○	○	○
j. Evaluate the impact of your knowledge brokering activities	○	○	○	○	○

Section III: Training program

16. Have you received any type of formal training to help you in performing your knowledge brokering activities? (Yes/No)

Note: Formal training refers to any types of degree, course, or certificate that helped you to fulfill your knowledge brokering activities.

17. What type of training did you receive?
(e.g., Degree, Diploma, Course, Certificate, Workshop)

18. What was the main topic discussed during this training?

19. How did you learn about this training opportunity?
(e.g., It was suggested by someone/you found it online)

20. What additional training would you like to receive in the future to improve your ability to perform your knowledge brokering activities?

(*): A mandatory question

Additional Files of Chapter 7

Additional file 1: The role domains of knowledge brokering

A) Information manager	• Seeking and sharing relevant health research, as well as context-specific Knowledge, • Possessing an understanding of less formal contextual evidence across settings that can be important to exchange with stakeholders to inform decision-making processes, • Delivering key information to specific audiences in ways that will best promote its uptake, and • Improving access to evidence in the clinical setting through academic affiliations and collaborations
B) Linking agent	• Connect and foster trust and relationships among people with shared interests, and facilitate "shared agendas", • Link researchers and clinicians, decision makers, and/or other key stakeholders can expedite the process of KT by creating opportunities for knowledge exchange, and • Facilitate the creation of networks of individuals or groups with overlapping interests and promote understanding about other members' local contexts.
C) Capacity builder	• Develop of positive attitudes toward evidence, as well as skills, • Establishing a common language among stakeholders, • Providing education, and • Mentoring in the clinical setting on both research skills and how to apply research.
D) Facilitator	• Guide and support of knowledge users to find ways to integrate knowledge about research, as well as context, collaboration to address identified knowledge or skill gaps, • Promote inter-professional knowledge exchange, and • Foster a cultural shift within an organization to enhance the valuing of research evidence.
E) Evaluator	• Evaluate of the context, processes, and outcomes of KT at the research and clinical levels, and • Evaluate the KBs own knowledge brokering performance.

Additional file 2: Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	line no(s)
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Reported
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Line 1-34
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Line 83-89
Purpose or research question - Purpose of the study and specific objectives or questions	Line 89-90
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Line 94
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Line 145
Context - Setting/site and salient contextual factors; rationale**	Line 100-102
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Line 114-117
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Line 617-621
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Line 124-138 Line 141-142
Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Line 124-138 Line 146-147
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Line 191-193
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Line 156-167
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Line 169-180
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Line 181-182

Results/findings		
	Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Line 199-427
	Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Line 199-427
Discussion		
	Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Line 429-567
	Limitations - Trustworthiness and limitations of findings	Line 579-594
Other		
	Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	Line 626-627
	Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Line 629-630

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference: O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Academic Medicine, Vol. 89, No. 9 / Sept 2014 DOI: 10.1097/ACM.0000000000000388

Additional file 3: Semi-structured interview guide

1. What is your definition of a KB (as opposed to other types of change agents like opinion leaders)?

2. What do you think led your organization to create a KB position?

3. To your knowledge, what are the main objectives of your job?
- Who developed these objectives?

4. How does your role as a KB meets the objectives of your organization?
- How do you monitor your performance?
- How can your performance be improved?

5. How confident are you that you are able to fulfill your role as a KB?
- can you elaborate?

6. How were you identified as someone with the potential to be a KB?

7. What skills (personal, clinical, research, or communication skills) made your organization identify you to play this role?
o Other qualifications?

8. What resources (physical space and time) do you have at your disposal to achieve your work goals as a KB?
- What other resources would you have liked to receive?
- What challenges do you expect in receiving other resources?

9. To what extent do you have access to all the necessary information to achieve your goals?
- What types of information can you access? (e.g. internal information sharing, written
- documents, online resources, support to attend conferences, etc.)
- How do you typically find out about new information, such as research evidence, clinical
- practice guidelines, new initiatives, courses or conferences?
- What kinds of changes will be needed to improve your access to relevant information?

10. What kind of training have you received to fulfill your responsibilities as a KB? (courses, workshops, online programs, educational materials, etc.)
- What kind of training you would like to receive?

11. What kind of support have you received from your manager/superiors in your role as a KB?
- What types of barriers might they create?

12. Can you describe your working relationship with managers in your setting?
- How often do you meet? Formally? Informally?

13. To what extent do you network with your colleagues inside your organization?
- What kind of information exchange do you have with them?
- What is your preferred mode of communication? (Intranet, emails, telephone, face-to-face)
- Why? in which context?

- How can communication methods be improved in your organization?

14. To what extent are you aware of the needs (e.g. information needs, training for a new practice etc..) of your colleagues/the team you are working with?
- How did you find out about these?

15. To what extent are your colleagues open to receiving information/guidance/instruction from you as a KBs? Can you say why?

16. In your opinion, which factors have helped/facilitated your role as a KB?

17. What are the main difficulties you face in your role as a KB?

18. What kinds of incentives/ reward systems does your organization offer you as a KB? (e.g. performance reviews, promotions, salary raise, or less tangible incentives such as increased stature or respect)

19. To what extent do you network with colleagues in positions similar as yours outside your setting?

20. Who is responsible for paying your salary?
- Do you have any challenges or concerns on the subject? Are you stable in your position?

Additional file 4: Thematic content analysis based on the CFIR

CFIR domain / Specific themes	Facilitators N (%)	Barriers N (%)	No Influence N (%)	Question (N)
Characteristics of Individuals				
A. Knowledge about KB roles				1
• Being a driver to seek, adapt, and share evidence			16 (70%)	
• Being able to connect different groups of stakeholders			13 (57%)	
• Being responsible to implement new practices, building individual capacities, and addressing barriers to clinical practice change			9 (39%)	
• Being proactive actor of KT			2 (9%)	
B. Self-efficacy to perform KB roles				5
• Feel confident	19 (83%)			
a. Owning skillsets promote confidence	6 (26%)			
b. Receiving positive feedback promote confidence	5 (22%)			
c. Having a good team promote confidence	4 (17%)			
d. Having ongoing communication promote confidence	2 (9%)			
e. Having long-period experience promote confidence	2 (9%)			
C. Individual Identification to perform KB activities				6
• KB activities evolved within a current position			12 (52%)	
• Job application			9 (39%)	
• Volunteer to perform KB activities	4 (17%)			
D. Personal Attributes				7
1. Clinical experience				
• Having clinical experience	17 (74%)			
• Understanding the clinical topics in which KB activities performed help to fulfill the needs	10 (43%)			
• Having less clinical experience		3 (13%)		
2. Research skills				
• Having graduate studies (i.e., Master degree)	17 (74%)			
• Being involved in research activities	15 (65%)			
• Not having research skills		2 (9%)		

3. Communication skills			
• Having communication and networking skills	21 (91%)		
4. Personal attributes			
• Being motivated	12 (52%)		
• Being flexible	11 (48%)		
• Having emotional intelligence	10 (43%)		
• Having leadership skills	9 (39%)		
• Being lifelong leaner	6 (26%)		
• Being passionate toward knowledge	5 (22%)		
• Having intellectual curiosity	5 (22%)		
• Being accessible	4 (17%)		
• Having analytic skills	3 (13%)		
• Being able to see the global view	3 (13%)		
• Having teamwork skills	3 (13%)		
• Having credibility	3 (13%)		
• Being positive	2 (9%)		
• Having project management skills	2 (9%)		
• Not being judgmental	2 (9%)		
• Seeking perfection	2 (9%)		
5. Other qualifications			
• Understating the healthcare systems	5 (22%)		
• Being affiliated to a university	4 (17%)		
• Being bilingual (English and French)	3 (13%)		
• Being suited in-between researchers and clinicians	2 (9%)		
Inner Setting			
A. Networks & Communications			
• Having a constant networking and engagement with clinical teams and other stakeholders	21 (91%)		13
• Sharing relevant information	14 (61%)		
• Providing mentorship	2 (9%)		
• Need more communication with different stakeholders		15 (65%)	

a. Need communication via online platforms		6 (26%)		
b. Need to be involved in decision making		3 (13%)		
c. Need communication via newsletter		3 (13%)		
d. Need communication via face-to-face meeting		2 (9%)		
e. Need communication with the provincial groups		2 (9%)		
• Being responsible for large areas or big organization limits communication		4 (17%)		
Mode of communication:				
• Online communication			21 (91%)	
• In-person communication			18 (78%)	
B. Needs of Those Served in the organization				
• Awareness of needs via raised questions and concerns	21 (91%)			14
• Awareness of needs via informal engagement	21 (91%)			
• Awareness of needs via attending periodical staff meetings	16 (70%)			
• Awareness of needs via asking stakeholders about their needs	10 (43%)			
• Awareness of needs via receiving feedback and complains	7 (30%)			
• Awareness of needs via conduct needs assessment	7 (30%)			
• Not assessing needs, but follow the latest research evidence	3 (13%)			
• Not assessing needs, but comparing the standard of similar sites	2 (9%)			
• Not conducting need assessment		5 (22%)		
• Being responsible for large areas or big organization limits the awareness of the needs		3 (13%)		
• Feel not aware of needs		2 (9%)		
D. Implementation Climate				
1. Tension to change				17
• Lack of awareness of KB roles		6 (26%)		
a. Lack of peers' awareness of KB roles		4.(17%)		
b. Lack of managers' awareness of KB roles.		2 (9%)		
2. Relative Priority				17
• Not considered KB activities as a priority		12 (52%)		
• Organizational pressure toward clinical productivity		3 (13%)		

3. Learning Climate				
• KB roles not valued by middle-level managers		4 (17%)		
4. Organizational Incentives & Rewards				18
• No incentives or salary raise		22 (96%)		
• Reward system (i.e., Recognitions awards)	5 (22%)			
• Lack of recognition and appreciation		5 (22%)		
5. Goals & Feedback				3
• Supporting implementation process			18 (78%)	
• Networking with stakeholders and engaging clinicians			9 (39%)	
• Improving the healthcare services			5 (22%)	
• Supporting research activities			4 (17%)	
• Providing mentorship to clinicians			4 (17%)	
• Supporting administrative activities			2 (9%)	
*Developing objectives:				3
• Goals are responsive to needs (not pre-determined goals)	18 (78%)			
• Goals developed based on organizational vision			4 (17%)	
• Goals developed by managers			2 (9%)	
• Lack of defined KB role and priorities		9 (39%)		
• Being overwhelming		8 (35%)		
6. Organizational support:				8
• Administrative support	8 (35%)			
• (i.e., graphic designs, clerical support, IT support, and digital media)				
• Time for KB activities	8 (35%)			
• Information sharing system	7 (30%)			
• Collaboration among different departments (i.e., quality improvement department, knowledge resources center, project management department)	5 (22%)			
• Access to experts	5 (22%)			
• Lack of financial support		18 (78%)		
a. Lack of financial support for training		6 (26%)		
b. Lack of financial support to attend conferences		4 (17%)		

c. Lack of financial to hiring staff		3 (13%)	
• Lack of time		18.(78%)	
a. Not liberating time for KB activities		14 (61%)	
c. Not liberating time for clinicians to participate in KB activities		7 (30%)	
• Lack of administrative support		14 (61%)	
a. Need clerical support		4 (17%)	
b. Need more KB positions		2 (9%)	
E. Readiness for Implementation			
1. Leadership Engagement			11 &12
• Providing guidance	15 (65%)		
• Accessible and available manager	12 (52%)		
• Supportive manager	11 (48%)		
• Openness to discussion	9 (39%)		
• Good relationship	7 (30%)		
• Liberating time for training	6 (26%)		
• Believe in KB roles	6 (26%)		
• Allow autonomy	6 (26%)		
• Liberate staff to participate in KT activities	4 (17%)		
• Lack of manager accessibility and availability		7 (30%)	
• Need autonomy		5 (22%)	
• Need authority		5 (22%)	
2. Available Resources			9
• Access to computer	23 (100)		
• Having offices	13 (57%)		
• Access to networking programs (i.e., Telemedicine Skype, , Zoom, SharePoint, Adobe connect, OneNote)	12 (52%)		
• Access to conference rooms	8 (35%)		
• Access to recording devices (i.e., recorder and camera)	3 (13%)		
• Lack of clinical staff participating in KB activities		4 (17%)	
• Need more office space		3 (13%)	

• Need clinical educators		2 (9%)	
• Need wireless internet connection (WiFi) in the working area		2 (9%)	
• Need access to conference rooms		2 (9%)	
3. Access to Knowledge & Information			
• Networking with various stakeholders	18 (78%)		
• Subscription to journals and newsletters	17 (74%)		
• Having access to library (i.e. journal databases)	16 (70%)		
• Online searching	12 (52%)		
• Having internship for new clinicians	4 (17%)		
• Need access to information (i.e., databases)		12 (52%)	
• Need to subscribe to newsletter		4 (17%)	
• Need to attend conferences		4 (17%)	
• Need more access to researchers		3 (13%)	
• Need centralized back of information		2 (9%)	
Process			
A. Planning			
• Self-initiation training	10 (43%)		10
• Training providing by employers (organizational training)	8 (35%)		
• Build skillsets with on-job (with time)	7 (30%)		
• Building skillsets during graduate studies (i.e., Master degree)	6 (26%)		
• Receiving mentorships from peers	3 (13%)		
• Not receiving KB training		18 (78%)	
• Need training		20 (87%)	
a. Need training in KB activities		6 (26%)	
b. Need training on evaluation		6 (26%)	
e. Need training on research skills		5 (22%)	
d. Need training on communication		4 (17%)	
h. Need training in using technology		4 (17%)	
f. Need training on people management		3 (13%)	
g. Need training on project management		3 (13%)	
c. Need training on KT		2 (9%)	

i. Need training in teaching skills		2 (9%)		
j. Need training in change management		2 (9%)		
k. Need training in conflict management		2 (9%)		
• Not aware of KB training opportunities		4 (17%)		
• Lack of training decreases confidence		4 (17%)		
B. Engaging (peers open to receive knowledge)				
• Having credibility	11 (48%)			15
• Having teammate attitude and mutual respect	9 (39%)			
• Providing a justification for new evidence and having a shared decision-making strategy	8 (35%)			
• Being an insider	8 (35%)			
• Peers are interested in knowledge	8 (35%)			
• Peers are aware and valued KB role	4 (17%)			
• Using Multiple communication methods	2 (9%)			
D. Reflecting & Evaluating				
• Having ongoing follow-up with managers			22 (96%)	4
• Presenting periodical reports			19 (83%)	
• Receiving feedback of stakeholders			11 (48%)	
• Tracking the productivity of the team			8 (35%)	
• Meeting planned agenda and deadlines			7 (30%)	
• Staff engagement			2 (9%)	
• Comparing with other similar teams			2 (9%)	
• No evaluation for KB performance		23 (100%)		
• Need to evaluate KB performance		13 (57%)		
Outer Setting				
A. Cosmopolitanism				
• Connected to professional support groups (i.e., community of practices)	12 (52%)			9 &16
• Connected to provincial committees	8 (35%)			
B. Peer Pressure				
• Need to contact other for individuals who perform KB roles (i.e., COP)		14 (61%)		
• Connected with other individuals performing KB activities		10 (43%)		

• Not contacting KB at all		7 (30%)		
• Not being aware of other individuals who perform KB activities		3 (13%)		
I. Innovation Characteristics				
A. Innovation Source				
• Supporting clinicians and keeping them up-to-date			18 (78%)	2
• Providing mentorship			5 (22%)	
• Linking the clinical site with other sites			4 (17%)	
• Solving the shortage of staff			4 (17%)	
B. Relative Advantage				
• Feeling of satisfaction	8 (35%)			18
• Flexibility, in term of time and place	7 (30%)			
• Professional relationships	6 (26%)			
• Appreciation and acknowledgement	5 (22%)			
• Gain Credibility	4 (17%)			
• Awareness of the healthcare system	3 (13%)			
• Learn new skills	2 (9%)			
C. Cost				
• Governmental fund or foundations fund			19 (83%)	20
• Academic institutions (universities) or research institutions			3 (13%)	
• Feel stable in positions	16 (70%)			
• Not non-unionized positions		5 (22%)		
• Not stable position		3 (13%)		

Additional file 5: Findings of relevant domains together with illustrative quotes

CFIR Domains/Categories (themes)	Selected statements
I. Characteristics of Individuals	
A. Knowledge about KB roles	
Being a driver to seek, adapt, and share evidence. (0)	• *"It's helping people access the right evidence at the right time in the right amount to help them address their questions and or to have supporting evidence to move forward" (MB5)*
Being able to connect different groups of stakeholders (0)	• *"you are the hub in either a network or of group of stakeholders.....like a the conductor in an orchestra" (MB4)*
Being responsible to implement new practices, building individual capacities, and addressing barriers to clinical practice change (0)	• *"you have to build their (clinicians) competency and capacity" (BC2)* • *"knowledge brokering is they're identifying knowledge packaging it in a way that people can uptake ensuring that that knowledge is being used" (AB6)*
Being proactive actor of KT (0)	• *"it's a proactive actor in knowledge translation" (QC9)*
B. Self-efficacy	
Feel confident (+)	• *"I'm fairly confident" (BC2)*
a. Owning skillsets promote confidence (+)	• *"I feel confident that I can relate to rehabilitation staff so I am an occupational therapist ...for almost 14 years .....I have a really good understanding of the clinical environment, the frontline care.... I've also spent almost 12 years being actively engaged in research activities ...so having my feet in both worlds I think gives me a lot more confidence" (AB7)*
b. Receiving positive feedback promote confidence (+)	• *"the successfulness of some of the projects that we've completed certainly give me a sense that how I carry out those knowledge brokering activities appears to be somewhat effective " (AB17)*
c. Having a good team promote confidence (+)	• *"I am 90% confidence that I'm doing a good job....I have a very very good team and..... most of them has been with me for 10 years, so I haven't had a lot of turnover" (AB6)*

d. Having ongoing communication promote confidence (+)	• *"having those conversations and the clarity of mind….. feeling more confident is in the end when everybody comes out with" (MB5)*
e. Having long-period experience promote confidence (+)	• *"I would be very confident to be an KB. Back in the day when I first started I probably was not Yet. I also had lots of experience to help me brush" (MB3)*
C. Individual Identification with Organization	
KB activities evolved within a current position (0)	• *"I naturally have that curiosity and that inclination to do that knowledge brokering…..I'm already looking for answers in research so looking through database and bringing research in clinic" (QC9)*
Job application (0)	• *"There was a job posting and I interviewed for it" (ON1)*
Volunteer to perform KB activities (+)	• *"I was thinking that that I would be very interested in continuing in her kind of footsteps, and so I just actually volunteered myself" (MB5)*
D. Personal Attributes	
1. Clinical experience:	
a. Having clinical experience (+)	• *"I was had practice for 12 years clinically….I have advanced knowledge and skills to be able to assist them in delivering care.....I have strong clinical background" (ON1)*
b. Understanding the clinical topics in which KB activities performed help to fulfill the needs (+)	• *"A broker …. somebody who is somewhat connected to the topic right and understands the real life context so that's one thing" (AB6)* • *"I understand the patient population very well, and the team members I am working with" (ON1)*
c. Having less clinical experience	• *"I have less clinical skills"* • *"Moi je n'ai pas été formé en sante"*
Research skills	
a. Having graduate studies (i.e., Master degree) (+)	• *"my training as a master student is a facilitator because I've been exposed to research so looking for info in database is easier for me than it is for a clinician" (QC9)*

b. Being interested and involved in research activities (+)	• *"I've also spent almost 12 years being actively engaged in research activities….I've actively been involved in large scale and small scale research projects" (AB7)*
c. Not having research skills (-)	• *"I rely on the staff hre you know who work in our library and things like that to do research for me" (BC2)*
Communication skills	
a. Having communication and networking skills (+)	• *"I think that communication skills is probably one of my strengths" (QC12)* • *"my soft skills in terms of communication and wanting to engage with people were like my assets and why they thought I was a good fit for the job" (ON16)*
Personal attributes	
a. Being motivated (+)	• *"I love it I really really love it I'm at the end of my career but I'm still so excited to be involved with this I do this clinical work because it's it's where we should be" (QC12)*
b. Being flexible (+)	• *"I think having that flexibility and that own like my own personal openness and wanting to serve and help oh those of them you know real facilitators I think" (AB7)* • *"I'm wearing a few different hats I'm a PhD candidates research assistants and research coordinator " (ON8)*
c. Having emotional intelligence (+)	• *"my type of personality …. I like to be involved and I like to involve people and I think that is a strength ….. get things done and move things forward …..I can kind of gather the chips, get their feedback , create something and vision and give them the information and stuff ….. instead of getting stuck in there not moving something forward..... those two strings I think really helps" (AB6)*
d. Having leadership skills (+)	• *"you do have to be the leader at all times and display the behaviors that you want others to uptake" (MB15)* • *"I think It's in terms of my leadership style, I'm definitely a harmonizer....I am open to dialogue and have conversations around Other people's ideas....I feel like that is a strength" (ON19)*
e. being lifelong leaner (+)	• *"I guess the other thing is like just being a lifelong learner it's just like feeling I can always be better and what's out there and searching it out" (ON19)* • *"I'm like a lifelong learner and willing to learn forever essentially, is was a big strength…..I'm willing to keep learning and to keep reflecting on my skills" (ON16)* • *"J'ai toujours aimé me tenir à jour sur les connaissances" (QC13)*

f. Being passionate toward knowledge (+)	• *"I have a huge thirst for knowledge ……that is something that I'm super passionate about (finding new information" (ON16)* • *"being a like passionate and being a passionate and about the about what you're doing i think that that can help others just to feel more engaged" (MB5)*
g. Having intellectual curiosity (+)	• *"I already have that's and natural here curiosity which makes me already I'll say I'm already looking for answers in research" (QC9)*
h. Being accessible (+)	• *"being a very approachable type of person" (BC2)*
i. Having analytic skills (+)	• *I'm being able to Be analytical the critical analysis" (ON19)*
j. Being able to see the global view (+)	• *"we tend to have a very holistic view on things so you tend to try to look at the big picture generally all the time…..I'm looking at the broader picture I'm trying to find think of all those moving pieces and how one change can create it can create change with all those other pieces" (MB15)*
k. having teamwork skills (+)	• *"I worked on many interdisciplinary teams.... involves an interdisciplinary team" (ON1)* • *"c'est un aspect intéressant de ma personnalité la capacité à travailler en équipe les intéressait" (QC13)*
l. having credibility (+)	• *"being able to gain the respect ....and acknowledgement that I had something to offer took some effort and it took some real networking and ability to prove myself.... took some effort" (AB6)*
m. Being positive (+)	• *"I think that you need somebody that's positive ….you need to have that kind of ...you want to change the world kind of attitude" (AB6)* • *"il y a l'aspect de positif, aussi je suis quelqu'un qui voit toujours des solutions et non des problèmes" (QC14)*
n. having project management skills (+)	• *"you need to be able to do change management and you need to be able to do project manage it's kind of like everything is a little project and you need to be able to relay the information support people change it communicate it and if you are weak in any of those areas um you know things are not gonna move forward" (MB5)*
o. Not being judgmental (+)	• *"I'm not a judgmental person and so I think that that helps me a lot with my role" (QC12)*
p. Seeking perfection (+)	• *"I'm also a Maximizer as well So I do want to make the best decision based on the best evidence" (ON19)*
Other qualifications	

a. Understating the healthcare systems (+)	• *"I worked in the community I worked ....at the policy level and at the Health System level of lunch different level.....my experience working with communities.... I think also helped in the position….I have done two placements within the government Before I've been more at the political level" (MB3)*
b. Being affiliated to a university (+)	• *"being able to have a strong adjunct appointment …. really sort of gave me that clout and that recognition from both universities ……that I belong in that community as well and so I think having those adjuncts has been extremely important in all of this I think the bottom line is around communication" (AB6)*
c. Being bilingual (English and French) (+)	• *"au Québec il faut avoir une bonne capacité en français aussi parce qu'on fait de la production en français. Le bilinguisme est un élément vraiment important. " (QC14)*
d. being suited in-between researchers and clinicians (+)	• *"I have close relationships with researchers .....I think I'm well positioned to see what our clinical and managerial environment is" (QC18)*
II. Inner Setting	
A. Networks & Communications	
Having a constant networking and engagement with clinical teams and other stakeholders (+)	• *"I do lots of sort of networking with them in order to help give them the information they need to be able to support their teams as well" (AB7)* • *"I go on the discussion board daily….. so I daily have communication with some of them" (QC12)* • *"my rehab team that I'm the team lead for we meet every week I speak with them formally and informally several times a week" (AB17)*
Sharing relevant information (+)	• *"when I see opportunities I send a message out to all the staff saying hey here's an opportunity… we have also a newsletter that sort of shares you know a recent literature or a topic of interest so we try and I guess in professional practice were seen as a conduit for brokering" (MB4)* • *"if there's a workshop coming up or a webinar that people might be interested in, a grant funding, call for research or for program development, then I would email that to everyone in our organization" (MB11)*
Providing mentorship (+)	• *"I provide mentorship and support if somebody needs more training they're more than welcome to come here and train under me" (BC2)*
Need more communication with stakeholders (-)	• *"I think you know I don't know interprofessional rounds where we could talk about the latest evidence that would be great… if we had journal clubs that would be great" (ON1)*

a. Need communication via online discussion boards (-)	• *“Having a sort of the board it's basic but having a place where everyone can share info with everyone” (QC9)*
Not being involved in decision making (-)	• *"change this that's happening on a higher level so I think that sometimes the only challenge...it's just those higher-level conversations that I don't necessarily get to participate in and when I'm trying to affect change that a different" (BC2)*
c. Need communication via newsletter (-)	• *"I think newsletter would be great you know just that I last off two people with kind of the latest kind of information they should know" (ON1)*
b. Need communication via face-to-face meeting (-)	• *"if it is nice to have more face-to-face time with people so it really does help for you to feel accessible to people .....I think networking is huge piece ...and build those fill those relationships beyond your organization is quite helpful” (MB15)*
d. Need communication with the provincial groups (-)	• *"One thing that would improve my ability to do the KB role it certainly is more and better networking I still find that communication from kind of provincial groups getting that information to frontline is still a barrier" (AB17)*
Being responsible for large area limits communication (-)	• *"I think you're the biggest difficulties is so you need to be able to it is just ensuring that you're developing those key relationships” (MB15)*
* Mode of communication:	
Online communication (0)	• *"I would say everything's done mostly on internet email or phone….I would say the bulk of my communication with my end-users is by email and through meetings that we set up ... Skype for business calls” (AB7)* • *“over the telephone or through email or both because there's people who are six to eight hours away from me that are calling and asking for some sort of support or information" (BC2)*
In-person communication (0)	• *"I am very like my office is right on the same floor as all the rest of my staff so I'm easily accessible and I'm and they're accessible to me so that we have very easy access to each other" (AB17)* • *"my preferred is being in person ... so I'm here kind of in my office and I may not kind of bump into them like more it is nice to have to see each other for sure" (MB15)*
B. Needs of Those Served in the organization	

Awareness of needs via raised questions and concerns (+)	• *“they're gonna come to me and ask me like do you know where I could find said information and do you know if that information exists” (QC9)* • *“they have a clinical situation that they find they're having trouble navigating they're completely welcome to come to ask me” (MB15)*
Awareness of needs via informal engagement (+)	• *"I understand their needs based on our communications you know I hear from people every day I feel like I spend most of my day talking to people in different regards " (AB7)*
Awareness of needs via attending periodical staff meetings (+)	• *"so I also attend their rounds regularly so that I'm kind of there and listening to them talk listening that to see where do they trip up where do they struggle what what's challenging them what information are they missing trying to make decisions" (ON1)* • *“I there come to the meetings that we have on a regular basis or to join into small group work, which is how we end up spending time answering our top clinical queries .... i try and be part of all of those groups" (MB5)*
Awareness of needs via asking stakeholders about their needs (+)	• *"I always ask, you know are there any new questions and like i said you know if someone sees me in the hallway on a day i am there they'll they'll bring something up" (MB5)* • *"that happens a little bit more informally...I can all start asking what do you guys know about this what do you need to know about this to be effective in practice we safe to incorporate best practice" (MB15)*
Awareness of needs via receiving feedback and complains (+)	• *"we just check in like is this what you want like we asked that question all the time like in our process documents we have checkpoints to ask clinicians like is this meeting your needs yes or no" (ON16)* • *"you will see what the needs are based on if there are issues with clients so client complaints that come out at the end of the day you'll start to see that maybe there's gaps and knowledge” (MB15)*
Awareness of needs via formal needs assessment (+)	• *"we do formal things like implementation need survey educational needs surveys things like that" (ON1)* • *“every year we try and do a needs assessment and come up with the goals for the year and that's a way for us to do an environmental scan to see what some what is the most urgent need" (MB4)*
Follow the latest research evidence (+)	• *"we go by the IASP curriculum guidelines and so I mean we have that type of thing the IASB says this is what student clinicians need to know or students coming out of physiotherapy or a team approach what they need to know" (QC12)*
Comparing the standard of similar sites (+)	• *"we utilize the regional resource team which is the team I used to work on in terms of keeping up with who is hired where they're hired when they're hired how new they are what types of support they need" (QC2)*

Not conducting need assessment (-)	• *"I don't believe we've ever had a formal needs assessment done" (AB7)*
Being responsible for large area limits awareness of needs (-)	• *"geographically we're spread out ....sometimes we're relying on frontline staff to say hey I'm interested in X and then we go great" (MB4)* • *"I think I meet some of the needs I think I meet a small proportion of the nice Alberta Health Services has almost 200,000 people working in it" (AB7)*
Feel not aware of needs (-)	• *"I think I'm probably not really aware of their needs that's really a limitation now....I mean I think that I assume their needs I don't really know them" (QC12)*
C. Implementation Climate	
Tension to change	
Lack of awareness of KB roles (-)	• *"It comes to clinicians or teams or other parts of the organization ..... they will say well you know why should we why should we do what wants us to do ....I keep trying to explain ....I'm the messenger I'm the helper I'll help you move forward" (ON1)*
a. Lack of peers' awareness of KB roles (-)	• *"no it's definitely not not clear to them my role in any sense isn't always clear to them" (BC2)*
b. Lack of managers' awareness of KB roles (-)	• *"they're not understanding the importance of this so I do I need to do a better job at kind of selling them like Why this is important and how this can make a difference so that could be an obstacle" (ON19)*
Relative Priority	
Not considered KB activities as a priority (-)	• *I'm always having to kind of push myself on others when they're like why are you bothering us with this kind of thing..... others don't see it as a priority and because the organisation has not made it a priority" (ON1)*
Organizational pressure toward clinical productivity (-)	• *"If I do get free time on a clinical day my manager is gonna push me to see a patient not to take that time to do some research so that's the barrier" (QC9)*
Learning Climate	

KB roles not valued by middle-level managers (-)	• *"People on the executive level that don't quite understand what happens on the ground ….so they don't simply understand the importance of including us ….in the preliminary stages …it really saves time in the end because we are the ones on the ground" (BC2)*
Organizational Incentives & Rewards	
No incentives or salary raise (-)	• *"Nope no we don't have any incentive program" (ON8)*
Reward system (i.e., Recognitions awards) (+)	• *"We actually had a compensation model that we had where you were evaluated …. the organization has created some awards we have a spirit award and we have a President's Award" (AB6)*
Lack of recognition (-)	• *"I'm the only person doing this type of work and not always really I don't think it's fully appreciated what I to achieve " (AB7)* • *"you don't have any recognition and you don't get paid for it I think it's those are big determines to doing that job great" (QC9)*
Goals & Feedback	
a. Supporting implementation process (0)	• *"I also me and my team supports them [clinicians] then with actual implementation with ongoing education as well as evaluation so we can come in and do audits we come in and do training we help them treat things" (AB6)*
b. Networking with stakeholders and engaging clinicians (0)	• *"I'd say and encourage the teammates to question is that the best I can do and is there anything else that I haven't thought of before to get my goal" (QC9)* • *"to facilitate ...communication opportunities for individuals" (ON8)*
c. Improving the healthcare services (0)	• *"to improve the quality of health and social health care and social services" (QC18)*
d. Supporting research activities (0)	• *"I think would be to facilitate answering those questions and either by helping the teammates to do their research or do their research for them not the research as in from a research point of view ….reading the data database and reading in the books" (QC9)*
e. Providing mentorship to clinicians (0)	• *"improving the approving the orientation of the new clinicians" (QC10)*
f. Supporting administrative activities (0)	• *"to organize meetings related to we had an knowledge mobilization advisory committee… I did a bit more like administrative work" (MB3)*

*Developing objectives:	
a. Goals are responsive to needs (not pre-determined goals) (+)	• *"I've set out to achieve have really been self-driven….I totally agree yeah it's it's really based on the needs of them yeah what gets identified" (AB7)*
b. Goals developed based on organizational vision (0)	• *"they're developed obviously by our organization our strategic plan and what our goals are moving forward as a Health Authority" (BC2)*
b. Goals developed by managers (0)	• *"definitely our manager" (ON16)*
Lack of defined role (-)	• *"I don't have any anything to justify to anyone so if that position was recognized named and if I had proper objectives and definition of role then that would be a very good first step to improve my knowledge brokering…….I need a clinical knowledge broker task definition…….I don't feel .... I'm a good knowledge broker because I don't know what's that hat is but I haven't read a definition of knowledge brokering best book role" (QC9)*
Being overwhelming (-)	• *"it becomes challenging..... because of the volume of your workload you don't necessarily have the time to consider all of the little caveats to the change" (MB15)* • *"overwhelmed with everything else going on…..what can be challenging is when people have so many other things on their plates" (ON16)*
Organizational support:	
a. Administrative support (i.e., graphic designs, clerical support, IT support, and digital media) (+)	• *"we have someone who's more equipped in like Digital media and all that type of fast, so quite as like all of us are from different backgrounds. So I think that really helpful" (MB3)* • *"I definitely have like physical space resources we have you know some secretarial support (MB5)*
b. Time for KB activities (+)	• *"very flexible in terms of time for what I need to dedicate my time to complete my role" (ON8)* • *"I never feel like I don't have enough time to do my job" (ON16)*
c. Information sharing system (+)	• *"we do have some a fairly good system for knowledge sharing between our colleagues … so we're able to communicate between ourselves" (ON8)* • *"we do have in our organization like a weekly it's called the prompts a weekly email that gets sent to everybody of what's happening in the region" (MB15)*

d. Collaboration among different departments (i.e., quality improvement department, knowledge resources center, project management department) (+)	• *"we also have a department that's focused on knowledge management so if I need support with things like project management tools or setting up these SharePoint sites things like that they're all available to me" (AB7)* • *"I think definitely having a support of the of the evidence center i think i would find this very hard to do without and if i was just reporting like to you know" (MB5)* • *"we actually have a quality improvement department within the organization ... so if there's things that touches on rehab I would get that information and we can actually go through the database and see if there are any issues or things that needs to get attention" (AB6)*
e. Access to experts (+)	• *"we have a patient engagement expert we have a communications expert" (MB3)* • *"I'm connected with people within the organization decision support data specialists" (ON1)*
Lack of financial support (-)	• *"limited budget that you have access to. they usually you know the common phrases we have no money. we have no money neutral yeah" (MB4)* • *"C'est une question de budget. C'est vraiment dérangeant parce qu'on est mis sur la sellette" (QC13)*
a. Lack of financial support for training (-)	• *"if there's a training or course most of the time if there's a financial cost to it that's the barrier …… The hardest part is if it has a monetary in if you need a budget or funds that hardest thing" (MB4)*
b. Lack of financial support to attend conferences (-)	• *"I attend conferences although I'd like to have a be able to attend or it's a limited budget again so yeah I think I feel pretty good about that" (ON1)* • *"definitely financial.....it's just not it's a big barrier ... I can't afford to pay for the conference in the travel and so I lose out on the networking" (QC12)*
c. Lack of financial to hiring staff (-)	• *"what we needed more funding for more positions because if we had adequate .. obviously we'd be able to provide improve service and better manage their needs" (BC2)*
Lack of time: a. Not liberating time for KB activities (-)	• *"Time...absolutely it's just endless it's an endless job...service delivery is so diverse that it's sometimes it can be really hard to kind of identify your priorities" (AB17)* • *"I could have additional time that because there's never enough of it right" (MB15)* • *"not enough time to do all of the things that I'm interested in doing" (MB11)* • *"time time again I'm yeah we don't get given the specific time slot to do that work so it's either taken in our personal time or on my research time for myself so my research time which is not related to my clinical time but I do take it anyway because I've got that urea city but yeah" (QC9)*

b. Not liberating time for clinicians to participate in KB activities (-)	• *"the other is carving out time for clinicians and teams to work with me, so I don't know if that would fall under that but I think that's a challenge" (ON1)* • *"trying to encourage frontline staff to participate that's probably the hardest thing because frontline staff are so busy " (MB4)*
Lack of administrative support (-)	• *"I have very limited administrative help…I have very limited administrative help, I would greatly I see the value of probably having a full-time coordinator role within the knowledge brokering kind of activities" (AB7)*
a. Need clerical support (-)	• *"Access to clerical support. I don't have clerical support you know maybe it's not the best use of my time to be formatting certain material that I've created" (ON1)*
b. Need more KB positions	• *"I think for me it's just being only one person in a big organization and recognizing that there's so much more I could do if there were other people like me in similar positions" (AB7)*
D. Readiness for Implementation	
Leadership Engagement	
a. Providing guidance (+)	• *""We talked all the time…..she just told me what I had to do" (MB3)* • *"we discuss the work I've been doing and what my plan is" (ON8)* • *"The supervision time helps me to set up new to-do lists like to continue the job so supervision time and email exchanges are very helpful" (QC10)*
b. Accessible and available manager (+)	• *"our offices are on the same floor so we see each other regularly … so that's very available to me and and I can meet with my manager and director as needed" (ON1)* • *"we see each other pretty much every day that I'm in clinic she's in clinic as well" (QC9)* • *"my manager is a like anytime I need help with anything we'll have if we need an hour or two hour-long meeting to discuss and problem-solve something together very like she's there" (ON16)*
c. Supportive manager (+)	• *"my manager is fantastic .....I think of it but we really work well as a team" (BC2)* • *"My manager was great….Very supportive" (MB3)* • *"I think my manager is very supportive of that role" (AB17)* • *"She's good. I think we have a respectful relationship for sure. ….I think she she's very supportive of the work" (ON19)*

d. Openness to discussion (+)	• *"she also is is very open-minded and i think she's maybe still just trying to see, you know where things aligned kind of thing and we're just getting still to know everybody. it's a complicated big center" (MB5)* • *"My directors are really open to like all of my ideas ….manager review posters …and .. offer feedback" (MB11)*
e. Good relationship (+)	• *"I think friendly positive working relationships" (MB11)* • *"I have a good relationship with her" (QC12)*
f. Liberating time for training (+)	• *"approving my time away for conferences or training that's you know never a question that's not a problem" (ON1)* • *"my manager makes time within my work schedule to be able to take like online courses that are related to knowledge translation" (ON16)*
j. Believe in KB activities (+)	• *"she understands and appreciates the work that I do" (AB7)*
h. Allow autonomy (+)	• *"I feel like she provides me with tremendous independence and support from that regard…..I really am appreciative of the independence that she gives me and sort of the you know the ability to create it with the resources that I have" (AB7)* • *"Et oui l'autonomie ça c'est clair qu'il faut beaucoup d'autonomie. Le côté aussi peut-être créatif, avoir de la place quelque part à faire du changement" (QC22)*
i. Liberate staff to participate in KT activities (+)	• *"freeing up time for the clinicians to work on certain things she's great to do that" (ON1)*
Lack of manager accessibility and availability (-)	• *"if it's something urgent then I would just go and set up a meeting or go and find her. my director is not on the same floor as I am" (MB4)* • *"I wish I had more access to her sometimes she's a very busy woman her title is the associate chief Allied Health Officer for the province" (AB7)*
Need authority (-)	• *"I think one of the difficulties is that …. I have no authority ….they have no accountability to me …..I have no authority over anybody" (ON1)* • *"I don't have any, you know, kind of power or authority to to change that so" (MB5)* • *"I do wish I sometimes that I had more direct leadership around how to grow how to grow the program how to be you know even more effective" (AB7)*

Need autonomy (-)	• *"I always have to go to back to the committee before I can take a decision….I think that I need more in my role I need more autonomy…..I definitely need more decision more decision-making" (QC12)* • *"we'd like to have more control over the website and internet and the social media because we know this is key……. we don't have a lot of autonomy to put anything on our website" (QC18)*
Available Resources	
a. Having access to computers (+) b. Having offices (+) c. Having access to conference rooms (+)	• *"I was given a computer … that's very helpful" (QC10)* • *"I've an office and I've got my computer you need it you probably need a laptop because if you're traveling" (AB6)* • *"Physical space, I have an office at our center….I have plenty of meeting areas….a lot of space and rooms here" (MB11)* • *"J'ai mon ordinateur" (QC23)*
d. Networking programs (i.e., Skype, Telemedicine, Zoom meeting, SharePoint, Adobe connect, and OneNote) (+)	• *"we need telehealth video Skype business all sorts of things" (BC2)* • *"Because everything we do is virtual, we use Skype for business for everything I'm on my headset all day long every day….I've been using platforms like zoom more frequently" (AB7)* • *"we use Skype for business all the time" (AB17)*
e. Recording devices (i.e., recorder and camera) (+)	• *"the only quote-unquote equipment we have is we have some video cameras that we potentially use for some of our you know if we want a video type sessions and use it for training " (AB6)* •
f. Lack of individuals performing KB activities (-)	• *"we have very few people capable of doing that part ...it's the implementation phase is not very well organized in our establishment….The capacity building is very limited now" (QC18)* • *"I think for me it's just being only one person in a big organization and recognizing that there's so much more I could do if there were other people like me in similar positions" (AB7)*
g. Have no office (-)	• *"no I don't have an office in the yellow because everything is done online and so I do everything from home" (QC12)*
h. Need clinical educators (-)	• *"As a kind of a weakness is we don't have a lot of educators .... have no rehab educators ....so we're not only knowledge brokering but we are actually doing all quote-unquote clinical education and if we could get assigned clinical educators we can do a much better job of educating staff orientating staff" (AB6)*

i. Need wireless internet connection (WiFi) in the working area (-)	• *"the Wi-Fi is not well the Wi-Fi connection does not exist everywhere in our in our different installations but every staff member can access a computer but not on a regular basis" (QC18)*
j. Need access to conference rooms	• *"Access to book a room for conferences with internet plugs" (QC10)*
Access to Knowledge & Information	
a. Networking with various stakeholders (+)	• *"I have very close access to clinicians and patients so that has definitely improved my research" (ON8)* • *"Being exposed to the different researchers so what is current what is happening" (QC12)* • *"we're also involved in various communities of practice which shares information latest research clinical practice guidelines" (BC2)*
b. Subscription to journals and newsletters (+)	• *"I've subscribed to certain journals that are very focused in the field of research and they send updates and some new articles that have been published recently there" (ON8)* • *"I had signed up for quite a few different newsletters from different organizations" (MB11)* • *"Newsletters, I receive multiple newsletters on email, my committees …they send things to me all the time …being on their distribution list" (ON1)*
c. Having access to library (i.e. journal databases) (+)	• *"I feel fairly that I have a good access to information, certainly the library here and I get regular a journal of articles that I have their table of contents sent to me regularly so that I can pull from that" (ON1)* • *"I couldn't do that knowledge brokering and that knowledge translation without having access to the database.....I think it's a minimum to do knowledge brokering you need to have access to the info" (QC9)*
d. Online searching (+)	• *"I would just search online like through the Health Authority library and for the like the current information" (MB11)* • *"On fait des recherches par mots clés puis on tombe sur de nouvelles technologies ou quelque chose. Je pense c'est un mélange de tout ça" (QC23)*
e. Having internship for new clinicians (+)	• *"These interns give me a lot of opportunity to keep up to date and to bring that back to clinic in to my colleagues" (QC9)*
f. Need access to library databases (-)	• *"you don't have like online resources like library …something that can help you to achieve your role" (QC10)*

	• *"it's quite hard to access evidence-based because our Library Services is not great…..you need to turn to Google more than to our librarian because we don't have much access to data back databases" (QC18)* • *"Le réseau public ne donne pas accès à ce genre de données-la par nous-mêmes" (QC20)*
g. Need to subscribe to newsletter (-)	• *"Je pense qu'il y a d'autres sujets qui pourraient être pertinents que je fasse en veille automatique comme ça" (QC14)*
j. Need to attend conferences (-)	• *"if I travel it takes me away from my work for a day ....to make decisions attending things in person that are limited to Calgary number one because we do try to limit our travel within HS you know having funding for travel" (AB7)*
h. Need more access to researchers (-)	• *"sometimes … in our meetings people will bring stuff up or … there's a couple of researchers i work with who, will say…. there's going to be a new developmental coordination disorder like i learned that there would be the new European consensus guideline update coming up. so, you know, sometimes it is by word of mouth. but yeah, I am if there are better ways. I'd love to hear about them" (MB5)* • *"C'est sûr que l'accès aux chercheurs, ces personnes-là c'est souvent des chercheurs, des personnes qui en ont bâti quelque chose de particulier. Souvent c'est difficile, faut le trouver justement. Faut être en contact avec eux dans une quelconque organisation" (QC22)*
i. Need centralized back of information (-)	• *"I would enjoy personally being able to connect to one website that curates different areas of knowledge translation …. like something that has all of those categories because I feel like I need to go to eight different places to get all that information so if there was like one place that I could go to" (ON16)*
III. Process	
A. Planning (Training opportunities)	
Self-initiation training (+)	• *"there was the opportunity to do this knowledge translation certificate at Sikkids ....I did the one through Guelph…..that course in knowledge translation open my eyes" (ON19)* • *"I signed up for the sick kids by a course on knowledge translation and then the year after that I did the st. Mike's practicing knowledge translation course and now I'm enrolled in the st. Mike's end of grant knowledge translation course" (ON16)*
Training providing by employers (organizational training) (+)	• *"we had a brief in person orientation for the Institute …..it was very preliminary and most of it was online … a form of orientation to what resources we had …. a suggestion to reach out to family leaders and talk to families … I think the majority of our training was focused on research ethics" (ON8)*

	• *"I've done is a lot of course on personal skills… like in terms of leadership, in terms of change management, in terms of project management, things about how to both teams virtually communication, conflict management, that all within Alberta Health Services" (AB6)* • *"There were some webinars developed so it was suggested that I complete those webinars" (MB5)*
Build skillsets with on-job with time (+)	• *"no I really think your training happens through on-the-job learning you need to be you need to have a little bit of a thick skin to be able to receive feedback if things don't go well" (MB15)* • *"I've just been kind of learning on the job" (AB17)* • *"Je pense qu'il y a beaucoup ça l'apprentissage l'APPR dans le fond problèmes et projets" (QC20)*
Building skillsets during graduate studies (i.e., Master degree) (+)	• *"my MSC master where I've been doing more more research you know so methodology statistical classes ethical classes those are all relevance… I'd say mainly my master my research master is the big helpful tip here for my knowledge translation" (QC9)* • *"we had a talk of trained as an OT talk about professionalism in the workplace we had a full course on professionalism and so I do very much rely on that as well" (MB15)*
Receiving mentorships from peers (+)	• *"I think i had quite good mentoring from the evidence center staff as i mentioned, you know is always able to reach out" (MB5)* • *"my team has a very strong mentorship type model so I shadowed my colleagues a lot I went to consults with them and they directed me….I would say one of my biggest resources is being in contact with my two members all the time .....if we have any questions .... talk to each other" (ON16)*
Not receiving KB training (-)	• *"no..no they didn't give me any special training to do my job" (ON1)* • *"I haven't really received any like official training for knowledge brokering" (MB11)* •
Need training (-)	• *"I think I could be more effective if I add more training….training for myself in terms of upping my skills" (ON1)* • *"I always value you know sort of that that mentorship the leadership development from within the organization and that's certainly something that I currently don't be available to me in Alberta Health Services specifically within the field of rehabilitation" (AB7)*
a. Need training in KB activities (-)	• *"I would like more training on how to do KB or different ways to improve or even different media avenues....more specific training on knowledge brokering would be really helpful" (MB11)*

	• *"I would be an advocate for some sort of continuing like fulsome continuing education opportunities for knowledge brokers……a lot of knowledge brokers have have you know some sort of different are coming from all sorts of different career paths that", "some sort of comprehensive foundations course, that's like centralized" (ON16)* • *"a 101 course our knowledge brokering would be awesome" (QC9)* • *"I think it would be very interesting even just to take some of that very baseline training about what role of a knowledge broker is…..how that actually falls into what we know about the what's the most effective way for knowledge brokers to work" (AB17)*
b. Need training on evaluation (-)	• *"I feel like there's probably a lot more learning that I can do is specifically around program development program evaluation and policy development …..large program development, program evaluation, other sort of larger types business strategies" (AB7)* • *"like more training in evaluating impact in knowledge translation ....impacting clinicians ....patient outcomes ...would be really helpful" (ON16)*
c. Need training on research skills (-)	• *"for evidence synthesis I feel like there are very limited opportunities and very little curriculum developed on how to do like narrative synthesis .....synthesizing evidence for like immediate clinical like an immediate clinical use in like a six month time span …. that perspective would be like my biggest thing" (ON16)* • *"Personnellement, il y a vraiment [inaudible] aller rapidement identifier la pertinence de certains articles scientifiques, mais ce n'est pas ça que je veux dire- la façon de faire ressortir rapidement les informations nécessaires » (QC13)*
d Need training on communication (-)	• *"maybe I workshop or something about like writing in plain language….different ways to use graphics or to make an infographic….how to best make an oral presentation or a poster for a conference" (MB11)*
e. Need training in using technology (-)	• *"an online course on basic principles of graphic design and how to use different software would be really really helpful" (ON16)*
f. Need training on people management (-)	• *"Alors là je vais y aller. J'ai trouvé une formation sur le volet humain de la gestion, donc j'ai une formation au mois d'avril" (QC13)*
g. Need training on project management (-)	• *"Mais c'est quelque chose qui manque. Moi ça fait deux ans que je demande une formation en gestion de projet" (QC13)*
h. Need training on KT (-)	• *"but you can take more formally so you know anything around implementation science is helpful …..I'd love to have training with anything to do with knowledge translation or knowledge management" (ON1)*

i. Need training in teaching skills (-)	• *“I would say that you need to train the person a lot more as an educator” (QC12)* • *“"adult learning principles is helpful I think you know " (ON1)*
j. Need training in change management (-)	• *"Changer la pratique, c'est toujours quelque chose d'intéressant à faire, puis je me sens moins équipée” (QC22)*
k. Need training in conflict management (-)	• *"Gestion de conflits, c'est intéressant, ça j'aimerais ça » (QC21)*
Not aware of KB training opportunities (-)	• *"I can tell you I have never taken a course titled knowledge brokering. I don't even know if there is such a thing I've never you know it's not something that I've seen or heard or even had access to, it's not something that I seeked out" (AB6)* • *"I just don't know that it exists…..I’ve never really heard about like a week-long workshop on KB ..... I guess you had a challenge that I don't know that it exists, but if I did hear about it, I would definitely be interested" (MB11)* • *"I'm not aware of what training opportunities are out there no" (MB15)*
Lack of training decreases confidence (-)	• *“I feel less confient because I don't have a degree in KT” (ON16)*
B. Engaging (peers open to receive knowledge)	
Having credibility (+)	• *"yes I would say so yes yeah...it has to do with my credibility Authority and come relational interpreter relational competencies" (QC18)* • *“I think people see me as a leader and an opinion leader in many ways and they come to me for information and they come to me for direction” (AB7)*
Having teammate attitude and mutual respect (+)	• *"I think that they're fairly open I feel that I'm very open with them there with me we share a lot of information and we learn from each other which is great….I like to think of myself as their teammate not a manager" (BC2)* • *"we develop trust and respect for each other" (ON16)* • *“we have a very good back and forth relationship they tend to be pretty agreeable” (MB15)*
Providing a justification for new evidence and having a shared decision-making strategy (+)	• *"it's always this is the initiative this is the example or the guideline how can we help you implement this so that whole attitude opens it up" (AB6)* • *"this is a shared decision-making and they put their input in these Guidelines so the resistance is less" (MB3)*

Being an insider (+)	• *"I think that they very open because of the relationship because of the context that.... we not outsiders we are not somebody coming and we never ever" (AB6)* • *"I've been their manager for a while so I can speak their language now" (MB15)* • *"so it's knowing your local context well that really helps you to adapt that the evidence that you have" (QC10)*
Peers are interested in knowledge (+)	• *"I also surround myself with people who are as passionate about a topic as I am….my team is extremely open to that I have a very I have everybody I have a very strong team that is also very driven and they are very open to change and also value the embedding of new evidence into practice" (AB17)* • *"There's quite a few individuals that are information-seeking" (ON16)*
Peers are aware and valued KB role (+)	• *"yes I open because I'm in a regional position so they know to expect like an information from me or guidance as in help they can come and ask me for help if they need so" (QC10)*
Using Multiple communication methods (+)	• *"it's tough because everyone has their own communication style and how they prefer to get information…..taking like a multi method approach is is how I try to best " (ON16)*
C. Reflecting & Evaluating (outcomes of KB activities)	
Having ongoing follow-up with managers (0)	• *"I have one-to-one meetings with my manager every month discuss the projects I'm working on" (ON1)* • *"I also have one-to-one meetings with my manager in order to report on what is going on in our department" (BC2)* • *"we have we have formal meeting once every two months ….. we quickly share what's been done …. so that everyone is up-to-date from what's been done" (QC9)*
Presenting periodical reports (0)	• *"There's annual performance reviews with my manager….there's an opportunity to formally sit down and see how I'm doing and evaluate thought that, so that happens annually" (ON1)* • *"I probably submit a briefing note geez I probably saw that six per year" (BC2)* • *"it's ongoing it is we do it quarterly right so it so it's usually quarterly reports" (AB6)* • *"there are reports, periodic performance reports, I think every six months (ON8)*
Receiving feedback of stakeholders (0)	• *"I mentioned that feedback and reflection piece so you can generally monitor how things are going" (MB15)* • *"our major indicators are like are people involved are people satisfied" (ON16)* • *"I've always liked the feedback that i've gotten in my performance appraisals…..I've always gotten the sense that i am meeting the objectives and doing a good job that way " (MB5)*

Tracking the productivity of the team (0)	• *"I also track things like scholarly outputs from our research challenge teams….I sort of track you know presentations or papers or things that come out of the work that I helped to facilitate" (AB7)* • *"Yes, absolutely….we developed a number of guidelines for clinicians working in general" (MB3)* • *"It's really more like of a catering service. I like to what each person needs at that time rather than just doing the same thing for everybody" (MB11)*
Meeting planned agenda and deadlines (0)	• *"we have that provincial rehab strategic plan so our performance are measured on whether we are actually meeting the objectives within that plan and that's a three-year plan" (AB6)*
Staff engagement (0)	• *"i measure how many times we meet you know who how many people attend and then of course, you know, how many questions are brought forward what avenues we use to appraise the evidence at our center we use a traffic lighting framework that evidence alert traffic lighting framework" (MB5)*
Comparing with other similar teams (0)	• *"I also get that sense when i meet with our in our community of practice you know when we share experiences within our group, i feel like our OT groups very productive" (MB5)*
No evaluation for KB performance (-)	• *"no there is not really. That's definitely a gap" (ON1)* • *"No formal evaluation for your work as a knowledge brokering activities" (BC2)* • *"I think that's one thing major Pitfall with knowledge brokers that we don't know like how effective we are what we do How we monitor ourselves things like that. So definitely no, I did not know That anything like that" (MB3)* • *"I don't rely on a specific framework or I don't have my own monitoring program in place for my own output it's a lot more informal" (AB7)* • *"I don't have a real way to monitor did I do it and if I did it did I do a good job or did I just did the bare minimum" (QC9)* • *"I don't do any sort of monitoring…..it's funny that I tell clinicians that they should be evaluating their programs, but I actually don't evaluate my services" (MB11)* • *"no no this I have no way of measuring the effectiveness of my role" (AB17)*
Need to evaluate KB performance (-)	• *"it would be awesome though because you know then we really have a way to follow up on how essential that role is but also how good it is for in a whole clinical setting to have that role filled in but we don't have a formal way to evaluate it " (QC9)* • *"you could go more formal and your performance assessment so one thing that would be a nice thing to do….you could do it more formally in terms of kind of having a formal questions to ask all of your groups*

	or do some surveying of staff … would be my way that you could assess I could have set my performance" (MB15) • *"more I feel like there must be a better way to measure. I'm just not sure what it is….momentum plan where we said like three months six months or one year type goals and it has anything to do with knowledge brokering" (ON16)*
IV. Outer Setting	
A. Cosmopolitanism	
Connected to professional support groups (i.e., community of practices) (+)	• *"As a physiotherapy I'm also part of my national and provincial Association so physiotherapy Association Canadian and Quebec and those associations give me access to a lot of knowledge translation platforms" (QC9)* • *"we have our community of practice and things like that that we discuss you know best practice and what is going on and what people are experiencing at their sites and work together as a team" (BC2)* • *"we knew information comes down from lots of our working groups it's shared through some of our professional networks that we have" (AB17)*
Connected to provincial committees (+)	• *"Being within a large provincial organization (Alberta Health Services) where you know we have many many many people working within research and other areas I can go to those departments" (AB7)* • *"I work provincial organizations in terms of you know when I need information I can reach out to them" (ON1)* • *"I am involved provincially and so that places me in a really good spot to get some of that new evidence new best practice and help to filter it down to frontline and ensure that it is embedded into practice and sustained" (AB17)*
B. Peer Pressure	
Need COP for individuals who perform KB activities (-)	• *"Maybe just thinking kind of like a community of knowledge broker. You can like communicate together. That might be helpful, but I think also advancing our evidence because the effectiveness about the knowledge brokers would be Very good" (MB3)*

	• *"it is really important to the people that like the KB community of practice so yeah that mentorship having other knowledge brokers to talk to you know the librarian and just having like some of those structures that are in place and the support and the you know" (MB5)* • *"an accreditation or like an a small scale order…..we can have like even like something, like a license" (ON16)*
Connected with other individuals performing KB activities	• *"I can talk to the other knowledge brokers in our community our we have our KB community of practice meetings that happen throughout the year, not two or three times a year so we can talk to each other then" (MB5)*
Not being aware of other individuals who perform KB activities (-)	• *"I am work in brain injury, so I am not aware of anybody necessarily play a KB role" (ON1)* • *"I don't really know of anyone else who has a position like mine" (MB11)*
Innovation Characteristics	
A. Innovation Source:	
Supporting clinicians and keeping them up-to-date (+)	• *"make sure that they're up to date understand best practice have somebody who can help them, again put evidence into practice…..focus on helping the clinician how to do their job and implement the best practice" (ON1)* • *"I think having a knowledge broker or a middle person is definitely essential like all of the people within track …..leading experts in their area …. don't have the time to deal with the things that a knowledge broker would deal with" (MB3)* • *"having knowledge brokers that that will feed up the you know implementation of evidence-based practice that that's appropriate for those individuals" (MB5)*
Providing mentorship (+)	• *"so a lot of the times you see northern communities creating roles that are more mentorship roles for consultation possibly building competency and capacity and that type of thing….the knowledge brokering types of positions really do help the new grads that start in these various roles" (BC2)* • *"I serve as a what's a mentor for the other therapy managers....a person that they can Lead with about the work that they're doing and help support them with their challenges to" (MB15)*
Linking the clinical site with other sites (+)	• *"one person can't do everything or be an expert at everything so they would be like the hub for assisting and facilitating and supporting you know a larger group" (MB4)*

	• *"it definitely needed a knowledge broker position .....because there are so there were so many players…I think having one central person that kind of coordinated all of that was pivotal so for me" (MB3)*
Solving the shortage of staff (+)	• *"my team does not have a lot of time to devote to organize knowledge because of the pressure put on performance and because of the shortage of professionals ....it's hard to dedicate time to knowledge transfer" (QC18)*
B. Relative Advantage	
Feeling of satisfaction (+)	• *"my satisfaction that's my satisfaction that's my incentive that's that the reason, I do the job I do, not financial" (QC12)* • *"well it's the satisfaction to meet our need that the needs of the people we work with….to see that we have improved" (QC18)* • *"I feel very blessed to be in the role that I'm in and so I'm really quite happy" (AB7)*
Flexibility, in term of time and place (+)	• *"doing brokering activities maybe you have more flexible time than being a PT... working at home" (QC10)* • *"I've just started doing a little bit of work from home" (AB17)* • *"I feel like it's a real trade-off for me….have the flexibility of working from home has been a huge advantage for me personally….I've been granted the flexibility of being able to conduct my roles completely virtually …. for me that's just an incredible bonus of my role of being able to work from home" (AB7)*
Professional relationships (+)	• *"to being to building strength within your teams and building that relationship building that trust…..being involved with some of these projects has really built my network of knowledgeable people that I can draw on" (AB17)* • *"the rewards are just building a better team as well as a community of practice between clinicians and really connecting all of the lines of service" (BC2)*
Appreciation and acknowledgement (+)	• *"I had a recognition of the hours I had done and the work I had done and that gave me access full access to clinical assistant teacher role.. I sort of have a recognition of what I had been doing and so that's how" (QC9)*
Gain Credibility (+)	• *"I think you know respect and being a respected colleague that's probably the most rewarding" (BC2)*
Awareness of the healthcare system (+)	• *"I guess as if you if people want to work at more of the macro level around You know changing behavior" (ON19)*

Learn new skills	• *"you need to be adaptive so I think that benefits of being a knowledge broker are you are flexible, you are you incorporate feedback readily I think it just helps your general skillsets" (MB15)*
C. Cost	
1. Governmental fund or foundations fund (0)	• *"well I work in a hospital in Ontario, it is publically funded…through the lens from the Ministry of Health" (ON1)* • *"the public is a public health authorities" (MB4)* • *"my position is funded by our foundation...foundation raises money to the charity" (MB11)*
2. Academic institutions (universities) or research institutions (0)	• *"it's the Research Institute that I work at" (ON8)*
*Being Stable	
1. Feel stable in positions (+)	• *"I feel fairly confident that the position is stable" (ON1)* • *"I'm very stable in my position" (BC2)* • *"I think it's stable. .....foundation I guess like recognizes the importance of having a research coordinator" (MB11)*
Not non-unionized positions (-)	• *"I said a non-union a non-management so you know in that respect you know how stable it is anybody's job these days" (ON1)* • *"I am not unionized now I'm out of scope and so I think we all always feel a little bit at risk" (AB7)* • *"it's not a unionized position so if priorities change and if we don't meet our priorities the way that it is expected we can always be I mean we can lose our position as managers" (QC18)*
Not stable position (-)	• *"no I think that it's very unstable it depends" (QC12)*

Appendices of Chapter 9

Appendix 1: The five role domains of knowledge brokering

Role Domains	Definition	Example of activities
Information manager	This role includes seek and share relevant health research, as well as context-specific Knowledge, possess an understanding of less formal contextual evidence across settings that can be important to exchange with stakeholders to inform decision-making processes, deliver key information to specific audiences in ways that will best promote its uptake, improve access to evidence in the clinical setting through academic affiliations and collaborations.	• Seek, promote access to, appraise, organize, and share relevant health research and context-specific knowledge (e.g; culture, processes, and barriers)
Linking agent	This role includes the KBs' ability to connect and foster trust and relationships among people with shared interests, and facilitate "shared agendas", link researchers and clinicians, decision makers, and/or other key stakeholders can expedite the process of KT by creating opportunities for knowledge exchange, facilitate the creation of networks of individuals or groups with overlapping interests and promote understanding about other members' local contexts.	• Connect and foster trust and relationships between people with overlapping interests (e.g.; researchers and decision makers) • Coordinate interaction between stakeholders to cultivate 'shared agendas' and information sharing. • Foster engagement in the research process. • Connect with a network of knowledge brokers.
Capacity builder	This role includes the development of positive attitudes toward evidence, as well as skills, establishing a common language among stakeholders as well as providing education and mentoring in the clinical setting on both research skills and how to apply research. KBs can enhance organizational capacity for research use by targeting individual or organization barriers to change including promoting positive attitudes toward evidence and	• Build the knowledge and the skills required to access, appraise, and apply evidence. • Address barriers to change (e.g., individuals and organizational) • Enable communication across sectors through the development of a common language. • Increase capacity for research by leverage network connections.

	developing structures and supports for individuals within those organizations. The connections of the KBs can also enhance capacity for research by expanding participant recruitment potential and enhancing funding competitiveness by bringing together a strong team with a common vision.	
Facilitator	This role includes the guidance and support of knowledge users to find ways to integrate knowledge about research, as well as context, collaboration to address identified knowledge or skill gaps, promoting Inter-professional knowledge exchanges, and fostering a cultural shift within an organization to enhance the valuing of research evidence. Also, this role includes highlighting the scientific and tacit knowledge from the worlds of the researchers and their stakeholders to inform the design of robust, clinically relevant research in addition to engaging stakeholders, and fostering problem-solving throughout the research process.	• Guide or support evidence-informed practice processes to assist knowledge users to integrate research, contextual and experiential knowledge into clinical decision making or research processes • Improve attitudes toward research use • Enhance the clinical applicability of research
Evaluator	This role encompasses evaluation of the context, of the processes, and outcomes of KT at the research and clinical levels, and of the KBs own knowledge brokering performance.	• Assess the local context to inform knowledge brokering activities • Integrate KT frameworks and evidence into evaluation processes • Evaluate linkage and exchange networks • Evaluate knowledge brokering activities and outcomes.

Appendix 2: Types of skills of knowledge brokers

Skill Domains	Example of skills
Research skills	Being aware of the best sources of synthesized evidence, being able to search for less formal contextual evidence such as policy documents and evaluation reports, being able to evaluate the evidence's quality, importance, and applicability to a particular context, and being able to gather and critically appraise the research evidence.
Communication skills	Have strong oral and written communication skills, have access to colleagues, understand the clinical and organizational contexts, and have active listening skills to gain insight into the interest of colleagues; communication skills are used to bring people together and facilitate their interaction, using a variety of methods targeted to the needs of the diverse stakeholders.
Mediation skills	Being able to build effective relationships, encourage collaboration with individuals who would not normally work together, identify the common goals, and negotiate mutually beneficial roles of group members.
Knowledge brokering skills	Being able to perform knowledge translation activities in the action cycle in the knowledge-to-action cycle, including adapting knowledge to local content, tailoring KT strategies to stakeholders needs, and sustaining the targeted change.

Appendix 3: List of the invited rehabilitation organizations in Canada

KT communities of practice (n=10)
Centre de Transfert pour la Réussite Éducative du Québec
Centre for Effective Practice
Choosing Wisely Canada
Integrated Knowledge Translation Network
Patients Experience Evidence Research (PEER)
Knowledge Into Practice Learning Network
KT Alberta
KT Canada
KTECOP (Closing The Loop between Theory and Practice)
SPOR Evidence Alliance
Alberta SPOR Knowledge Translation Platform
List of regulatory members of rehabilitation professions in Canada (n=16)
College of Physiotherapists of Ontario
Ordre Professionnel de la Physiothérapie du Québec
Ordre des Ergothérapeutes du Québec (OEQ)
Alberta College of Physical Therapists
Alberta College of Occupational Therapists (ACOT)
British Columbia College of Physical Therapists
British Columbia College of Occupational Therapists of (COTBC)
College of Physiotherapists of Manitoba (CPM)
College of Occupational Therapists of Manitoba (COTM)
College of Occupational Therapists of Nova Scotia (COTNS)
College of Physiotherapists of Nova Scotia
New Brunswick College of Physiotherapists
Prince Edward Island College of Physiotherapists
Prince Edward Island College of Occupational Therapists
Newfoundland & Labrador College of Physiotherapists
Newfoundland & Labrador Occupational Therapy Board (NLOTB)
Provincial/Territorial Occupational Therapy Professional Associations (n=24)

Ontario Society of Occupational Therapists (OSOT)
Association Québécoise de la Physiothérapie
Society of Alberta Occupational Therapists (SAOT)
Physiotherapy Association of British Columbia
Manitoba Society of Occupational Therapists (MSOT)
Nova Scotia Society of Occupational Therapists (NSSOT)
Saskatchewan Health Authority
Saskatchewan Society of Occupational Therapists (SSOT)
Prince Edward Island Occupational Therapy Society (PEIOTS)
Newfoundland and Labrador Association of Occupational Therapists (NLAOT)
Association of Occupational Therapists (NBAOT)
Manitoba Southern Health-Santé Sud
Northern Health authority
Sunny Hill Centre's KBs Facilitator Sunny Hill
Alberta Health Services
Covenant Health
Fraser Health Canada
Island Health
Vancouver Costal Health
Interior Health
Interlake Eastern-Regional Health Authority
Canadian Association of Occupational Therapists (CAOT)
Canadian Association of Physical Therapists
Canadian Occupational Therapy Foundation
List of Canadian rehabilitation profession programs (n=18)
McMaster University: School of Rehabilitation Sciences
Ottawa University
University of Toronto: Occupational science
University of Toronto: Physical therapy
University of Guelph
McGill University
Université de Montréal

Université de Sherbrooke
Université Laval
Université du Québec à Trois-Rivières
University of Alberta: Department of occupational Therapy
University of Alberta: Department of Physical Therapy
University of British Columbia : Department of Physical Therapy
University of British Columbia: Department of occupational Therapy
University of Victoria.
Dalhousie University: School of Physiotherapy
University of Manitoba: School of Medical Rehabilitation
University of Saskatchewan: School of Physical Therapy
List of Research Institutions in Canada (n=38)
Alberta Research Centre for Health Evidence (ARCHE)
Arthritis Research Canada
Association de Recherche Qualitative
Canadian Institutes of Health Research
CanChild
CCGHR (Canadian Coalition for Global Health Research)
Centre de Collaboration Nationale sur les Politiques Publiques et la Santé
Centre de Liaison sur l'intervention et la Prévention Psychosociale (CLIPP)
Centre for Health Evaluation & Outcome Sciences (ECHO)
CISSS Chaudière-Appalaches
CIUSSS de l'Estrie-CHUS
CIUSSS du Centre-Sud de l`Île de Montréal (les deux responsables de l'AAPA)
Cochrane Canada Francophone CHU de Québec-Université Laval
Centre de Recherche Interdisciplinaire en Réadaptation (CRIR)
Dorothy Wiley Health Leaders Institute
Entreprise Privée Groupe Qualiso
Entreprise Privée Pica Conseil inc.
Institut de Formation Continue du Québec
Institut de Psychologie Contextuelle
Institut National de la Recherche Scientifique

Institut National de Santé Publique du Québec
Institution for Work and Health
Kids Brain Health Network
Michael Smith Foundation for Health Research
National Collaborating Centre for Healthy Public Policy
National Collaborating Centre for Methods and Tools
Ontario Institute for Cancer Research
Ontario Neurotrauma Foundation (ONF)
Physician Learning Program
PsyMontréal
Rehabilitation Network Canada
Research Impact Canada
RQSPFV (Réseau de Recherche Québécois en Soins Palliatifs et Fin de Vie)
TELUQ
The Ontario Institute for Studies in Education, University of Toronto
Translating Emergency Knowledge for Kids (TREKK)
Translating Evidence in Child Health to Improve Outcomes (ECHO)
Women and Children's Health Research Institute (WCHRI)