Factors and Outcomes of Collaborative Information Monitoring

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Abstract

Background

Keeping up to date with scientific literature is intrinsic to research but remains challenging due to information overload, time constraints, and despite existing tools (e.g., search alerts). It is particularly challenging for researchers in multidisciplinary fields, such as Patient Oriented Research (POR), who need to cast their nets wide to identify relevant studies. Collaborative information monitoring, or sharing the monitoring effort among group members, may be a solution. Indeed, collaboration is intrinsic to research and peers are often preferred sources for keeping up to date. Collaboration is also known to have the potential to solve complex problems and lead to knowledge discovery. Yet, some knowledge gaps remain. While recognized as important, most studies focus on active searching rather than monitoring. Most studies investigate individual rather than collaborative behaviour. More research is needed to understand the experiences and outcomes of collaboration, and to bridge collaborative information seeking with collaborative information monitoring.

Objectives

Study 1: To identify the factors and outcomes of collaborative information seeking and adapt a conceptual framework for environmental scanning (i.e., 'best fit' *a priori* framework) to a collaborative context.

Study 2: To identify and understand the factors and outcomes of collaborative information monitoring from the perspective of POR stakeholders engaged in a unique collaborative monitoring system called eSRAP.

Methods

Study 1: A systematic mixed studies review with a framework synthesis was conducted to adapt the conceptual framework for environmental scanning to collaborative information seeking. Data extracted from included studies were analyzed using deductive-inductive thematic analysis. Text passages were coded against existing themes from the a priori framework and new themes were generated from the data.

Study 2: Guided by the conceptual framework for collaborative information seeking from Study 1, a qualitative multiple case study was conducted. A 'case' was defined as an implemented

eSRAP project involving members interested in monitoring the same topic. Data were collected with individual semi-structured interviews, triangulated with documents (i.e., search strategies and selection criteria comprising each eSRAP project) and archives (i.e., system logs). Data were analysed using deductive-inductive thematic analysis in two stages, within-case analysis followed by cross-case analysis.

Results and Discussion

Study 1: Fifty-one studies were included, from which data on factors and outcomes were extracted. The resulting framework for collaborative information seeking includes seven types of factors (personal, group, organizational, informational environment, information sources, system, task) and five types of outcomes (performance, behavioural, cognitive, affective, relational).

Study 2: The multiple case study included seven cases representing four case types: (1) collaborative monitoring with eSRAP, (2) collaborative monitoring without eSRAP, (3) individual monitoring with eSRAP, and (4) no monitoring and no use of eSRAP. The study confirmed the factors and outcomes identified in Study 1, and generated new sub-themes related to collaborative information monitoring (19 for factors and 12 for outcomes). Cross-case analysis identified the sub-themes specific to cases that engaged in collaborative monitoring with and without eSRAP.

This research presents original contributions to knowledge on collaborative information seeking and monitoring. It offers actionable recommendations valuable for implementing, supporting, and evaluating collaborative information projects, potentially helping POR stakeholders and researchers in other fields keep up to date collaboratively.

Résumé

Introduction

Rester à jour avec la littérature scientifique est essentiel en recherche. Malgré divers outils existants (p. ex., des alertes de recherche), il persiste de nombreux défis en raison de la surabondance d'informations et du manque de temps. Ceci est particulièrement difficile pour les chercheurs dans des domaines multidisciplinaires, comme la recherche axée sur le patient (RAP), qui doivent couvrir une littérature plus large. La veille collaborative peut être une solution. En effet, la collaboration est connue pour son potentiel à résoudre des problèmes complexes et à mener à la découverte de nouvelles connaissances. De plus, la collaboration est inhérente à la recherche et les pairs sont une des sources d'information préférées des chercheurs pour se tenir à jour. Malgré son importance reconnue, la plupart des études se concentrent sur la recherche d'information plutôt que sur la veille. De plus, la plupart des études scientifiques examinent le comportement individuel plutôt que le comportement collaboratif. Des études sont nécessaires pour comprendre les expériences et les effets de la collaboration, et pour faire le lien entre la recherche collaborative d'informations et la veille collaborative.

Objectifs

Étude 1: Identifier les facteurs et les effets de la recherche collaborative d'informations et adapter un cadre conceptuel pour l'analyse de l'environnement (identifié comme le cadre a priori le plus approprié) au contexte collaboratif.

Étude 2: Identifier et comprendre les facteurs et les effets de la veille collaborative du point de vue des parties prenantes de la RAP engagées dans un système innovant de veille collaborative appelé eSRAP.

Méthodologies

Étude 1: Une revue systématique mixte et une synthèse des cadres conceptuels ont été réalisées. Les données extraites des études incluses ont été codées selon le cadre conceptuel défini a priori et de nouveaux thèmes ont été générés à partir des données (synthèse thématique déductive-inductive).

Étude 2: À partir du cadre conceptuel de l'étude 1, une étude qualitative de cas multiples a été menée. Un cas a été défini comme un projet eSRAP implanté et impliquant des membres intéressés par la veille sur le même sujet. Les données ont été collectées par des entretiens

individuels semi-structurés, triangulées avec des informations sur le projet (les stratégies de recherche et les critères de sélection de chaque projet eSRAP) et les registres du système eSRAP. Les données ont été analysées selon une analyse thématique déductive-inductive en deux étapes: une analyse intra-cas suivie d'une analyse inter-cas.

Résultats et discussion

Étude 1 : Un total de 51 études ont été retenues dans la revue systématique. Le cadre conceptuel résultant explique la recherche collaborative d'informations et comprend sept types de facteurs (personnel, groupe, organisation, environnement informationnel, sources d'information, système, tâche) et cinq types d'effets (performance, comportemental, cognitif, affectif, relationnel).

Étude 2 : L'étude de cas multiples comprenait sept cas représentant quatre types de cas : (1) veille collaborative avec eSRAP, (2) veille collaborative sans eSRAP, (3) veille individuelle avec eSRAP, (4) pas de veille et pas d'utilisation d'eSRAP. L'étude a confirmé les facteurs et les effets identifiés dans l'étude 1. Aussi, de nouveaux sous-thèmes liés à la veille collaborative ont été identifiés (19 pour les facteurs et 12 pour les effets). L'analyse inter-cas a identifié des sous-thèmes spécifiques aux cas correspondant à une veille collaborative avec et sans eSRAP.

Cette recherche contribue de manière originale aux connaissances sur la recherche et la veille d'informations collaborative. De plus, elle offre des recommandations pratiques pour la mise en œuvre, le soutien et l'évaluation des projets collaboratifs. Elle peut aider les intervenants et les chercheurs à se tenir à jour grâce à la collaboration.

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List of Abbreviations

CAS – Current Awareness Services

CIM – Collaborative Information Monitoring

CIS – Collaborative Information Seeking

CSCW – Computer-Supported Cooperative Work

eSRAP – eStratégie de recherche axée sur le patient (SRAP), translated from French as electronic Strategy for Patient Oriented Research

LIS – Library and Information Science

POR – Patient Oriented Research

SDI – Selective Dissemination of Information

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Preface

Contribution of Authors

This manuscript-based dissertation includes three manuscripts, constituting Chapters 3, 4, and 5. While I benefited from the invaluable constructive feedback and guidance of my thesis committee, the three manuscripts, as well as this thesis, are my original scholarship and solely my own writing. I was responsible for conceiving the thesis and the research design, as well as data collection, analysis, interpretation of findings, and writing the manuscripts. All co-authors read, reviewed, and approved the final versions of the manuscripts and permitted the manuscripts' inclusion in this thesis.

Manuscripts 1 and 2 in this thesis have been published in the *Journal of the Association for Information Science and Technology* and the *Education for Information* journal, respectively. Manuscript 3 is formatted and ready for submission to the *Journal of the Association for Information Science and Technology.* Below is the detailed breakdown of co-authors' contributions for each manuscript.

Manuscript 1 – Chapter 3

Granikov V, El Sherif R, Bouthillier F, & Pluye P. (2022). Factors and outcomes of collaborative information seeking: A mixed studies review with a framework synthesis. *Journal of the Association for Information Science and Technology,* 73(4): 542-560.

I conceived, planned, and carried out the systematic literature review and framework synthesis, with consultation and feedback provided by co-authors and doctoral co-supervisors, Bouthillier and Pluye. I conducted all data collection and analysis. As the independent second reviewer, El Sherif participated in screening the bibliographic records and full text articles. She also checked the coding for 30% of the included studies. I wrote and edited the manuscript, with feedback from all three co-authors. In addition, feedback on an earlier version of the manuscript was provided by three anonymous peer reviewers from the journal.

Manuscript 2 – Chapter 4

Granikov V, Bouthillier F, Pluye P. (2020). Understanding collaboration in monitoring research publications: Protocol for a qualitative multiple case study. *Education for Information, 36*(1): 69-79.

I conceived, developed, and wrote the manuscript. My doctoral co-supervisors, Bouthillier and Pluye provided feedback on research design and commented the manuscript. In addition, feedback on an earlier version was provided by the editor from the journal.

Manuscript 3 – Chapter 5

Granikov V, Bouthillier F, & Pluye P. (To be submitted to the *Journal of the Association for Information Science and Technology*). Exploring the factors and outcomes of collaborative information monitoring: A multiple case study.

I conceived, planned, and conducted the qualitative multiple case study. Consultation and feedback concerning the research design was provided by Bouthillier and Pluye. I recruited participants, collected, organized, and analysed data from all included sources (interview, documents, archival records) with guidance from Bouthillier and Pluye. I wrote and edited the manuscript based on their feedback.

Statement of Originality and Contribution to Knowledge

The research described in this thesis represents an original contribution to knowledge on the factors and outcomes of collaboration in information monitoring, as well as on collaborative information seeking. Specifically, Manuscript 1 proposes a novel conceptual framework for collaborative information seeking. Moreover, the framework was developed based on a mixed studies review (a systematic literature review that includes quantitative, qualitative, and mixed methods studies) with a framework synthesis – approaches that are not commonly used in Library and Information Science (LIS) research.

Informed by the conceptual framework, Manuscript 2 reports a qualitative multiple case study that aimed to identify and understand the perceived factors and outcomes of collaborative information monitoring. The case study confirmed the types of factors and outcomes of collaborative information seeking in the context of collaborative information monitoring. Moreover, new sub-types of factors and outcomes related to collaborative information monitoring were generated.

Overall, important knowledge gaps were identified in the literature concerning limited research on collaborative information behaviour (vs. individual), information monitoring (vs. searching), and information outcomes. In addition, previous research investigations have not extended or bridged collaborative information seeking and collaborative information monitoring. This thesis reports original scholarship and provides conceptual, methodological, and practical contributions to knowledge.

Chapter 1. Introduction

Novel monitoring solutions are needed to help researchers keep up to date with the ever-increasing volume of scholarly publications. This thesis explores collaboration, or sharing the monitoring effort among group members, as a potential solution. Given that keeping up to date is intrinsic to doing research, yet remains challenging, the value of this thesis is in advancing knowledge on collaborative information monitoring, which may help overcome the challenges of keeping up to date.

In this chapter, I introduce the context of my doctoral research. First, I identify the problem and the research motivations – presenting the existing knowledge and the remaining knowledge gaps. Then, I state the research aims, objectives, and questions, followed by an overview of my research approach and research paradigms. Finally, I present the significance of my research and the structure of the dissertation.

1.1 Research Problem

Keeping up to date is fundamental across research disciplines and at all stages of the research process. To keep up to date, researchers engage in information monitoring and filtering. Information monitoring is a type of information seeking activity defined as maintaining awareness of developments in a field of interest by monitoring specific information sources (Ellis, 1989). In this context, information filtering refers to the process of discerning which information is relevant, and which is not (Pontis, Blandford, Greifeneder, Attalla, & Neal, 2017).

The most common challenges to keeping up to date are information overload, time constraints, and insufficient evaluation skills (Blummer & Kenton, 2014; Pain, 2016; Pontis et al., 2017). As the volume of information and the number of tools for keeping up to date continue to grow, researchers have little time to continuously monitor and filter scholarly articles. Consequently, they may access only a small selection of information resources, have little time to assess article quality, and not use available information monitoring services (Connaway, Dickey, & Radford, 2011; Savolainen, 2006). While librarian services and tools exist to monitor the scientific literature (e.g., table of contents or search alerts), some have suggested that the growing number of options only contributes to information overload (Barr, 2006). Based on anecdotal evidence from my experience of working with health researchers, many subscribe to such alerts, which end up accumulating in inboxes, often unopened.

Information filtering represents an additional challenge experienced by researchers in trying to keep up to date. In a recent study, researchers, regardless of seniority (i.e., research experience), identified filtering as a major difficulty, feeling like they had to read everything and sift through a lot of information to identify few relevant high-quality studies (Pontis et al., 2017). Indeed, given that the internet provides access to more information sources, greater discernment is necessary to know what to read in depth (Ollé & Borrego, 2010).

A potential solution to the challenges of keeping up to date may be in using collaboration to monitor and filter scientific literature (Adams, Blandford, Budd, & Bailey, 2005). Among researchers, collaboration is not only essential, but is also believed to have the potential to solve complex problems and lead to new knowledge discovery (Hara, Solomon, Kim, & Sonnenwald, 2003; Karamuftuoglu, 1998; Shah, 2014a; Sonnenwald, 2007). Peers and social connections, also referred to as the invisible college, are known to be valuable information sources and facilitators for keeping up to date – "human filters you trust" who "turn noise into signal" (Al Shboul & Abrizah, 2016; Bates, 2002; Choo, 2001; Dale, 2014, p. 200; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Talja, 2002; Wang, Dervos, Zhang, & Wu, 2007).

1.2 Research Motivation

Given the changing reality of internet access, internet use, proliferation of information and of networked environments, people increasingly more often look for information together or collaboratively. Simply put "if it is impossible to manage the whole information available on the internet alone, let us try to handle it together" (Francq, 2011, p. 3). While there is no consensus on one definition of collaborative information seeking (Shah, 2014a), at its core, it is a process of more than one person looking for information in collaboration with others and in pursuit of a shared goal (Morris & Teevan, 2010).

Collaborative information seeking may be influenced by several factors such as collaborators' individual characteristics (e.g., personal expertise, skills, or attitudes), their roles and relationships, group size, length of involvement, motivation, location, time, group structure, system support, cost and benefits of participation (Beamish, 2010; Morris & Teevan, 2010). In terms of outcomes, collaborative information seeking could lead to broader information coverage, collaborative filtering and validation of information, greater productivity, information discovery and learning (Morris & Teevan, 2010; Pontis et al., 2017; Shah, 2010b).

While research interest in collaborative information seeking is growing, several knowledge gaps remain. Most empirical studies and conceptual models in LIS focus on individual, rather than group or collaborative information behaviour (Foster, 2010; Hyldegård, 2006; Karunakaran, Reddy, & Spence, 2013; Reddy, Jansen, & Spence, 2010; Shah, 2014a). More knowledge is needed to define collaborative information seeking, its conceptual field, and how it should be studied (McNeese & Reddy, 2017).

There is also a need for more research to understand the context in which collaboration happens (or not), to assess the effectiveness of tools in supporting collaboration, and to develop guidance for evaluating the impact of collaboration (Shah, 2014b). Since group-based information behaviour such as collaborative information seeking is complex, various influencing factors need to be looked at more closely (Hyldegård, 2006; Shah, 2010a). Some unanswered questions are: How to engage participants in collaborative information seeking; how to encourage more active participation; are certain topics and scenarios better-suited for collaboration; and finally, how to evaluate the impact and innovation resulting from collaboration (Morris & Teevan, 2010).

Furthermore, collaboration in information monitoring has not been investigated (Shah, 2010). In other words, despite the growing literature on collaborative information seeking, research on collaborative information monitoring is still lacking. In addition, most LIS research studies investigate active searching behaviours rather than monitoring, which some consider passive (Attfield, Blandford, & Makri, 2010; Wang et al., 2007). Finally, an important gap in LIS research is related to a lack of studies on information outcomes. For example, an analysis of 1,391 journal articles, representing 915 empirical studies, published between 1950 and 2012, demonstrated that only 8% studied information outcomes, defined as "what happens after information is found or received […] effects, such as a change in knowledge or emotional state, or an action or decision based on the information" (Case & O'Connor, 2016, p. 653).

In summary, the following general and specific gaps in the current literature motivated the research presented in this thesis:

- Limited research on collaborative information seeking (vs. individual seeking);
- Limited research on information monitoring (vs. active searching);
- Limited research on information outcomes;
- Lack of research bridging knowledge on collaborative information seeking with collaborative information monitoring.

Therefore, if collaboration could make a difference, helping researchers and professionals keep up to date, it is important to understand the influencing factors (i.e., barriers and facilitators), as well as the potential outcomes.

1.3 Research Context

Monitoring multidisciplinary fields with a 'high field scatter' is particularly challenging (Bates, 1996; Pontis et al., 2017). One such example is Patient Oriented Research (POR) (Canadian Institutes of Health Reasearch, 2017). POR is meant to be multidisciplinary and collaborative – conducted in partnership with researchers, patients, health professionals, and health system decision-makers (hereinafter referred to as POR stakeholders). Consequently, the diverse experiences and levels of research expertise among POR stakeholders may present additional barriers to keeping up to date with scholarly publications, which in turn would make finding solutions more valuable.

To help POR stakeholders, in 2016, the Unité de soutien SSA ("Système de Santé Apprenant", i.e., Learning Health System) Québec developed and implemented a collaborative research trend monitoring system called eSRAP. eSRAP stands for "eStratégie de recherche axée sur le patient" (SRAP), which translates from French as electronic Strategy for POR. eSRAP is an online platform designed to help groups identify and select new relevant publications by optimizing and sharing the monitoring efforts among group members (see Chapter 4 for more details). A monitoring project in eSRAP consists of a tailored bibliographic search strategy and screening criteria. Typically, the search strategy and the screening criteria are developed by the group leader, in consultation with group members, and sometimes with assistance from a specialized librarian. Once a monitoring project is set up, based on the search strategy, bibliographic records (i.e., research article abstracts and supporting information) automatically populate the eSRAP project as they become indexed in a bibliographic database. System users then share the ongoing tasks of reading and screening (i.e., filtering) new records using the pre-determined selection criteria. Potentially, group members benefit from a reduced individual workload and peer-based identification of relevant records, which can be consulted in eSRAP or exported from eSRAP as a spreadsheet.

1.4 Researcher's Pre-understanding

Personal knowledge, experiences, and background influence our choice of research questions, research design and methods, as well as how we interpret the findings (Patton, 2002). It is therefore important to be aware of our pre-understanding and clarify our positionality, which in turn contributes to our reflexivity as researchers (Lincoln, Lynham, & Guba, 2018).

I came to doctoral studies after eight years of working as an embedded information professional in patient oriented research. Most research projects I worked on involved collaboration, information sharing, and employed participatory research approaches. I have also met many researchers, health professionals, and students, who struggled with too much to do, too much information, and not enough time. Most of them were skilled both when it came to new technologies and to searching for information. For example, to keep up to date, they subscribed to various alerting services (e.g., search alerts, citation alerts, table of content alerts). Some even created dedicated email accounts where all these alerts went, and where they stayed, often never opened. It became apparent to me that keeping up to date was a major 'pain point' in the words of Pontis et al. (2017). Based on my prior experience and readings, collaboration seemed like a possible solution to overcome the challenges of keeping up to date, which could also lead to additional unanticipated outcomes. This research came from a desire to explore collaboration in keeping up to date and to understand its influencing factors and potential outcomes.

1.5 Research Objectives and Questions

My research builds on the potential of collaboration to overcome the challenges of keeping up to date, addressing the need for more knowledge on collaborative information monitoring. Specifically, the purpose of this research is to identify and understand the factors and outcomes of collaborative information monitoring from the perspective of POR stakeholders who implemented a monitoring project using eSRAP (hereinafter referred to as eSRAP members). The eSRAP system is used to select and "bound" the cases to be investigated but is not evaluated as a software artefact. In line with user studies, this investigation includes users, non-users, and potential users, as well as potential uses of the system.

For the purpose of this thesis, collaborative information monitoring is defined as intentional (i.e., purposeful) information monitoring activities pursued by a group of members (i.e., two or more), who explicitly share an information need (i.e., research interest) and who actively intend to collaborate (i.e., not implicit algorithmically based collaboration such as with recommender

systems). In the context of eSRAP, members are meant to collaborate in monitoring and filtering new scholarly publications to discover those that are relevant to their research interests.

As discussed in the Research Motivation section, more knowledge is needed on information monitoring and collaborative behaviours in general, as well as information-related outcomes. Specifically, we need more research that investigates collaboration in information monitoring, its influencing factors, and outcomes. Informed by the research problem and the knowledge gaps, my research objectives and questions are presented in Table 1.

Table 1. Research Objectives, Research Questions, and Approaches

Research Objective	**Research Question (RQ)**	**Approach**
Adapt an existing conceptual model to a collaborative context	(RQ1) Based on the literature, what are the factors and outcomes of collaborative information seeking?	Mixed studies review with a framework synthesis
Identify the influencing factors and outcomes of collaborative information monitoring	(RQ2) How do eSRAP members engage in collaborative information monitoring for keeping keep up to date? (RQ3) What factors influence collaborative information monitoring from the perspective of eSRAP members? (RQ4) What are the outcomes (actual or anticipated) of collaborative information monitoring from the perspective of eSRAP members?	Qualitative multiple case study

1.6 Research Approach

My thesis contributes to LIS research by offering new knowledge and conceptual understanding of the factors and outcomes of collaborative information seeking and monitoring. To answer the research questions, I conducted a mixed studies review with a framework synthesis (Chapter 3, Manuscript 1), and a qualitative multiple case study (Chapter 5, Manuscript 3).

1.6.1 Framework Synthesis

Given that collaborative information behaviours are complex phenomena and empirical research in information science typically involves quantitative, qualitative and mixed methods, the mixed studies review approach (i.e., a systematic review that includes quantitative, qualitative, and mixed methods studies in the synthesis) was deemed appropriate (Hong, Pluye, Bujold, & Wassef, 2017; Pluye & Hong, 2014; Pluye, Hong, Bush, & Vedel, 2016).

The 'best fit' framework synthesis method, a type of qualitative synthesis, is an appropriate choice for this review, given the importance of themes and concepts to understanding collaborative information monitoring (Carroll, Booth, Leaviss, & Rick, 2013). This method was chosen for two reasons. First, there was no current framework that was appropriate for collaborative information monitoring, but there was a 'best fit' candidate framework for environmental scanning proposed by Choo et al. (2001), which could be adapted. While Choo's framework identifies three types of factors influencing environmental scanning, it does not specifically include factors related to collaboration. Second, given the considerable number of existing information seeking models and frameworks (Case & Given, 2016), the goal of the framework synthesis was to use a systematic and replicable method to build upon an existing framework, and revise or adapt it for a new context (i.e., collaborative monitoring).

1.6.2 Qualitative Multiple Case Study

The study of collaborative information seeking and collaborative information monitoring is complex. In addition to the interaction between the user, the information, and the system, there is also the interaction between users, which may lead to new or different information seeking processes and behaviours (Shah, 2014b). Qualitative methodology and the constructivist paradigm constitute an appropriate approach, as they recognize the importance of context and its role in understanding the meanings of human behaviour (Braun & Clarke, 2013).

By using a qualitative multiple case approach, I examined collaborative information monitoring in seven groups of POR stakeholders (i.e., cases) who implemented an eSRAP project to keep up with new publications in their fields. This research approach helped me gain an in-depth understanding of the actual and potential factors and outcomes of collaborative information monitoring.

1.7. Research Paradigms

My thesis, being problem-centered and focusing on the 'multiple meanings of participants' (Creswell & Plano Clark, 2018), is informed by pragmatist and constructivist research paradigms. In this subsection, I discuss the two paradigms, present the basic ideas related to the paradigms, and describe how they shaped my research approach.

A research paradigm refers to "general philosophical orientation about the world and the nature of research that a researcher brings to a study" (Creswell & Plano Clark, 2018, p. 5). That is to say, a research paradigm consists of a set of fundamental philosophical assumptions of reality, values, and beliefs held by the researcher(s) and which shape how research is conducted (Kuhn, 2012). The discussion of research paradigms often includes epistemological (i.e., how knowledge is constructed), ontological (i.e., how reality is understood/perceived), axiological (i.e., what is valued) and methodological (e.g., qualitative, quantitative, mixed methods) assumptions.

1.7.1 Pragmatism

The pragmatic paradigm is problem-centered and real-world practice oriented (Creswell & Creswell, 2018). This paradigm focuses on the research problems and questions that arise out of practical real-world problems and uses the most appropriate research approaches to find solutions to the problems. Therefore, in terms of methodology, pragmatism is "not committed to any one system of philosophy and reality" and researchers can use the research methods that best match their research purpose and research questions (Biesta & Burbules, 2003; Creswell & Creswell, 2018, p. 10; Patton, 2014).

In terms of the epistemological and ontological assumptions of pragmatism, knowledge is constructed and understood through our (people's) interactions with the environment (i.e., specific contexts). Thus, pragmatism recognizes the integral role of the environment (e.g., physical and social contexts, culture, language) in our lives, as well as the intrinsic connection between the experience of individuals and knowledge (Biesta & Burbules, 2003; Johnson & Onwuegbuzie, 2004). In other words, our experience leads to both building knowledge and understanding the world (i.e., reality) (Hildebrand, 2011). In terms of axiology, research is seen as being value-laden with a focus on being practical (Lincoln, Lynham, & Guba, 2018).

In addition to the research problem and the questions guiding my research, the underlying principles of pragmatism are aligned with my research focus (i.e., collaboration in information monitoring), as well as my research participants (i.e., POR stakeholders). In a recent publication,

Allemang, Sitter, and Dimitropoulos (2022) argued that the pragmatic paradigm is appropriate for POR because of its' pluralist view of life, which is characterised by participation, discussion, cooperation, and different perspectives. These same elements are at the heart of collaboration. Moreover, pragmatism's recognition of the importance of local contexts (in which problems occur) fits with the important role of context in collaborative information seeking (Morgan, 2014; Spence, 2013). Thus, pragmatism's emphasis on solving real-world problems, as defined by the communities within which these occur (Allemang et al., 2022), makes it a fitting approach to guide my research and enhances the overall coherence of this thesis.

According to John Dewey, one of the founders of pragmatism, scientific inquiry must arise out of actual conditions or problems experienced by individuals, in order not to be false or artificially determined by the researcher (i.e., inquirer) (Allemang et al., 2022; Dewey, 1982). In line with this view, my research is motivated by and addresses the practical challenges experienced by POR stakeholders trying to keep up to date (i.e., problems arising from practice). Having worked as a research-embedded information specialist prior to joining the doctoral program, I have witnessed many researchers, trainees, and health professionals, who struggled with the ever-increasing volume of scholarly publications.

1.7.2 Constructivism

The second paradigm guiding my work is constructivism, typically associated with qualitative research. Constructivists believe that individuals make sense of the world in which they live based on their individual perspectives (Crotty, 1998). Given this belief, researchers should seek a multitude of (participants') views on the phenomenon being studied, as well as an understanding of the participants' context (Creswell & Creswell, 2018).

The ontological assumption of the constructivist paradigm is that there are multiple constructed realities in people's minds that cannot exist outside the social contexts that create them (Lincoln & Guba, 1985). The epistemological assumption is that "knowledge is known through the subjective experiences of people" (Creswell, 2007, p. 20). Studies should be conducted in the natural setting where people live and work (i.e., field), with the researcher interacting closely with those being studied (i.e., researcher as key instrument), and collecting multiple forms of qualitative data (Creswell, 2007; Gorman, Clayton, Shep, & Clayton, 2005). Qualitative methodology is described as "inductive, emerging, and shaped by the researcher's experience in collecting and analyzing data" (Creswell, 2007, p. 22). In other words, subjectivity in the research process is not

only inevitable, but at the core of constructivist research (Lincoln & Guba, 1985). Finally, in terms of axiology, research is seen as being value-laden with a focus on being contextual (Lincoln et al., 2018).

1.8 Significance of the Research

The research presented in this dissertation contributes to scientific knowledge and practice in LIS and is potentially transferable to other areas. My research questions are meaningful to researchers investigating collaborative information seeking and collaborative information monitoring, information professionals providing monitoring services and looking for solutions to overcome the challenges of keeping up to date, team leaders implementing and supporting collaborative projects, system designers, and all those training the next generations of researchers and professionals who will need to keep up to date. Overall, my contributions to knowledge are conceptual, methodological, and practical.

1.8.1 Conceptual Contributions

More knowledge is needed on collaborative information seeking and specifically on collaborative information monitoring. Using a framework synthesis, I adapted an existing framework of environmental scanning to propose a novel framework of collaborative information seeking applicable to collaborative monitoring. Moreover, this thesis contributes new knowledge on the factors and mechanisms influencing collaboration during information seeking and monitoring, going beyond designing technology, and evaluating collaboration outcomes and specific processes (e.g., making relevance judgements by a group) (Foster, 2006; Hyldegård, 2006; Reddy et al., 2010; Shah, 2010a, 2014a). My findings offer needed insights on how to encourage or sustain participation in collaborative information monitoring and how to evaluate the impact and innovation resulting from it (Morris & Teevan, 2010).

1.8.2 Methodological Contributions

The methods used in this research are innovative in LIS. While case studies are common, systematic literature reviews remain rare in LIS research (Koufogiannakis, 2012a; Xu, Kang, & Song, 2015). LIS reviews that use the framework synthesis technique are even more rare. Therefore, this framework synthesis is valuable as it provides a systematic, replicable, and transparent example for conducting future syntheses in LIS.

1.8.3 Practical Contributions

Finally, this research contributes to practice, as it offers potential solutions that are useful to researchers who struggle with monitoring trends in their fields, as well as information professionals who support researchers and provide current awareness services. In other words, this thesis can contribute to evidence-based library and information practice (Eldredge, 2014). Finally, collaborative information monitoring has the potential to save time and enable multidisciplinary teams of POR stakeholders to keep up to date with research trends, contributing to the advancement of POR, evidence-informed health practices, and learning health systems.

1.9 Dissertation Structure

This dissertation is organized in seven chapters. The remaining chapters are organized as follows:

- Chapter 2: Literature Review provides an overview of the current literature on keeping up to date, especially by researchers, information monitoring, information filtering, and collaboration in research.
- Chapter 3: Manuscript 1 presents a conceptual framework of collaborative information seeking that is transferable to collaborative information monitoring. The framework is the result of a systematic mixed studies review and a framework synthesis.
- Chapter 4: Manuscript 2 describes and justifies the methodology (i.e., qualitative multiple case study) and methods used (i.e., setting, recruitment and sampling, data collection, data preparation, and data analysis), as well as the ethical considerations.
- Chapter 5: Manuscript 3 presents the methods and the findings of the multiple case study.
- Chapter 6: Discussion situates the research findings in existing literature, reflects on the strengths, the challenges, and the limitations of this thesis.
- Chapter 7: Conclusion presents a broad summary of the findings in relation to the aim of this research, offers directions for future research, as well as concluding remarks.

The manuscripts presented in Chapters 3, 4, 5 were prepared as independent manuscripts and transitions sections were added to bridge them. Each chapter was written according to the thesis preparation, formatting, and submission guidelines of McGill's Graduate and Postdoctoral Studies Office.

Chapter 2. Literature Review

The challenges associated with keeping up to date are not new (Hensley, Savage, Sowarby, & Resnick, 1962; Housman & Kaskela, 1970). Back in the 1960s, 47% of participants in an interview study reported lack of time or knowledge of information sources as key barriers to keeping up with current information, hoping for "some sort of system which notifies persons of information without requiring much individual effort" (Hensley et al., 1962, p. 57). In fact, the challenges of keeping up to date are becoming exacerbated due to the exponential growth of scientific publications (Bornmann & Mutz, 2015). The number of journals and articles continue to grow while researchers and other knowledge users continue to face information overload (Jinha, 2010). With the pandemic, researchers who studied Covid-19 described simply drowning in the flood of new scientific papers (Brainard, 2020). As an illustration, LitCovid, a curated hub for scientific information about Covid-19 from the National Library of Medicine, contained 284,150 PubMed articles on August 31, 2022. What is becoming apparent based on anecdotal evidence – there is "way too much, and impossible to keep up with" (Matthews, 2021, p. 141).

Traditionally, to help researchers keep up with current information, librarians and information specialists developed current awareness services (CAS), which alerted users to new information (Blummer & Kenton, 2014; Fourie, 2006; Mahesh & Gupta, 2008). Today, library-mediated CAS are less common. Instead, most academic libraries offer library guides on CAS, directing researchers and trainees to various online tools and services (e.g., table of contents or search alerts). At the same time, new software tools such as recommender systems are becoming available (Bobadilla, Hernando, Ortega, & Bernal, 2011). However, some argue that the growing number of tools may further contribute to our overall sense of information overload (Barr, 2006). In a recent study, after investigating how academic researchers keep up to date, Pontis et al. (2017) concluded that new and innovative solutions are needed, other than just additional digital tools.

Collaboration in information monitoring could be one such solution and is the focus of this thesis. This Literature Review chapter is organized as follows. In Section 2.1, I begin by situating information monitoring, a type of information seeking activity in which researchers engage to keep up to date, in the larger research area of information seeking behaviour. In Section 2.2, I discuss relevance and information filtering, which is related to monitoring. Since this thesis is in the LIS discipline, in Section 2.3, I overview the history and literature on CAS, often provided by librarians, which play(ed) an important role in helping researchers keep up to date. The focus of

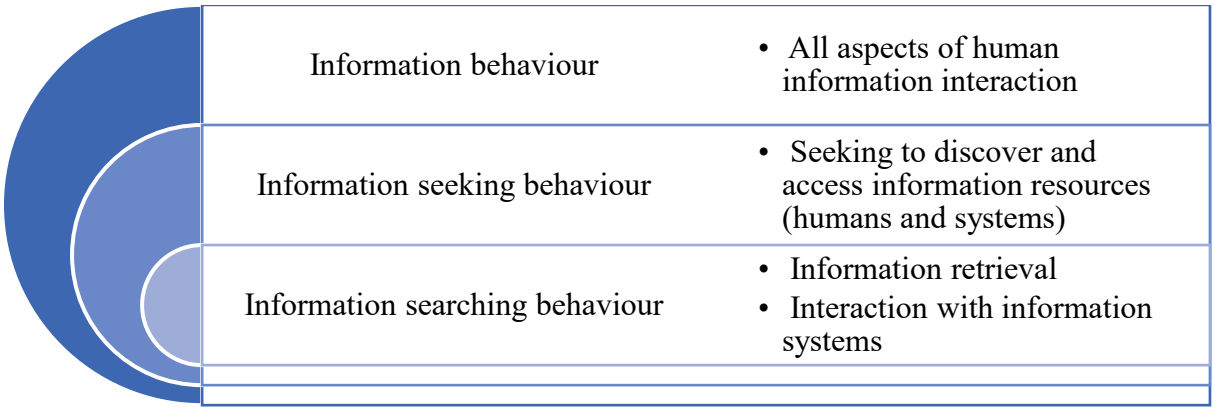
Section 2.4 is on what information monitoring and keeping up to date looks like in practice, as it is experienced by researchers in general, and health researchers specifically. I present the channels and sources researchers use, the factors that influence their monitoring behaviour, and the perceived value of keeping up to date. To conclude, in Section 2.5, I set up the stage for collaboration as a potential solution to overcoming the challenges of information monitoring and keeping up to date. The literature on collaborative information seeking is explored in detail in the following chapter, Chapter 3.

2.1 Situating Information Monitoring

2.1.1 Information Behaviour and Information Seeking

This research fits within the information behaviour subfield in information science research. Wilson defines information behaviour as "the totality of human behaviour in relation to sources and channels of information, including both active and passive information seeking, and information use" (Wilson, 1999, p. 92). Case and Given (2016) complement Wilson's definition by saying that information behaviour "encompasses information seeking as well as the totality of other unintentional or serendipitous behaviors (such as glimpsing or encountering information), as well as purposive behavior that do not involve seeking, such as actively avoiding information" (p. 6). Information behaviour is thus a meta-concept and can be sub-divided into three nested 'conceptual areas': information behaviour, information seeking behaviour, and information searching behaviour (Wilson, 1999) (See Figure 1).

Figure 1. Nested Model of Information Behaviour



Information behaviour can occur at the level of individuals, groups, or society at large (Bates, 2010). However, most empirical studies and conceptual models in LIS focus on individual

rather than group or collaborative behaviour (Hyldegård, 2006; Karunakaran, Reddy, & Spence, 2013; Reddy et al., 2010; Shah, 2014a). In fact, in 1980 and most of 1990s, information seeking studies focused almost exclusively on individual behaviour, a trend that began to change with the widespread use of the internet (Foster, 2010).

Research on information behaviour can be "broadly defined as that which is concerned with information seeking, determining people's information needs, and information use" (Julien & Duggan, 2000, p. 291). While thousands of publications focus on human information behaviour, and this body of literature continues to grow (Chowdhury & Chowdhury, 2011), information behaviour research is still considered to be in a "modeling" or pre-theoretical stage (Savolainen, 2017). There are many information behaviour models, but few theories that can be used to explain and predict behaviour.

Information seeking is a subset of information behaviour. It is the most used term and is also the focus of most information behaviour research (Case & Given, 2016). Information seeking could be summarised as a user perceiving an information need, who will then interact with a formal or an informal source of information, to successfully locate (or not) a relevant piece of information, and potentially use this information. Each information seeking stage is influenced by cognitive, affective, and situational factors (Choo, Detlor, & Turnbull, 2000b; Wilson, 1999). Unlike information retrieval, information seeking is considered to be "human-oriented and open ended" due to the centrality of the seeker and the dynamic nature of information needs, which may evolve or even change completely as new information is discovered (Choo et al., 2000b; Marchionini, 1995, pp. 5-6).

2.1.2 Monitoring and the Model of Information Seeking Behaviour by David Ellis

A valuable starting point for conceptualizing and investigating information monitoring comes from the work of David Ellis. Being interested in the behavioural aspects of information seeking, Ellis was looking for an alternative to quantitative research, striving to propose an integrated view and an "authentic picture" of researchers' perceptions and information seeking activities (Ellis, 1993, p. 469). He used the grounded theory approach to study information seeking behaviour of social scientists (Ellis, 1989), academic researchers (Ellis, 1993), chemists and physicists (Ellis, Cox, & Hall, 1993), and engineers and industrial research scientists (Ellis & Haugan, 1997).

Ellis's model describes individual information behavior with eight generic types of seeking characteristics (i.e., activities): starting, chaining, browsing, differentiating, monitoring, differentiating, extracting, verifying, and ending (see Table 2). His work fits within the cognitive approach to study information behaviour, as it focuses on the individual and how she/he/they "thinks and behaves in response to an information need" (Pettigrew, Fidel, & Bruce, 2000, p. 47). Although the identified information seeking characteristics differ slightly across user groups, Ellis felt confident that the information seeking behaviours of social scientists and scientists are not significantly different, and that the difference lies in the emphasis (i.e. which activity is important and when) (Ellis et al., 1993).

What differentiates Ellis's model from others, is that it does not represent a linear set of information seeking steps. In his own words, the model "consists of a set of related categories that, taken together, can be used to describe or explain the components of the patterns" (Ellis, 1993, p. 482). The aim was not to explore the interactions or the relationships between categories, nor the order in which they are carried out. "The exact relationship of the features of the models depends upon the circumstances associated with the information seeking behaviour of a particular individual at a particular time" (Ellis et al., 1993, p. 359).

Table 2. Characteristics of Information Seeking Behaviour of Social Scientists (Ellis, 1989; Ellis et al., 1993)

Characteristic (activity)	**Explanation**
Starting	Initial search for information, often triggered by a key paper
Chaining	Following referential connections (i.e., citation linkages) between materials
Browsing	Semi-directed or semi-focused searching in an area of potential interest
Differentiating	Comparing sources to assess nature, coverage, and quality of material
Monitoring	Monitoring information in field of interest to stay up-to-date (e.g. using current awareness services)
Extracting	Systematically identifying relevant material
Verifying	Checking the accuracy of information
Ending	Searching at the end of a project (e.g., checking for recent articles while preparing a publication)

A recognized strength of Ellis's work is his methodology, as many information seeking studies are conducted in isolation and are not comparable (Robson & Robinson, 2013). By using the grounded theory approach, each time he developed a new "model" (with a different user group), new findings could be easily compared to, and correlated with, the original study because of shared objectives, methodologies, and definitions. However, Ellis's model has been criticized for not considering crucial factors affecting information seeking behavior such as user's information needs, perceived knowledge gaps, self-efficacy, mental processes, personality, and context (Case & Given, 2016; Järvelin & Wilson, 2003; Robson & Robinson, 2013).

To return to information monitoring, Ellis defined it as monitoring information in field of interest to stay up to date (e.g., using current awareness services). Numerous studies that aimed to validate and expand Ellis's model, especially in the era of the internet and electronic knowledge resources, confirmed the existence of monitoring as an important information seeking activity (Savolainen, 2017). One of the studies modifying Ellis's model is that of Bronstein (2007), who investigated the information seeking behaviour of Jewish Studies scholars. The key contribution of her work to that of Ellis', is organizing information seeking activities in phases aligned with research phases (Bronstein, 2007; Savolainen, 2017). In Bronstein's elaboration of the model, monitoring is part of a Current Awareness Phase, along with networking and citation tracking.

Networking was added as another information seeking activity by Meho and Tibbo (2003), who also validated and updated Ellis's model. Networking was defined as communicating and maintaining relationships with colleagues in similar research areas to gather and share information (Meho & Tibbo, 2003). The addition of networking, and its placement by Bronstein alongside monitoring, is significant as it highlights the importance of the social connections in current awareness, which will be addressed later in this chapter.

An additional elaboration of Ellis's model is that by Makri, Blandford, and Cox (2008), who observed the information seeking behaviour of academic lawyers to better understand it, and to provide system recommendations. As in other elaborations, Makri et al. reorganized Ellis's activities in categories. A significant difference of this elaboration that is relevant to information monitoring, is separating monitoring strategies into active (e.g., regularly conducting searches in specific sources or "pull") and passive ones (e.g., subscribing to alerts or "push"). In contrast,

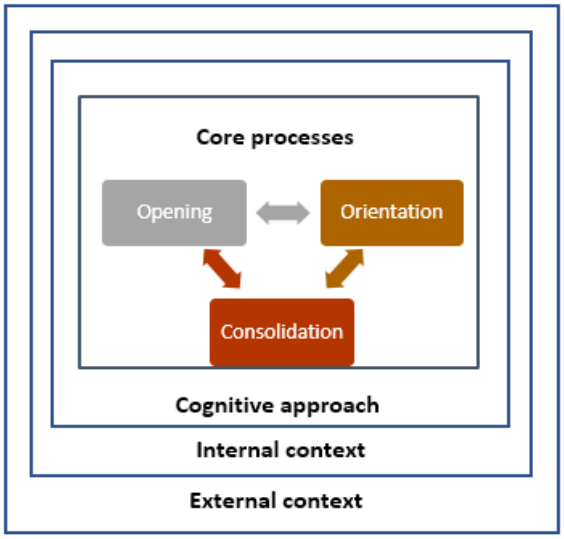
Ellis's monitoring was predominantly passive, for example, receiving regular summaries or alerts for recent additions from selected sources.

2.1.3 The Nonlinear Model of Information Seeking Behaviour by Allen Foster

Another model relevant to the study of information monitoring was developed by Foster (2004) by interviewing 45 interdisciplinary academic researchers. While Ellis investigated the behaviour of scholars and academics within the same discipline, information behaviour in interdisciplinary fields is known to be different, especially when it comes to monitoring (Bates, 1996; Foster, 2004). Foster's model is relevant to my research due to its focus on the information seeking behavior of interdisciplinary researchers, the addition of influencing factors (i.e., contexts), which were absent in Ellis's model, and the presence of monitoring and networking processes.

At the centre of Foster's model are three core processes: orientation, opening, and consolidation (See Figure 2). Of interest to the study of information monitoring is the 'opening' process, which represents the early steps of information seeking similar to Ellis's 'starting' (Ellis, 1993; Foster, 2004). Opening is relevant as it includes both monitoring and networking processes. In line with Ellis, monitoring was observed to be an ongoing process of returning to "fruit-bearing sources of information," which could be done either by accessing specific web sites (i.e., active/pull) or by subscribing to mailing lists (i.e., passive/push) (Foster, 2004, p. 234).

Figure 2. Nonlinear Model of Information-Seeking Behaviour (adapted from Foster, 2004)



In terms of networking, Forster's participants reported that social channels like conferences, colleagues, and research groups were critical for locating information and sources, especially when lacking time, having limited access to resources, and facing information overload (Foster, 2004). However, Foster also found that the outcomes of networking could be mixed since peers in a network can increase, as well as reduce, access to information resources. This opposite effect is perhaps more present in an interdisciplinary context as the backgrounds, disciplines, and status of collaborating individuals could be heterogeneous. This heterogeneity may also require interdisciplinary researchers to use more information sources and carry out more seeking activities in comparison to their peers from single disciplines (Foster, 2004).

The three core processes are in turn "embedded" in three contextual layers: cognitive approach, internal context, and external context, as seen in Figure 2. In contrast to Ellis, Foster recognised that information seeking is influenced by contextual interactions (Case & Given, 2016; Foster, 2004). The external context represents the seeker's social environment or the used information system. Internal context includes the feelings, thoughts, experience, prior knowledge, and understanding of the seeker. The cognitive approach refers to the seeker's mode of thinking, for example, being open, flexible, or holistic. Interaction with the internal context (e.g., prior knowledge) and cognitive approach (e.g., being "open to how this might fit in with their information need") plays an important role in making relevance judgements and filtering information (Foster, 2004, p. 233).

2.2 Relevance and Information Filtering

2.2.1 Relevance

"Knowing what information is needed is just as helpful as what information is not needed" (Choo, 1998, p. 28). This quote from Choo speaks to the importance of selecting information based on relevance judgements, also known as information filtering. Information relevance is based on users' judgments of the strength of the relationship between available information and an information need at a given point in time (Borlund, 2003; Schamber, Eisenberg, & Nilan, 1990). Thus, without a doubt, information filtering goes hand in hand with monitoring.

Relevance could be a property of the system or of the relationship between the user, their information need, and their environment (Cosijn & Ingwersen, 2000). System relevance is more objective, while user relevance is more subjective. Finally, similar to the concepts of information seeking and information needs, the concept of relevance is multidimensional and dynamic, as it is based on users' judgments of the strength of the relationship between information and information need at a given point in time (Borlund, 2003; Schamber et al., 1990). Commonly used relevance criteria are presented in Table 3.

Table 3. Common Relevance Evaluation Criteria (adapted from Barry & Schamber, 1998)

Criterion	Explanation
Depth/scope/specificity	Is information focused, detailed, specific to information need?
Accuracy/validity	Is information correct, valid?
Clarity	Is information clear?
Currency	Is information up to date?
Tangibility	Is information related to real tangible issues?
Quality of sources	Is information source reputable, reliable?
Accessibility	What effort is needed to access information?
Availability	Is information source available?
Verification	Is information consistent with other information (e.g., in this field)?
Affectiveness	What is user's emotional response to information (e.g., pleasure)?

Another way to evaluate the relevance of information is by considering its potential for immediate or future use. Information use may include making sense of a situation (i.e.,

enlightenment), understanding a particular problem (i.e., problem understanding), deciding what to do or how to do something (i.e., instrumental), determining facts (i.e., factual), confirming another piece of information (i.e., conformational), predicting the future (i.e., projective), and stimulating personal involvement (i.e., motivational) (Taylor, 1991). In other words, if the information may be used in one or more than one of the above-listed ways, it will be considered relevant.

2.2.2 Information Filtering

Information filtering can be a process or an information delivery system. As a process, it is often discussed along with information avoidance, as an effective strategy to overcome or diminish the perceived information overload (Savolainen, 2007). Filtering is a known challenge associated with information seeking by scholars and academics. One example is a qualitative study by Ollé and Borrego (2010) on the impact of electronic journals on information behavior of academic researchers in Catalan universities. Given that the internet allows scholars to access more journals and a bigger variety of sources, they read more, but the reading is also more superficial (Ollé & Borrego, 2010). Greater "discrimination" is needed to know what to read in depth, making filtering the bigger challenge of keeping up to date (Ollé & Borrego, 2010). These findings were confirmed in a more recent study, where researchers, regardless of seniority, identified filtering as a major 'pain point,' feeling like they had to read everything and sift through a lot of information to identify few relevant high-quality studies (Pontis et al., 2017).

Information filtering, as an information delivery system, can have several forms. An early example, which is inherently tied to information monitoring and current awareness, is Selective Dissemination of Information (SDI) systems (Deardorff & Garrison, 1997; Fourie, 2006). SDI is defined as a "computerized method to provide for the effective flow of technical information among scientific workers" (Housman & Kaskela, 1970, p. 78). The purpose of an SDI system is to select potentially relevant information items based on user interests, with the ultimate goal to "continuously improve the scientists' ability to make day-to-day decisions" (Housman & Kaskela, 1970, p. 79). To operationalize this, profiles consisting of keywords were created for both system users and current information items. Potentially relevant information items were identified by the system when the profiles matched; the user was then notified, usually by receiving a hard copy of the list (Hensley et al., 1962; Schlembach, 2001).

One current example of information filtering are automated recommender systems. Some recommender systems use content-based filtering, where information items are matched against user profiles, just like in the SDI systems. Alternatively, recommender systems use collaborative filtering, where personalized recommendations are made to users based on information (e.g., aggregated ratings) provided by other users (Bobadilla et al., 2011; Maltz & Ehrlich, 1995).

Another example of information filtering is content curation. Using social media and blogs as its main tools, the purpose of curation is to "connect users to selected content, rather than to everything" (Ovadia, 2013, p. 59). Domain experts and/or networks are mobilized to interpret, validate, and share their insight on given information, functioning as "human filters you trust" needed to "turn noise into signal" (Dale, 2014, p. 200). In the context of researchers keeping up to date, insufficient appraisal skills or lack of familiarity with a research domain have been identified not only as barriers but as major 'pain points' (Pontis et al., 2017). Thus, curated content, filtered and validated by more experienced peers or entire networks, may help researchers to overcome some of the challenges related to evaluating information.

2.3. Current Awareness Services

2.3.1 What Are Current Awareness Services?

Current information refers to information made available for the first time; current awareness refers to keeping up with and being aware of current information (Fourie, 2006). In turn, Current Awareness Services (CAS) can be defined as "services which will alert users to new information (usually concentrating on published material) and will then support this current awareness by providing direct links to article supply mechanisms" (Brunskill, 1997, p. 57). CAS can take different forms (e.g., service, system, publication), be specific (e.g., documents) or general (e.g., research trends or subject developments); can monitor diverse types of information (e.g., articles, books, websites), and is tailored to user needs (e.g., individual or group) who can be automatically notified when new information becomes available (Fourie, 2006).

CAS may be produced externally by commercial database producers or 'in-house' by librarians. According to Rowley (1994), the major advantage of an external CAS is that it can provide access to a larger pool of information (e.g., citations) than those available through the library. Meanwhile, in-house services are more labour intensive for library staff, but may provide

a more tailored product containing fewer results and lead to additional benefits by actively involving the library in researchers' activities (Brunskill, 1997; Rowley, 1994).

2.3.2 Early Examples of Current Awareness Services (Pre-2000)

The concept of CAS dates to the 1950s (Deardorff & Garrison, 1997; Fourie, 2006; Luhn, 1958). Before computers, librarians manually compiled potentially relevant material based on users' interests. For example, libray users were notified when new journal issues or books were acquired by the library (Schlembach, 2001). Other early examples of CAS included bulletins comprising titles, abstracts, and first pages of potentially relevant journal articles or tables of contents (TOC) of specific journals (Mahesh & Gupta, 2008; Schlembach, 2001).

In the 1970s, CAS became partially automated as librarians were able to search bibliographic files (Deardorff & Garrison, 1997). SDI is a key example of automated CAS and the two terms are sometimes used as synonyms (Deardorff & Garrison, 1997; Fourie, 2006). Many CAS initiatives were implemented and discussed in the 1970s, but fewer publications focused on CAS between the 1970s and the 1990s, even though librarians continued to offer these services (Rowley, 1994). The interest in CAS was revived in the 1990s with the proliferation of internet and email use, as well as online access to journals and full text articles (Schlembach, 2001). These technological changes enabled librarians to automate the process of searching, creating, and disseminating potentially relevant citations directly to the users (Deardorff & Garrison, 1997).

In addition to technological changes, CAS developed in parallel with the ever-growing volume of scholarly publications. Monitoring practices such as consulting a few key journals, interacting with colleagues, and being aware of new library acquisitions, were no longer sufficient after the 1950s as the number of publications grew at the same time as the interdisciplinarity of academic researchers (Deardorff & Garrison, 1997). In other words, researchers had to monitor more publications in their own discipline, as well as outside of it, which made keeping up to date more difficult and time-consuming (Butler, 1993).

2.3.3 Current Awareness Services Post-2000

Accessing journals online became an integral information seeking activity of academic researchers in the 21st century. This transition is important in the context of keeping up to date. Many publishers of electronic journals and databases offer CAS as a built-in value-added feature, thus, transforming CAS from a library-based information service to a publisher-based one (Mahesh

& Gupta, 2008; McKee, Koltutsky, & Vaska, 2009; Rowley, 2000). Most common examples of this type of CAS are TOC, keyword, citation, or search alerts (Mahesh & Gupta, 2008). In comparison to in-house CAS provided by librarians, journal-based CAS is timelier and can alert users to latest content in resources (i.e., journals) outside of library's subscriptions (Mahesh & Gupta, 2008; McKee et al., 2009).

Publisher-provided alerts are disseminated by email directly to the users. Some argue that email-based CAS exacerbates the flooding of users' inboxes "already brimming with unread items" (Johnson, Osmond, & Holz, 2009, p. 52) and further contributes to information overload (Attfield & Blandford, 2011; Barr, 2006). At the same time, some academic researchers prefer email delivery, despite the overload, suggesting that email alerts are more 'visible' and act as reminders (Neilson, 2008; Stacey, Wentzell, & Humphreys, 2010). An alternative to email-based CAS is RSS used to monitor latest content posted on websites and blogs, which are previously identified as relevant. The main benefit of RSS is that all news feeds are aggregated in one place outside the email inbox (Badman & Hartman, 2008; Barr, 2006; Farkas, 2011; Johnson et al., 2009; Neilson, 2008). Overall, given that CAS users have different interests, needs, and preferences, various tools and approaches are needed (Barr, 2006).

2.3.4 Perceived Value of Current Awareness Services

Detailed results on the effects of CAS (in this case SDI) on researchers' work was collected by Housman & Kaskela (1970). Participants reported having saved time in literature searching (69%), revealed other researchers working in the same field who later provided valuable information (34%), affected technical decisions (28%), increased productivity (27%), revealed duplication of effort (20%), reduced time required to complete a specific task (20%), indicated where additional work was required (14%), and changed the "course of work" (4%) (Housman & Kaskela, 1970, p. 79). Only 3% of SDI users in this study reported no SDI-associated benefits. Similar benefits were found in the study by Butler (1993), where interdisciplinary researchers using CAS reported saving time and identifying relevant publications that would have been missed otherwise.

In a more recent study, 60 academic staff and 31 graduate students from the University of Bath participated in an online survey on their preferences for keeping up to date (Stacey et al., 2010). Most respondents (76%) used TOC alerts received by email. The reported perceived benefits of alerts were ease of use, potential for serendipitous discovery (i.e., interesting

publications that could be missed in a search), link to full text, saving time, and identifying the latest relevant information (Stacey et al., 2010). On the other hand, the reported disadvantages of CAS were information overload, inbox clutter, gaps in what is monitored, and overall difficulty of fitting CAS-related activities into the workflow and workload (Stacey et al., 2010).

However, investigating the outcomes of information monitoring or keeping up to date presents several challenges. Assessment tends to be subjective; it is difficult to control for confounding variables, outcomes may be intangible, and outcomes may be long-term, requiring time to appear (Gainor & Bouthillier, 2014; Poll, 2012; Poll & Payne, 2006; Tenopir, 2011).

2.4 The 'How' of Keeping Up to Date: Sources and Other Factors

2.4.1 Sources Used by Researcher to Keep Up to Date

In a recent study, Pontis et al. (2017) interviewed 61 researchers to understand how they keep up to date with research trends. The majority of respondents agreed that this activity is "intrinsic to academia" and defined it as knowing relevant facts and papers to cite for theoretical background, knowing what others are doing, knowing latest advances and trends, knowing what has not been done yet (Pontis et al., 2017, p. 28). There is consensus in the literature on two main types of sources used for information monitoring and keeping up to date. These are formal and informal sources or channels (Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Wang et al., 2007).

Formal channels include 'hard sources' such as different publication types, while informal channels use 'soft sources' such as personal exchanges with colleagues, networking at conferences, etc. (Choo, 2001; Meho & Tibbo, 2003; Pontis et al., 2017). For formal sources, researchers may subscribe to email alerts (e.g., citation alerts) as described in the section on CAS. Receiving alerts to keep up to date is seen a fast and reliable. At the same time, it is labour-intensive, especially for those working in interdisciplinary fields who need to set up alerts in many different databases or journals (Stacey et al., 2010).

Others suggest that informal sources are in fact more important in the context of monitoring or scanning (Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Wang et al., 2007). For some, describing information obtained from informal sources such as peers, "the most important information is information that's not yet published" (Pontis et al., 2017, p. 29). Along similar lines, academic staff and graduate students in another

study reported that going to conferences is more efficient and timelier (Stacey et al., 2010). Just like journal publications, most conference presentations go through a rigorous peer-review process, but without the publication delay associated with journals (Wang et al., 2007). In other words, some information discoverable only through soft sources, like research peers, may be preferred.

Coming from a biological/anthropological perspective, Bates (2002) claims that individuals are more accustomed to finding needed information from their social milieu. Moreover, the 'social infrastructure' of people with shared interests and areas of knowledge is key to monitoring (Bates, 2002). In the context of researchers and academics, this concept is also referred to as the 'invisible college' which involves the exchange of ideas at conferences and through interpersonal communication (Al Shboul & Abrizah, 2016; Brown & Allison, 2014).

These findings and views are further supported by the work of Meho and Tibbo (2003), who in validating and updating Ellis's model of information seeking, identified networking, defined as communicating and maintaining relationships with colleagues to gather and share information, as an additional information seeking activity. Therefore, a study of information monitoring should consider networking activities and peers or community as important sources, and potentially influencing factors.

2.4.2 Factors Influencing How Researchers Keep Up to Date

Without doubt, information monitoring, like all information seeking behaviour, is dynamic, contextual, and differs between individual researchers, as well as research groups (Tenopir, King, Spencer, & Wu, 2009). Many factors influence the monitoring behaviour of researchers, which were studied and classified by LIS scholars in various ways. Often, studies focus on factors such as age, gender, subject discipline, work responsibilities, or the purpose of information activities (Tenopir et al., 2009). For example, in the study by Tenopir et al., (2009), self-reported data revealed that in comparison to other age groups, faculty members who were older than 60 years of age were the highest readers for the purpose of current awareness.

Related to age is the level of seniority and domain expertise. Junior researchers (i.e., PhD students) monitoring scholarly publications reported that it was difficult to identify which references were important to their field (Pontis et al., 2017). In the same study, mid-level participants (i.e., postdoctoral fellows) reported feeling that they had to read "everything that might

be relevant" as a result of having access to a growing number of publications and receiving many alerts, but not having a way to filter relevant from irrelevant ones (Pontis et al., 2017, p. 31).

Also interested in academic position, Kwon (2017) discovered that despite the challenges, the responsibility of gathering the literature to identify current trends was in fact given to junior researchers rather than those at the principal investigator level. Furthermore, principal investigators also engaged in scanning for research trends, but did so primarily by attending conferences (Kwon, 2017). In other words, depending on age and seniority, researchers may need different kinds of support and with different aspects of keeping up to date.

Another influencing factor is the subject discipline of the researchers. Tenopir et al. (2009) discovered that U.S. and Australian faculty in medicine and health disciplines engaged in reading of scholarly articles for the purpose of current awareness more often than any other speciality. At the same time, researchers in medicine are considered to be more inundated with scholarly literature than in other disciplines (Hemminger, Lu, Vaughan, & Adams, 2007).

The influence of subject discipline is particularly pronounced for researchers working in multi- and interdisciplinary fields, as demonstrated by important scholars in LIS (Bates, 1996; Foster, 2004). Such fields are characterized by a high 'field scatter,' meaning that the subject is not well defined, and the literature is not clearly organized. As a result, interdisciplinary scholars participate in more, and a different kind of information seeking (Bates, 1996). Specifically, monitoring the literature and keeping up to date is harder as potentially relevant citations can be found in several different fields of literature (Bates, 1996).

This is supported by findings of Pontis et al. (2017), showing that researchers working in well-defined fields with low scatter did not report difficulty with filtering relevant information to keep up to date. On the other hand, a participant from a high scatter field described their experience as follows: "That's a time issue. I don't pretend to do a very good job at it, partly because the things I'm interested in are so broad, it's extremely difficult to stay up to date in a comprehensive way. The biggest answer to it is I really don't stay up-to-date and it takes too much time." (Pontis et al., 2017, p. 31). As proposed by Bates (1996), subject discipline and field scatter are crucial factors to consider in developing information monitoring support for researchers.

Another way of organizing influencing factors is by dividing them into three categories: perceived personal situation, social context, and resource characteristics (Wang et al., 2007). Factors under perceived personal situation include time constraints, information overload,

availability, and convenience. These are major concerns for researchers, and as demonstrated with CAS-related studies difficult to overcome. In a study evaluating the implementation of an RSS services in a small special library, one participant described their situation as follows: "consumed with doing what must be done in order to stay afloat, and taking advantage of the current awareness posts was a luxury she could not afford" (Neilson, 2008, p. 64). Not surprisingly, information overload and time constraints are most frequently reported barriers by researchers in the context of keeping up to date (Attfield et al., 2010; Neilson, 2008; Pontis et al., 2017).

Availability and convenience are also important, and researchers prefer to get information in the most convenient and fast way, without paying (i.e., they are not paying directly, but access through the library) (Hemminger et al., 2007). Convenience could be what explains the popularity of Google Scholar which offers in single interface to search across databases and journals, access full text (depending on institutional subscriptions), and download citations to reference management software (Hemminger et al., 2007). This finding supports that of Talja et al. (2004), who found in an earlier study on the use and perceived usefulness of scholarly mailing lists that tools, which are not integrated with other existing systems, remain unused.

Factors associated with social context include a sense of trust (e.g., peer review process or known colleagues) and network (i.e., what others in the community are doing and using) (Wang et al., 2007). As demonstrated above, the social context, community, and networks of peers are invaluable in keeping up to date. With hard sources, such as journal publications or conference proceedings, trust is built and gained through the peer review process. Trust is also key to using soft sources for scholarly communication and information sharing (Kwon, 2017) and in content curation (Dale, 2014).

Finally, resource characteristics such as format, organization, focus, and usefulness also impact information monitoring practices of researchers, as demonstrated by studies evaluating CAS (Butler, 1993; Stacey et al., 2010). Perhaps, the most significant resource characteristic is customization. In the study by Butler (1993), surveyed faculty demonstrated different preferences: some preferred unfiltered references from specific journals, others were interested exclusively in hard-to-find publications, while others wanted results ranked by relevance or in a specific format. In other words, there may be not one solution or approach for information monitoring and keeping up to date, which fits all users' needs and preferences (Neilson, 2008).

2.5 Summary

Keeping up to date is an integral part of research practice, yet despite services provided by librarians or new information and communication technologies, researchers continue to face significant challenges to keep abreast of developments in their fields. In the context of information monitoring, current awareness, and content curation, participants across research studies and generations report that the social context, community, and networks of peers are key. They act both as valuable sources of current information, as well as factors facilitating information monitoring and filtering.

The literature review presented above sets the stage for investigating collaboration in the context of keeping up to date. As the first step, existing literature on collaboration in information monitoring must be reviewed. However, while much progress has been made in research on collaborative information seeking, collaborative information monitoring has not yet been studied much. Therefore, in the next chapter (Chapter 3), I focus on collaborative information seeking. I report a systematic mixed studies review (i.e., systematic review that synthesised results of quantitative, qualitative, and mixed methods studies) with a framework synthesis that allowed me to develop a conceptual framework of factors and outcomes of collaborative information seeking, which subsequently guided a qualitative multiple case study on collaborative information monitoring (Chapter 5).

Chapter 3. Factors and outcomes of collaborative information seeking: A mixed studies review with a framework synthesis – Manuscript 1

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Abstract

Despite being necessary, keeping up to date with new information and trends remains challenging in many fields due to information overload, time constraints, and insufficient evaluation skills. Collaboration, or sharing the effort among group members, may be a solution, but more knowledge is needed. To guide future research on the potential role of collaboration in keeping up to date, we conducted a systematic literature review with a framework synthesis aimed to adapt the conceptual framework for environmental scanning to a collaborative context. Our specific objectives were to identify the factors and outcomes of collaborative information seeking (CIS) and use them to propose an adapted conceptual framework. Fifty-one empirical studies were included and synthesized using a hybrid thematic synthesis. The adapted framework includes seven types of influencing factors and five types of outcomes. Our review contributes to the theoretical expansion of knowledge on CIS in general and provides a conceptual framework to study collaboration in keeping up to date. Overall, our findings will be useful to researchers, practitioners, team leaders, and system designers implementing and evaluating collaborative information projects.

Introduction

Back in 2009, Saracevic wrote, "although information is more accessible than 20 years ago, it is harder to get to the right information at a given time" (Saracevic, 2009, p. 2571). Indeed, this statement still applies to keeping up to date with new information. While recognized as essential across domains and professions, it remains a challenge due to information overload, time constraints, and lacking evaluation skills (Pain, 2016; Pontis et al., 2017). While services and tools exist, they are insufficient and may contribute to information overload (Attfield & Blandford, 2011; Barr, 2006; Pontis et al., 2017). More research is needed on overcoming the barriers of keeping up to date and solutions other than providing additional digital tools (Pontis et al., 2017).

Collaboration, or sharing the efforts among group members, is a potential solution (Fourie, 2006). Chirag Shah (2013) defined collaborative information seeking (CIS) as an interactive and mutually beneficial process, which includes searching, retrieving, browsing, sharing, assessing, and synthesizing information in collaboration with others. Potential outcomes of collaboration include broader information coverage, collaborative filtering and validation of information, and greater productivity (Morris & Teevan, 2010; Pontis et al., 2017). By collaborating, we may benefit from each other, develop a deeper understanding, discover and learn about information, which we may not when working alone (Shah, 2010b). While the body of research is growing (Case & Given, 2016; Foster, 2010; Hertzum & Hansen, 2019; Shah, 2014), more knowledge is needed to define CIS and its conceptual field and a closer look at the influencing factors and outcomes of CIS (Hertzum & Hansen, 2019; McNeese & Reddy, 2017; Morris & Teevan, 2010; Shah, 2010a).

This systematic review of quantitative, qualitative, and mixed methods studies (i.e., mixed studies review) is the first step toward exploring collaboration in keeping up to date. Specifically, we bridge the CIS literature with the conceptual framework for environmental scanning, a type of information-seeking behavior that refers to keeping up to date in organizational contexts (Choo, 2001). The review objectives are to (a) identify the factors and outcomes of CIS and (b) use the findings to adapt the framework for environmental scanning to a collaborative context. Expanding our understanding of CIS contributes to the theoretical advancement of information behavior and practices. Information seeking and collaboration are inherently interconnected; information seeking helps collaboration and collaboration helps information seeking (Hertzum &

Hansen, 2019; Shah, 2014). Furthermore, exploring the potential role of collaboration in keeping up to date (e.g., saving time) can have practical implications for professionals and trainees across fields, including library and information science.

Conceptual Background

Two conceptual areas inform this review: the conceptual framework for environmental scanning (Choo, 2001), being the a priori framework for framework synthesis, and CIS.

Environmental Scanning

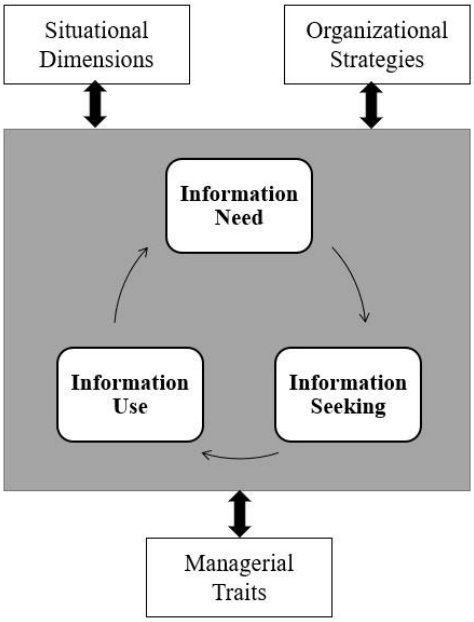
Environmental scanning is defined as "the acquisition and use of information about events, trends, and relationships in an organization's external environment, the knowledge of which would assist management in planning the organization's future course of action" (Choo, 2001). For Chun Wei Choo (1998), the environment is an important source of information, which needs to be continuously scanned for changes, trends, and events, interpreted, and acted on. Scanning the environment involves "both looking at information (viewing) and looking for information (searching)" (Choo, 2001, p. 1).

Choo recognized the key role of context in information seeking and use (Case & Given, 2016; Courtright, 2007) and proposed three types of factors influencing environmental scanning. They include situational dimensions such as the complexity and the rate at which the environment changes (i.e., external factors), organizational strategies referring to the overall strategy and scanning strategies (i.e., organizational factors), managerial traits such as cognitive style or knowledge of the scanner (i.e., personal factors) (Choo, 2001). Scanning itself was conceptualized as a type of information behavior that involves information need, information seeking, and information use (Choo, 2001). Information need was operationalized as the focus or scope of scanning; information seeking consisted of the sources, methods, and systems used to monitor the environment; information use was operationalized in relation to decision making, strategic planning, and organizational learning (see Figure 1) (Choo, 2001).

Based on a preliminary review of the literature, the environmental scanning framework proposed by Choo (2001) was selected as the a priori framework for adapting to a collaborative context. Both environmental scanning and CIS are aimed at information acquisition (Choo, 2001; Hertzum & Hansen, 2019). Both involve active and purposeful seeking. Hence, the influencing

factors identified by Choo could apply to CIS. Conversely, general factors and outcomes of CIS could be transferable to collaborative scanning.

Figure 1. Conceptual Framework for Environmental Scanning (adapted from Choo, 2001)



Collaborative Information Seeking

Given the changing reality of internet access and use, the proliferation of information, and networked environments, people often look for information collaboratively. Reflecting this user reality, research interest in CIS has been on the rise since the late 1990s (Foster, 2010; Hertzum & Hansen, 2019; Shah, 2010a). Although the importance of CIS has grown, there is no consensus on definitions, and concepts are used interchangeably (Shah, 2014) — a phenomenon Savolainen (2016) calls conceptual multiplicity. Based on reviewing the literature, Chirag Shah (2014) defined CIS as "an information-seeking process that takes place in a collaborative project (possibly a complex task) among a small group of participants (potentially with different sets of skills and/or roles), which is intentional, interactive, and mutually beneficial" (p. 219). The common feature found across most definitions is that CIS involves being "open to elements performed by individual actors as long as these elements serve to enable collaboration about the acquisition of information" (Hertzum & Hansen, 2019, p. 142).

As with all information behavior, internal and external contextual factors influence CIS. Given that CIS entails the combined efforts of several users (Karamuftuoglu, 1998), it is important

to consider who the users are, their roles, relationships (i.e., social ties), group size, and length of involvement (Morris & Teevan, 2010). Users may collaborate based on a shared topic (e.g., climate change) or a shared practice (e.g., hospital librarians). Their location (i.e., remote or colocated) and time (i.e., synchronous or asynchronous) will also impact collaboration (Morris & Teevan, 2010).

Different factors were identified as CIS facilitators, for example, a shared information need or a topic of interest, which act as the foundation for and stimulate collaboration (Morris & Teevan, 2010). Internet-based systems and networked environments support CIS activities by allowing users to work together, share their questions and knowledge. Nevertheless, there are also barriers. For example, sustaining collaborative communities can be challenging if collaborators do not perceive personal benefit or the perceived cost of participation is high (Richter et al., 2010). Overall, CIS research continues to be relevant, but more research is needed to better understand the influencing factors and to explore the outcomes (Hertzum & Hansen, 2019; McNeese & Reddy, 2017; Morris & Teevan, 2010; Shah, 2010a).

Methodology

Mixed studies reviews leverage the strengths of quantitative and qualitative evidence and are recommended for reviewing complex phenomena (Hong & Pluye, 2018; Petticrew et al., 2013). We chose this design because CIS is complex and empirical studies in CIS employ diverse research methods (Hertzum & Hansen, 2019). We report the current review according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guideline for systematic reviews and meta-analyses of quantitative evidence (Page et al., 2021) and the enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) statement for reporting syntheses of qualitative evidence (Tong et al., 2012).

Eligibility Criteria

The eligibility criteria were established prior to the screening. To be included, a study had to satisfy all the inclusion criteria in Table 1.

Table 1. Eligibility Criteria

	Inclusion Criteria	**Exclusion Criteria**
Study type	An empirical research study that uses quantitative, qualitative, or mixed methods	Literature reviews (secondary research studies)
Setting	Carried out in a laboratory or in the field	n/a
Population	With adult participants (18 years of age and older)	Children participants (younger than 18 years old)
Intervention	On collaborative information seeking involving an explicitly shared information need or search task AND information seeking carried out by two or more people AND/OR two or more collaborators sharing information explicitly (i.e., exchange and communication) or implicitly (i.e., information shared at the level of user interface)	Studies involving individual information seeking OR implicitly shared information needs and algorithmic sharing of information (e.g., recommender systems) OR social searching (e.g., individuals using social resources or social networks for individual search goals) OR social annotation of weblinks OR collaborative visual search (i.e., collaborative visualization)
Factors & outcomes	Reporting influencing factors and/or outcomes of collaborative information seeking	Not reporting factors influencing and/or outcomes of collaborative information seeking
Publication type	Original studies published as journal articles, conference proceedings, or dissertations (when not published)	Book chapters, published commentaries, editorials, conference posters, program descriptions, or study protocols (i.e., no results)
Language	Published in English or in French	Published in languages other than English or French
Date	Published in 1990 and onward	Published before 1990

Studies on social searching involving individuals using social resources to find information (e.g., social networks) were excluded. In contrast to collaborative seeking, in social searching, the information needs and search goals remain individual, although information seekers may engage in temporary collaborative activities when they reach out to their social network for information-related help (Evans et al., 2010; Evans & Chi, 2010). Studies on social annotation (i.e., social bookmarking or tagging) were also excluded. While social annotation involves collaboration in generating labels to categorize content on the web and may improve information retrieval (Zhou et al., 2008), it is difficult to ascertain what users' information needs are and whether they are explicitly shared. The collaborative visual search involving collaborative visualization (e.g., participants have a shared task to locate an object on the screen) or shared gaze (e.g., each searcher knows where the other is looking) were also excluded. Studies on these behaviors may offer insights relevant to CIS but were considered outside the scope of this systematic review.

Information Sources

We searched in three bibliographic databases: Library & Information Science Abstracts (LISA via ProQuest), Library, Information Science & Technology Abstracts (LISTA via EBSCO), and ERIC (via ProQuest). To ensure exhaustivity, we also searched in ProQuest Dissertations and Theses Full-Text database and conducted backward and forward citation tracking, as well as hand searching, in Scopus.

Search Strategy

A comprehensive search strategy (see Appendix 1) was developed by the first author, a research librarian experienced in systematic reviews, and peer reviewed by a specialized librarian in Library and Information Studies. The strategy's syntax was adapted to each database as needed.

Study Selection

All identified records were imported into EndNote x9 reference management software, where duplicates were removed using the Bramer method (Bramer et al., 2016). Unique records were then imported into Distiller SR for screening. Two reviewers (V.G. and R.E.S.) used 22 records as a teaching sample to ensure that the eligibility criteria were clear and well understood. Consequently, they independently screened the titles and abstracts of all records to identify those potentially relevant.

All records that satisfied the eligibility criteria, as well as those that did not provide enough information to decide, passed to the full-text screening stage. Full-text articles were imported into Distiller SR and independently screened by the same reviewers (V.G. and R.E.S.). Disagreements were solved through discussion. A third party (P.P.) was responsible for arbitrage if consensus could not be reached.

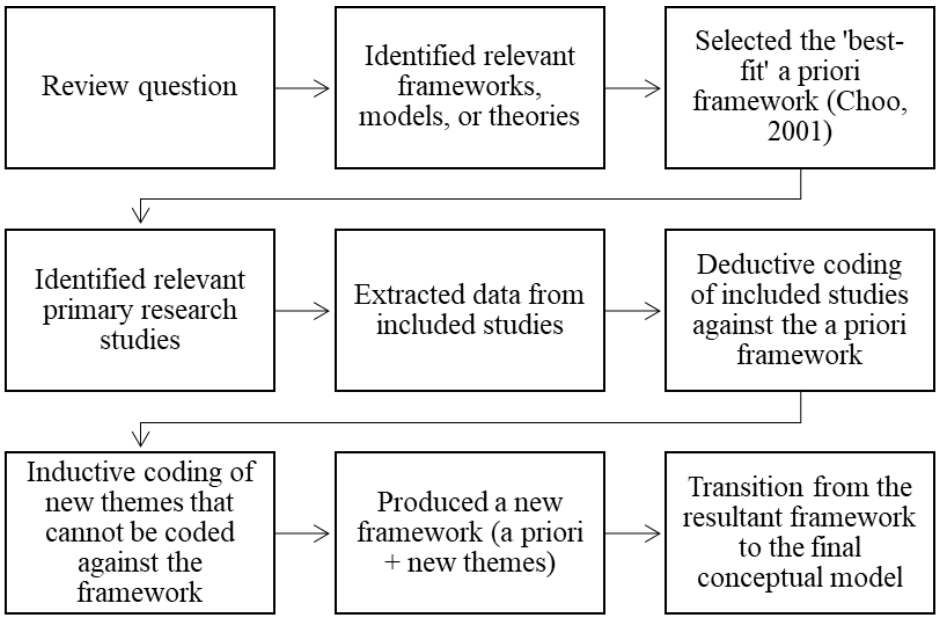
Quality Appraisal of Included Studies

Due to the qualitative nature of framework synthesis (i.e., synthesis of ideas, not measures), it is recommended to include all studies in the synthesis (Carroll et al., 2011). Therefore, we did not appraise the quality of included studies and added all coded factors and outcomes to the a priori framework. Comparing and contrasting factors and outcomes in "lower quality" and "higher quality" studies was outside the scope of this review.

Data Extraction and Synthesis of Included Studies

Following a convergent data-based synthesis design, results of included studies (i.e., quantitative and qualitative data) were extracted and analyzed using the same qualitative method and integrated at the synthesis stage (Hong et al., 2017). Because themes are important to understanding CIS, we used a qualitative synthesis, specifically, the "best fit" framework synthesis (see Figure 2) (Carroll et al., 2013).

Figure 2. Followed Framework Synthesis Steps



Framework synthesis is based on deductive-inductive analysis. Using thematic analysis, concepts are coded against the a priori framework and those which cannot be "accommodated," are added to create a "new expanded thematic framework" (Booth & Carroll, 2015, p. 3). It provides a transparent and reproducible process for identifying and combining the concepts from the a priori framework that are confirmed by evidence (i.e., extracted data) with new concepts (i.e., emerging from the data; Booth & Carroll, 2015; Brunton et al., 2020).

Coding Data and Identifying Themes

Using a hybrid deductive-inductive thematic analysis (Fereday & Muir-Cochrane, 2006), text passages from the included studies were coded line-by-line using NVivo 10 software. Themes from the a priori framework were operationalized in a coding guide (Booth & Carroll, 2015), which was pilot tested and revised as needed. The first author coded all included studies using the first version of the coding guide (v1). In addition to the three factor types from the a priori framework (see Figure 1), extracted data included study characteristics (e.g., author-reported design, participants, and group size). Other types of factors and outcomes were coded to general themes: "other factors" and "outcomes" — representing the first pass or "broad brush coding" (Jackson & Bazeley, 2019, p. 69).

After examining the data coded to new themes, the first author refined the coding guide, creating the second version (v2), available as Supplemental Information (see Appendix 2). New themes, their definitions, and illustrative quotes were discussed by the coauthors until reaching consensus. Using v2, the first author recoded all included studies. The second reviewer (R.E.S.) double checked the extracted data for 16 studies (31%). After which, the two reviewers (V.G. and R.E.S.) discussed the studies and solved disagreements when occurred (arbitrage by a third party was not needed). As recommended, the first author kept a coding diary to record reflections related to coding, new themes, and decisions (Jackson & Bazeley, 2019).

Producing a Revised Framework

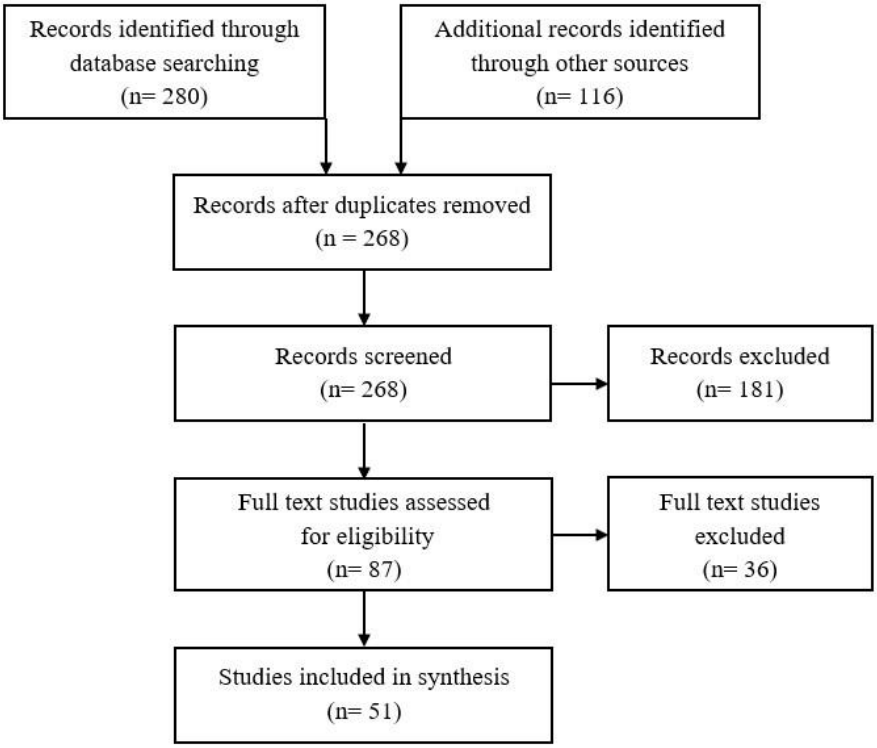
The first author interpreted the relationships between the a priori framework and the data to produce the first version of the revised framework of CIS factors and outcomes. The framework was then finalized using an iterative process involving peer checking, discussion with the coauthors, and presentation to other researchers at the ASIS&T 2020 virtual conference (Granikov, El Sherif, et al., 2020).

Results

Study Selection

We searched in three bibliographic databases (LISA, LISTA, and ERIC) on August 17, 2018, retrieving 280 records. Additional 116 records were retrieved using backward and forward citation tracking (in Scopus on April 6, 2019) and a search for dissertations (in ProQuest Dissertations and Theses on April 9, 2019). Due to the indexing overlap between databases (e.g., LISA and LISTA), we identified and removed 128 duplicates (i.e., a record representing the same study indexed in more than one database and retrieved more than once). Following the two-step screening process required in systematic reviews, 268 unique records were screened in the first step (i.e., title and abstract) and 87 were identified as potentially relevant. In the second screening step, we assessed 87 full-text studies for eligibility and included 51 (see Figure 3).

Figure 3. Flow Diagram



Study Characteristics

Fifty-one publications were included in the synthesis: 36 (71%) journal articles, 10 (20%) conference proceedings, and 5 (10%) doctoral dissertations. Twenty-three (45%) studies employed

mixed methods, 14 (27%) were qualitative and 14 (27%) quantitative. Out of 51 included studies, 29 (57%) were conducted in laboratory settings, 20 (39%) were field studies, and 1 (2%) study took place in both settings (Alarayedh, 2017). Nineteen (37%) studies investigated pairs of collaborators and 5 (10%) studies investigated groups of 10 or more. Seven (14%) publications, mostly ethnographic and case studies, did not specify the number of collaborators.

Collaborators were remotely distributed in 21 (41%) studies. Even in laboratory studies where participants were in the same room, they were working on different computers and were able to communicate only via the system (e.g., using the chat function). Twelve (24%) studies did not specify collaborators' location. In terms of timing, synchronous collaboration was observed more frequently, in 27 (53%) studies, which can be explained by the higher number of laboratory studies, where participants were required to work at the same time. In 15 (29%) publications, the authors did not specify the timing. The characteristics of all included studies are reported as Supplemental Information (see Appendix 3).

Thematic Synthesis of Included Studies

The aim of this review was to identify the factors and outcomes of CIS and to adapt the framework for environmental scanning to a collaborative context. The following sections describe the factors and outcomes extracted from the included studies and the revised framework. The breakdown of factors and outcomes organized by study is presented in Table 2.

Table 2. Mapping of Factors and Outcomes from the Included Studies

	Factors							Outcomes				
	Group	Personal	Task	System	Information source	Organizational	External	Performance	Cognitive	Behaviour	Affective	Relational
Alarayedh, 2017	✓		✓	✓				✓	✓			
Al-Thani & Stockman, 2018			✓	✓	✓			✓		✓		
Arif et al., 2015	✓	✓	✓		✓			✓		✓		✓

Bruce et al., 2003	✓		✓		✓	✓			✓			✓
Fidel et al., 2004	✓	✓	✓		✓	✓		✓	✓	✓		✓
Foster, 2009	✓											
Gazan, 2010	✓	✓	✓									
González-Ibáñez, Shah, & Córdova-Rubio, 2011	✓	✓						✓	✓		✓	✓
González-Ibáñez & Shah, 2012		✓						✓		✓	✓	
González-Ibáñez, Haseki, & Shah, 2013	✓			✓				✓	✓		✓	
Hansen & Jarvelin, 2004										✓		
Hertzum, 2010	✓				✓			✓	✓			
Htun, Halvey, & Baillie, 2018	✓			✓				✓			✓	
Hyldegård, 2009b	✓	✓									✓	✓
Hyldegård, 2006	✓	✓	✓					✓	✓	✓	✓	
Hyldegård, 2009a	✓	✓	✓		✓				✓	✓	✓	✓
Kim & Lee, 2014	✓	✓	✓		✓			✓	✓	✓	✓	✓
Komlodi & Lutters, 2008	✓	✓	✓			✓	✓		✓	✓	✓	
Lazonder, 2005								✓				
Lee, 2013	✓	✓	✓	✓		✓			✓	✓	✓	✓
Lee & Cho, 2011	✓	✓										
Leeder & Shah, 2016c	✓	✓		✓				✓	✓	✓	✓	

Leeder & Shah, 2016a		✓		✓					✓			
Leeder & Shah, 2016b								✓	✓		✓	
McNeese, Reddy, & Friedenberg, 2014	✓	✓							✓			✓
McNeese & Reddy, 2017	✓	✓							✓			
Moraes, Grashoff, & Hauff, 2019	✓							✓				
Paul & Morris, 2011	✓			✓				✓	✓			
Prekop, 2002	✓	✓				✓				✓		
Reddy et al., 2008	✓			✓				✓		✓	✓	
Reddy & Jansen, 2008	✓	✓	✓	✓	✓							
Reddy & Spence, 2008	✓	✓	✓		✓	✓	✓			✓		
Ruan, 2011	✓	✓	✓	✓	✓	✓	✓		✓	✓		
Saleh & Large, 2011	✓	✓	✓	✓	✓			✓	✓	✓		✓
Shah & González-Ibáñez, 2010		✓									✓	
Shah & González-Ibáñez, 2011	✓		✓	✓				✓	✓			
Shah, 2013				✓				✓				

Shah & González-Ibáñez, 2012	✓			✓				✓		✓		
Shah, Hendahewa, & González-Ibáñez, 2015	✓							✓	✓		✓	
Shah, Hendahewa, & González-Ibáñez, 2017	✓		✓					✓				
Shah & Marchionini, 2010				✓				✓				
Soulier & Tamine, 2015	✓							✓				
Spence & Reddy, 2012		✓		✓		✓						
Sun, Tian, & Cai, 2016	✓	✓		✓				✓	✓			
Tamine & Soulier, 2015	✓							✓				
Tao & Tombros, 2017			✓									
Wu, Liang, Dong, et al., 2018	✓	✓	✓					✓			✓	
Wu, Liang, & Xiang, 2017	✓	✓	✓	✓				✓		✓		
Wu, Liang, & Yu, 2018	✓	✓		✓				✓	✓	✓	✓	✓

Yue et al., 2008	✓	✓	✓	✓				✓			✓	
Yue, 2014		✓	✓					✓	✓	✓	✓	✓
Total (n)	**39**	**29**	**22**	**21**	**11**	**8**	**3**	**32**	**24**	**20**	**19**	**12**
Total (%)	**76**	**57**	**43**	**41**	**22**	**16**	**6**	**63**	**47**	**39**	**37**	**24**

Factors

Seven types of influencing factors were identified: personal, group, task, information sources, system, organizational, and external. All included studies reported at least one type of factor. The following sections describe the identified factors and are organized by frequency.

Group Factors. Given that the group is central to CIS, group factors were most frequently reported. Group factors refer to familiarity among members, division of roles, social rules, group size, location, and timing of collaboration. Participants were more likely to collaborate with people they knew (Gazan, 2010). When they did, group roles, goals, and each other's working styles were known from the beginning (Hyldegård, 2009a). Overall, knowing each other facilitated information sharing and CIS, and familiarity among members developed over time (Alarayedh, 2017; Lee & Cho, 2011; Reddy et al., 2008).

As with knowing each other, knowing what to expect from each other (e.g., well-defined roles), facilitated collaboration and team performance (Bruce et al., 2003; Fidel et al., 2004; Hertzum, 2010; Leeder & Shah, 2016c; McNeese et al., 2014; McNeese & Reddy, 2017). Group leadership also played a key role in organizing the work, delegating, promoting responsibility, and overcoming unequal participation (Lee, 2013; Leeder & Shah, 2016c; McNeese et al., 2014). In fact, effective division of labor determined by the group leader even compensated for lack of personal knowledge (Wu, Liang, & Yu, 2018).

Factors like timing, location, and group size directly influenced the interactions among members. For example, group members collaborating synchronously needed to interact with each other constantly to connect and contextualize the information that each one has found (Paul & Morris, 2011). In terms of group size, while dyads and triads outperformed individuals (e.g., greater information exposure) (Shah et al., 2015), having more people also led to more interactions, and potentially more time required for group decision making (Moraes et al., 2019; Shah et al., 2017). The same group factors may act as facilitators or barriers. For example, colocation helped participants to discuss emerging problems and be on the same page (Reddy &

Spence, 2008; Saleh & Large, 2011). At the same time, face-to-face information exchange created greater cognitive and emotional loads, making participants distracted and stressed (González-Ibáñez et al., 2013).

Personal Factors. Existing traits and personal characteristics that individuals brought to group situations, did not only impact but also triggered CIS (Fidel et al., 2004; Prekop, 2002; Reddy & Jansen, 2008; Reddy & Spence, 2008). The personal level of expertise and skills influenced how participants searched (Arif et al., 2015), how they perceived the difficulty of collaborative tasks (Kim & Lee, 2014; Saleh & Large, 2011), how comfortable they felt expressing their views (Wu et al., 2017), and what role they chose in exchanging and sharing information (Ruan, 2011). Furthermore, individual characteristics such as the quality of information the person could provide (i.e., expertise and knowledgeability) influenced not only how individuals engaged in CIS but also how they were perceived and "engaged" by peers (i.e., selected as potential collaborators) (Spence, 2013).

Personal factors could be social and affective. Social ties of individuals, even outside of the CIS setting, facilitated collaborative activities (Gazan, 2010; Lee, 2013; Lee & Cho, 2011). Feeling confident, in control, a sense of belonging impacted participants' cognitive and affective experiences and actions during the collaborative process (Hyldegård, 2006; Ruan, 2011; Yue et al., 2008). Personal attitudes (e.g., "group work fits my work habits"), self-perceptions (e.g., "I learn more efficiently by myself than in a group"), tendencies (e.g., individualistic predisposition), and personality traits (e.g., anxiety or stress avoidance) also influenced groupwork (Hyldegård, 2009b; Lee & Cho, 2011; Leeder & Shah, 2016c). For example, participants with "negative emotionality profiles" performed the assigned tasks individually even when expected to collaborate (Hyldegård, 2009b).

Task Factors. Task type intrinsically influenced how team members collaborated. Certain tasks were more suitable for collaboration. Navigational and informational tasks were easier to divide, in contrast to transactional tasks, which involved different methods for assessment and selection among team members (Wu, Liang, Dong, & Qiu, 2018). Saleh and Large (2011) proposed that the convergent or divergent nature of task activities was important. In their study, many groups reported that generating design ideas tended to be an individual activity, while the evaluation of these design ideas, aimed at selecting an appropriate one, was collaborative (Saleh & Large, 2011). Task complexity was another critical characteristic. Given that complex problems

often required more “agents” to solve them, bringing their individual expertise and perspectives, as problem complexity increased, so did the need for and the likelihood of collaboration (Al-Thani & Stockman, 2018; Gazan, 2010; Reddy & Jansen, 2008; Ruan, 2011).

Once the collaborative process began, task factors continued to play a role. For example, information-gathering tasks (e.g., searching for an unknown destination) required more planning and coordination, whereas decision-making tasks required more task content (Arif et al., 2015; Yue, 2014). Yue's work (Yue, 2014) echoed this in discussing group assessment of relevance. The relevance criteria in information-gathering tasks were objective and the assessments did not require discussion; the criteria in decision-making tasks were subjective and depended on team members' personal opinions (Yue, 2014).

Task factors represented the actual work that needed to be done as well as the time available to do it. Having limited time for group work translated into poorer group performance (Alarayedh, 2017). The timing of a task or a subtask was also important. The specific phase or stage of a collaborative project impacted participants' behavior and communication (Lee, 2013), as well as their emotional experience (e.g., feeling stressed toward the end) (Kim & Lee, 2014).

System Factors. Given the integral role of communication in working together, audio- and text-based communication channels were investigated in several included studies. System features could improve cooperation and increase information exchange among remotely located collaborators (Ruan, 2011), provide a sense of social presence while maintaining a sense of independence (González-Ibáñez et al., 2013), and help participants with the division of labor, understanding of group dynamics and group sensemaking (Paul & Morris, 2011). Ultimately, systems facilitated communication, improved the collaborative process, and enabled remote collaboration (Lee, 2013; Saleh & Large, 2011).

Awareness of who was doing what, especially when remotely distributed, helped participants engage in the task, develop new ideas, and improved performance (Al-Thani & Stockman, 2018; Htun et al., 2018; Leeder & Shah, 2016a). Communicating awareness information was done by email and instant messages, audio communication channels, or built-in awareness features (e.g., integrated team chat) (Al-Thani & Stockman, 2018; González-Ibáñez et al., 2013; Shah, 2013). Participants, who could view each other's search results and keywords, reported that awareness cues accelerated their research by allowing them to monitor colleagues' performance and reduced the duplication of efforts (Alarayedh, 2017). However, such tools need

to provide awareness of the teammates' status and the overall task without distracting (Shah & Marchionini, 2010). As shown by Shah and González-Ibáñez (2012), although remotely located collaborators using a built-in instant messaging system were likely to describe it as useful for awareness, in interviews, participants admitted that having less direct communication helped them concentrate.

Satisfaction and familiarity were important in considering system factors. Participants preferred using tools that were familiar and easy to use (e.g., Google Docs), instead of integrated collaborative text editing tools (Leeder & Shah, 2016c). Sometimes, technology added unanticipated complications. In the study by Yue et al. (2008), users personalized system parameters (the maximum number of search results displayed per screen), without telling each other, which caused problems for dividing up who would assess the results from what screen. Overall, being unfamiliar and unsatisfied with a system could result in participants abandoning it altogether and deciding to use an alternative system (Wu, Liang, & Yu, 2018).

Information Source Factors. Information source factors refer to characteristics such as format, availability, access, or organization. Namely, CIS was triggered and influenced by a lack of immediate access to or availability of information, a lack of knowledge about possible information sources, a need to access additional sources, incomplete or incorrect information, or an information source that was hard to understand (Arif et al., 2015; Fidel et al., 2004; Reddy & Spence, 2008). For example, partners started collaborating when not everyone could access the information necessary for accomplishing a search task (Al-Thani & Stockman, 2018). Additional challenges, even breakdowns in CIS, were encountered when information was distributed across multiple sources and all needed sources were not consulted (Hertzum, 2010).

Colleagues were sometimes the preferred information sources due to their expertise, experience, and easy access. In such situations, the people (i.e., informal local information sources) and direct communication between them facilitated information sharing and CIS, as well as task accomplishment (Bruce et al., 2003; Kim & Lee, 2014; Reddy & Spence, 2008; Saleh & Large, 2011). This was particularly true for complex and dynamic work environments, for example, a hospital emergency department, where contextual information was not always recorded in patients' charts (Reddy & Spence, 2008). Colleagues acted as reliable information sources and "effective and instant information filters," especially if consulting formal written sources was seen as time- and labor-consuming (Ruan, 2011, p. 127).

Organizational Factors. Given that most included studies were conducted in laboratory settings or naturalistic settings in universities, organizational factors were present only in eight. The studies by Bruce et al. (2003) and Fidel et al. (2004) observed teams working at Boeing and Microsoft. Their findings showed that while management and administration were critical for determining the focus, pace, and scale of collaborative projects, organizational culture influenced communication within teams, between teams, and with partners outside the organization — all fundamental elements of collaborative behavior (Bruce et al., 2003; Fidel et al., 2004). Besides, collaborators were conscious of and influenced by their organizational perspectives in carrying out their roles (Prekop, 2002).

The physical and temporal characteristics of organizations, the open space of an emergency department (Reddy & Spence, 2008) or the fast-paced environment of a regional health system (Spence, 2013), encouraged members to turn to each other and collaborate. As one firefighting instructor said: "We are so much family oriented. It's the way we behave. Our whole being is interacting. Being in the fire service for 31 years now, that's all I know. I would never think of and develop something on my own, without running it by my peers. I don't have all the ideas and the answers." (Ruan, 2011, p. 167).

External Factors. Only three studies reported external factors, representing three different informational environments: health (Reddy & Spence, 2008), law and engineering (Komlodi & Lutters, 2008), and firefighting instruction (Ruan, 2011). Each environment had its own distinguishing features. Health professionals found it difficult to keep up to date with the latest information within one's specialty and almost impossible in other related fields (Reddy & Spence, 2008). Consequently, team members often relied on information sharing and each other.

Among attorneys and service engineers, as presented by Komlodi & Lutters (2008), information practices were influenced by a constant threat of malpractice suits, resulting in documenting everything and creating an auditable paper trail for all important activities. Finally, Ruan (2011) described firefighting instruction as a multidimensional information environment with cyclical and interactive information-seeking processes, where each instructor spans many subject areas, representing more work, more time, and more information-seeking challenges.

Outcomes

Forty-three (84%) included studies reported at least one type of outcome. The most frequently reported outcome type was related to performance; the least reported outcome type was

relational. The following sections describe the identified outcomes and are organized by frequency.

Performance Outcomes. Performance outcomes were related to successfully accomplishing a task. For example, working with others reduced the possibility of overlooking some information (Fidel et al., 2004). Collaboration "of different minds" helped participants brainstorm different search terms and additional topics "leaving no stone unturned" (Saleh & Large, 2011, p. 213). Indeed, working in groups of two or more resulted in better relevant coverage, recall, query diversity, results diversity, and in general, more correct responses to the tasks (González-Ibáñez et al., 2011; Lazonder, 2005; Leeder & Shah, 2016b; Shah et al., 2017; Yue, 2014). Specifically, remotely located collaborators achieved higher recall and a greater diversity of queries than single users, collaborators at the same computer, or in the same room on different computers (Shah & González-Ibáñez, 2011, 2012). Shah et al. (2015, 2017) and Moraes et al. (2019) found that recall increased when group size increased. However, not all studies concurred on positive performance outcomes. Hertzum (2010), for example, found that CIS produced more information flow breakdowns, observed in 82% of analyzed incident reports.

The impact of collaboration on efficacy was also unclear. On one hand, Lazonder (2005), Leeder & Shah (2016b), and Saleh and Large (2011) found that pairs were more efficient and required less time to complete tasks. Other studies found that groups took longer and needed extra time to discuss, make sense of the information, and reach consensus before making decisions (Arif et al., 2015; Paul & Morris, 2011; Shah et al., 2017; Wu, Liang, & Yu, 2018). Time inefficiency was explained by interruptions (Kim & Lee, 2014), not having a clear role division (Tamine & Soulier, 2015), or not being aware of each other's progress (Yue et al., 2008). Additionally, collaboration sometimes resulted in work duplication, which lowered efficiency (Sun et al., 2016; Wu et al., 2017).

Cognitive Outcomes. Included studies reported several examples of positive cognitive impacts of collaboration, such as new ideas, better understanding, broader perspectives, discovered knowledge gaps, and learning from each other, both about topics and new skills (Bruce et al., 2003; Fidel et al., 2004; Kim & Lee, 2014; Komlodi & Lutters, 2008; Leeder & Shah, 2016a, 2016c; Ruan, 2011; Wu, Liang, & Yu, 2018). However, the findings related to cognitive load were varied. While Alarayedh (2017) reported no significant difference in cognitive load, Yue (2014) and Shah & González-Ibáñez (2011) found that the cognitive load in the collaborative search was

significantly lower than in individual search. Other studies reported higher levels, potentially related to additional coordination, communication, and conflict resolution (González-Ibáñez et al., 2011; Kim & Lee, 2014; Leeder & Shah, 2016b). González-Ibáñez et al. (2013) linked higher cognitive load to the higher social presence among face-to-face collaborators, in contrast to collaborators working remotely.

Making sense together to gain a shared understanding, known as collaborative grounding, was an important aspect of CIS (Hertzum, 2010; Paul & Morris, 2011). However, achieving a shared understanding was complex and time-consuming. Group members constructed group knowledge and developed team-level cognition and shared understanding by exchanging knowledge and articulating personal interpretation of available information (Hyldegård, 2006; McNeese & Reddy, 2017; Saleh & Large, 2011). Over time, some teams were able to "assume, predict, and expect each other's understanding" (McNeese et al., 2014, p. 337).

Affective Outcomes. Affective outcomes of collaboration were also mixed. Collaborators reported feeling satisfied, happy, and less stressed (Reddy et al., 2008; Yue, 2014), as well as upset, insecure, irritated, discouraged, and more stressed (González-Ibáñez et al., 2011; Leeder & Shah, 2016b). Hyldegård (2006, 2009b) explained this dichotomy of affective outcomes with participants' different emotionality profiles (i.e., negative affective experiences may be linked to negative emotionality profiles).

Familiarity among members influenced affective outcomes. As members got to know each other, they felt more comfortable and confident with each other (Hyldegård, 2009a; Lee, 2013). This highlights the impact of time on affective outcomes — as time passes, feelings change. For example, in the early stages of collaboration, participants felt more confident and motivated about the task, but later felt more frustrated, confused, and overwhelmed (Kim & Lee, 2014; Shah & González-Ibáñez, 2010; Yue et al., 2008). On the other hand, Wu et al. (2018) observed more negative emotions (e.g., frustration) at the beginning of the collaborative task associated with the division of labor.

Collaborators' feelings were also connected to and influenced by the feelings of peers. Participants who received negative emotional stimuli were more likely to report being unfamiliar with the topic than those who received positive stimuli (González-Ibáñez & Shah, 2012). Sharing personal negative feelings increased the emotional load of collaborators (González-Ibáñez et al., 2013). On the flip side, Komlodi & Lutters (2008) found that even if it represented extra work,

receiving positive reinforcement such as recognition and respect for being a domain expert, brought personal satisfaction and motivated future information sharing.

Behavioural Outcomes. In the included studies, the collaboration involved discussion, information sharing, group brainstorming, providing and receiving feedback, shared assessment of information, shared decision making, and shared problem solving (Al-Thani & Stockman, 2018; Fidel et al., 2004; González-Ibáñez et al., 2013; Komlodi & Lutters, 2008; Reddy et al., 2008; Reddy & Spence, 2008; Ruan, 2011; Shah & González-Ibáñez, 2012). Participants in several studies reported helping each other, for example, those with more domain knowledge recommended information to those with less (Arif et al., 2015; Leeder & Shah, 2016c; Saleh & Large, 2011; Wu et al., 2017; Yue, 2014). On a larger scale, CIS was associated with greater information sharing internally and externally (Hansen & Järvelin, 2005), or in Prekop's (2002) words, collaborators acted as the "eyes and ears into other environments" (p. 537).

It is important to note, that even in collaborative situations (i.e., we-mode), participants acted individually (i.e., I-mode), especially when facing difficulties (Hyldegård, 2006, 2009a; Lee, 2013). Because collaboration required negotiation and communication among group members, in contrast to individual information seeking, this caused stress and resulted in team members working individually (Kim & Lee, 2014). However, those who communicated and shared more were more likely to rate the sharing higher, thus creating "a virtuous circle" (Wu, Liang, & Yu, 2018, p. 16).

Relational Outcomes. Hyldegård (2009a) found that communication and face-to-face meetings contributed to building a "group spirit", but group members also reported having conflicts, which in turn lowered their motivation and interest. Negative relational outcomes, such as conflict and interpersonal friction, were common among the included studies that addressed this outcome type (Arif et al., 2015; Bruce et al., 2003; González-Ibáñez et al., 2011; Kim & Lee, 2014; Wu, Liang, & Yu, 2018). For example, Arif et al. (2015) reported that 8 out of 10 pairs in their study encountered conflict during decision making. Kim and Lee (2014) found that 25% of participants' statements concerned challenges related to group communication, coordination of different writing styles, and reaching consensus during remote collaboration.

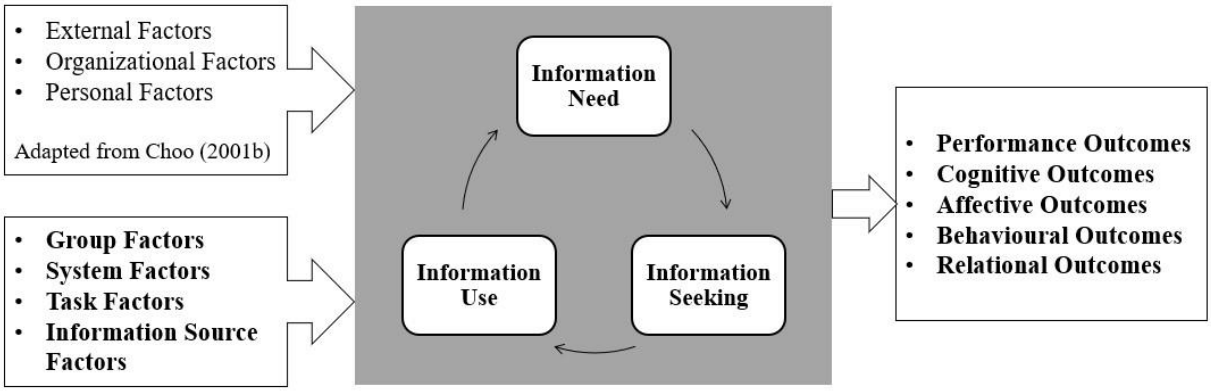
In terms of positive relational outcomes, collaboration contributed to developing social ties and personal networks (Fidel et al., 2004; Saleh & Large, 2011). Like behavioral outcomes, relational outcomes changed over time. As group members became more familiar with each other,

their perception of intimacy increased (Lee, 2013) and they became more comfortable in sharing information and talking about the difficulties they encountered (Saleh & Large, 2011).

Revised Conceptual Framework

Seven types of influencing factors and five types of outcomes were found in 51 primary studies on CIS. Based on these results, we revised the conceptual framework for environmental scanning (see Figure 1), our a priori framework, extending it to a collaborative context. The revised framework (see Figure 4) incorporates empirically based factors known to influence collaboration in the context of information seeking and the related outcomes. Based on included studies, we confirmed three factor types identified by Choo as present in collaborative situations and added four types of factors and five types of outcomes (highlighted in Figure 4).

Figure 4. Factors and Outcomes of Collaborative Information Seeking



The influencing factors could be interdependent as demonstrated in the included studies. For example, trust impacted the division of labor. Participants who did not trust each other and did not agree had difficulty in dividing up the tasks (Yue et al., 2008). Colocation also influenced the division of labor. Shah and González-Ibáñez (2012) observed that working on the same computer made it more difficult to divide tasks but encouraged more interactions facilitating the collective assessment of found information. The outcomes of collaboration present in the included studies were mixed and not always positive. For example, González-Ibáñez et al. (2013) observed that co-located participants (group factor) exchanged more information (behavioral outcome) but generated similar search strategies and accessed similar information sources (performance outcome).

Although the revised framework describes and analyzes CIS mechanisms, it does not predict or explain causality. We observed some connections between factors and outcomes. For example, participants who knew each other (group factor) reported feeling safe and more relaxed about the task (affective outcome) (Hyldegård, 2009b) and had fewer conflicts resulting in information flow breakdowns (relational and performance outcomes) (Arif et al., 2015). Knowing each other (group factor) impacted communication during collaborative activities (behavioral outcome). Teams of strangers chatted less about unrelated issues and searched more; teams of friends chatted more about issues unrelated to the search (Reddy et al., 2008).

Discussion

By conducting the first mixed studies review on CIS, we identified seven types of factors and five types of outcomes. By mapping them onto the a priori framework, we extend the conceptual framework for environmental scanning to a collaborative context. Specifically, four new factor types and five outcome types were added to Choo's framework. As observed in the included studies, factors influencing CIS were related to the individuals involved (i.e., personal), groups, tasks, systems, information sources, organizations, and informational environments (i.e., external). CIS outcomes were performance related, cognitive, affective, behavioral, and relational. The identified factors and outcomes are likely to apply to collaborative behaviors such as scanning. These findings represent a significant contribution to knowledge not only by proposing a comprehensive framework for CIS but also by identifying outcome types, which are often understudied (Case & O'Connor, 2016; Hertzum & Hansen, 2019).

The “who” of collaborative activities includes the individual participants and the groups they form. While individual factors were present in Choo's environmental scanning (Choo, 2001) and were confirmed by this review, a major addition to the a priori framework and the most frequently encountered factor type was related to the group. Group factors correspond to characteristics such as group size, longevity of involvement, social ties, governance, norms, location (co-located vs. remote), and timing (synchronous or asynchronous) (Foster, 2010; Francq, 2011; Morris & Teevan, 2010; Richter et al., 2010). We believe that group factors present in CIS are transferable to groups working together to keep up to date.

Factors related to information sources are critical in CIS as illustrated by this synthesis. This finding also applies to keeping up to date, especially the distinction between formal (i.e., “hard sources” such as different publication types) and informal (i.e., “soft sources” such as

personal exchanges with colleagues) sources (Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Wang et al., 2007). Many go further to suggest that informal sources are preferred and thus more important (Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Wang et al., 2007). According to Harris and Dewdney (1994), people tend to seek information from interpersonal sources, especially people with whom they are socially close or who are like them. Taking a biological/anthropological perspective, Bates (2002) agrees by saying that individuals are more accustomed to finding needed information from their social milieu composed of people with shared interests and knowledge. This proposition is supported in the included CIS studies — communities and networks were complementary and necessary information sources.

Task and system factors, both new additions to the a priori framework, are intrinsically linked to collaboration (e.g., a task may trigger collaboration). Task factors such as the nature of the task, task domain, and complexity influenced collaborative activities. CIS studies addressing task factors reaffirm the important influence of task complexity on information seeking. As claimed by Byström and Järvelin (1995), increased task complexity increases the complexity of information need, affects which and how many information sources are consulted, and ultimately the success of information seeking. To translate this factor type to keeping up to date, for example, multidisciplinary fields with "high field scatter" require researchers to monitor several fields for potentially relevant publications (Bates, 1996), thus representing a more complex task.

As for system factors, information systems are integral to individual and CIS activities. In the included studies, internet-based systems and networked environments did not only support collaboration but also were essential for remotely distributed participants. For keeping up to date even before the internet, Ellis (1989) suggested system features (e.g., a monitoring profile) that would enable the searchers to select sources that the system would search or provide notifications when new content is added to those sources. With the internet, many systems and tools exist, but may be insufficient solutions (Pontis et al., 2017), hence our interest in collaboration.

The least frequently encountered factors were organizational and external, both present in Choo's framework (Choo, 2001). The low occurrences could be explained by the high prevalence of laboratory studies. Organizational structure and culture were absent when collaboration was simulated. Similarly, participants in laboratory experiments were not necessarily familiar with the

informational environments within which CIS activities were performed (i.e., external factors) and were therefore not influenced by them.

Information-related outcomes remain understudied in information science (Case & O'Connor, 2016) and CIS (Hertzum & Hansen, 2019). Choo's framework includes information use, supporting his interest in what happens after and because of information seeking. Based on included studies, we added five general types of outcomes (i.e., performance, cognitive, affective, behavioral, and relational) occurring on individual, group, and organizational levels. While these were generated from CIS studies, we believe that they would apply to other collaborative behaviors such as scanning.

We conceptualized outcomes as the results or consequences of CIS, which could be tangible or intangible, immediate or long term, intended or unintended, actual or potential (Poll, 2012). Although some outcomes are long term (i.e., requiring time to manifest), which complicates their assessment (Gainor & Bouthillier, 2014), all included studies reported actual outcomes. Accordingly, additional outcomes may have emerged beyond the studies' time frames. Included studies employed both explicit (i.e., measured through actual outputs such as usage data) and implicit (i.e., asking users about the outcomes they associate or attribute to CIS) measures (Tenopir, 2011). Thus, our typology of outcomes is based on both objective information retrieval measures and perceived outcomes reported by study participants.

The purpose of this framework synthesis was to identify factors and outcomes of CIS and propose an adapted framework that may apply to collaboration in environmental scanning. Using Gregor's (2006) terminology, this framework corresponds to an analytical theory as it describes and classifies specific characteristics of CIS — presenting “what is” (p. 622). Analytical theories are valuable when little is known about a phenomenon and for guiding future interventions and action (Gregor, 2006). Namely, such frameworks provide insights into phenomena and increase the likelihood of successful implementations (Nilsen, 2015). Our framework could guide professionals, team leaders, and system designers in implementing and evaluating collaborative information projects by considering potential influencing factors and outcomes, both positive and negative.

Environmental scanning is similar to information monitoring, defined as maintaining awareness of developments in a field of interest by monitoring specific information sources (Ellis, 1989). Both scanning and monitoring are driven by the need to keep up to date. Some

scholars view monitoring as passive, a "back-of-the-mind alertness for things that interest us, and for answers to questions we have" (Bates, 2002, p. 5). Others characterize it as active and purposeful (Bronstein, 2007; Ellis et al., 1993; Foster, 2004), an "occasional continuing search […] carried out to update or expand one's framework" (Wilson, 1997, p. 563). In our view, and as corroborated by Choo, monitoring or scanning can be passive and active. Therefore, the identified factors and outcomes of CIS, which is usually active, may be transferable to collaborative scanning or monitoring behaviors.

In future research, the adapted framework will guide data collection and analysis in a qualitative multiple case study on collaboration in keeping up to date, leading to further framework revision (Granikov, Bouthillier, & Pluye, 2020). Additional empirical studies can be used to test and explain the associations between identified factors and outcomes, thus developing explanatory and predictive theories (Gregor, 2006). Finally, considering the number of included studies and the richness of extracted data, each type of factors and outcomes could justify dedicated investigations.

Strengths and Limitations

We employed several strategies to minimize the risk of bias in identifying, selecting, and analyzing studies. First, our systematic search located both published articles and conference proceedings. Including the latter is recognized to minimize bias, given that many conference papers do not become published articles in scholarly journals (Rethlefsen et al., 2021). Second, the search strategy was peer reviewed by a specialized librarian. Finally, two independent reviewers screened all records and full-text articles. For data extraction, a third of included studies was counterchecked by a second reviewer. Having two independent reviewers and comparing results contributed to the overall rigor of this review.

At the same time, our review has several limitations. A publication bias is always a risk in literature reviews due to the underreporting of negative outcomes and the overreporting of positive ones. We tried to overcome this limitation by conducting a comprehensive search of research articles, conference proceedings, and dissertations. As a result, we identified several studies reporting negative CIS outcomes. Because book chapters were excluded from this synthesis, some studies may have been missed. However, given the number of included articles (n = 51), we believe that including book chapters would not make a major difference to the findings.

In terms of generalizability, we synthesized studies exploring explicit collaboration, defined as "purposive sharing and generating of information" to support work or learning-related activities (Foster, 2010, p. xiii). Therefore, the proposed framework may not apply to implicit (i.e., "exploiting the traces of the information activity of others") or automated (i.e., machine-based such as recommender systems) collaboration (Foster, 2010, p. xiii). It may be valuable for future research to explore if and how this framework applies to different collaboration types.

This review followed the requirement of systematic reviews: it pursued a specific and focused review question on CIS, as detailed in the eligibility criteria. Additional insights and examples of factors and outcomes related to collaboration may be found in other kinds of information behavior and practices studies that address social and collaborative components (e.g., everyday life information seeking) or in other kinds of collaborative information behavior studies (e.g., social searching or collaborative visual searching). In both cases, these were outside the scope of this review. Finally, we did not systematically review all information behavior theories. Instead, we reviewed the most prevalent ones related to scanning/monitoring and CIS. The framework for environmental scanning (Choo, 2001) was identified as the "best fit" a priori framework to guide our work.

Conclusion

The results of this review, the proposed conceptual framework for analyzing CIS and potentially collaborative scanning, represent the first stage and the base of theoretical development (Gregor, 2006). Employing a systematic mixed studies review methodology, allowed us to develop a typology of CIS factors and outcomes. Future empirical research may test and validate the transferability of these factors and outcomes to collaborative scanning.

This review does not strive to divide influencing factors into barriers and facilitators, since the same factor may act as both, depending on the context. Similarly, we do not strive to promote collaboration as having only positive outcomes as testified by the included studies. Nonetheless, the proposed conceptual framework can guide future research on CIS and shed light on collaboration in keeping up to date (or scanning). The identified influencing factors may help group leaders to manage and support collaborative information projects, as well as group participants to better understand their collaboration experience.

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Bridging Chapters 3 and 4

The previous chapter provides a conceptual foundation for the entire thesis. Specifically, Manuscript 1 reports a mixed studies review with a framework synthesis that allowed me to produce a novel conceptual framework. Consequently, this framework informed and guided thematic analysis in the qualitative multiple case study, for which the research protocol is presented in the next chapter (i.e., Manuscript 2).

Chapter 4. Assessing the use of a collaborative system to monitor research publications: Protocol for a qualitative multiple case user study – Manuscript 2

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Abstract

Information monitoring and keeping abreast of research trends is essential for researchers. However, as the volume of information and the number of tools for staying up to date continue to grow, researchers struggle to continuously monitor and filter scholarly articles. This is particularly true for researchers working in complex multidisciplinary fields like Patient Oriented Research, who need to cast their nets wide to identify relevant high-quality studies. The proposed multiple case study will explore and analyze the use and user perceptions regarding a collaborative research trend monitoring system, called eSRAP. This research will advance knowledge on processes and outcomes of collaborative monitoring of research publications. The findings will be significant to those providing monitoring services, studying collaborative information behaviour, training future researchers and information professionals, as well as to system designers.

Introduction

The purpose of our study is to assess the use of a collaborative system used to monitor research publications. Keeping up to date with scientific literature is fundamental across research disciplines and at all stages of the research process, yet it remains a challenge (Pain, 2016; Pontis et al., 2017). The most common barriers are information overload, time constraints, and insufficient evaluation skills (Blummer & Kenton, 2014; Pontis et al., 2017). Services and tools exist to monitor scientific literature (e.g., alerting services), but the growing number of options may further contribute to information overload (Barr, 2006). Many publications describe monitoring tools and services provided by information specialists, but more knowledge is needed on researchers' awareness and actual use of such tools (McKee et al., 2009). Overall, scholarly literature in Library and Information Science (LIS) recognizes the importance of information monitoring (i.e., passive information behaviour), but most research continues to focus on active searching (Attfield et al., 2010).

Monitoring multidisciplinary fields such as Patient Oriented Research (POR) is especially challenging, as researchers need to scan several fields, for example, setting up alerts in many different databases and journals to identify few potentially relevant publications (Stacey et al., 2010). POR refers to research that either involves researchers, patients, health professionals, and decision-makers as partners (hereinafter referred to as POR stakeholders), or aims to address patient-identified priorities, or has direct impact on people's health, health services, professional practice, health care system and policy (Canadian Institutes of Health Reasearch, 2017; Kaur & Pluye, 2019). Given that POR is meant to engage different types of stakeholders as research partners, their diverse levels of research expertise and evaluation skills may act as additional barriers in keeping up to date with scientific publications (Bates, 1996; Pontis et al., 2017).

A solution may be in using collaboration to monitor and filter scientific literature (Adams et al., 2005). In research, collaboration is intrinsic and is believed to have the potential to solve complex problems and lead to new knowledge discovery (Hara et al., 2003; Karamuftuoglu, 1998; Shah, 2014; Sonnenwald, 2007). Peers and social connections are known to be valuable information sources and facilitators for keeping up to date, also referred to as the 'invisible college' (Al Shboul & Abrizah, 2016; Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Talja, 2002; Wang et al., 2007). However, more knowledge is

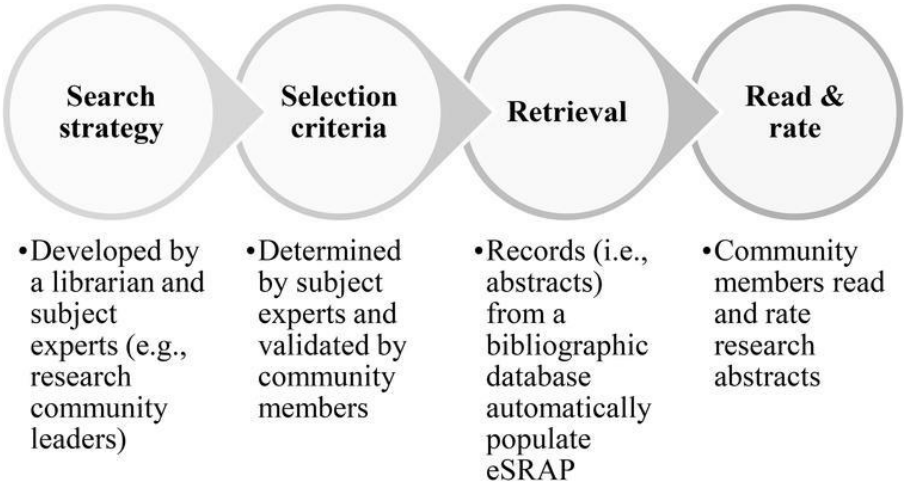
needed to see if, how, and why collaboration could help overcome the challenges of keeping up to date.

In information seeking, people increasingly look for information collaboratively due to the proliferation of internet access, online information, and networked environments (Francq, 2011). Although there is no consensus on one definition of collaborative information seeking (CIS) (Shah, 2014), at its core it is a process of more than one person looking for information in collaboration with others and having a shared goal (Morris & Teevan, 2010). CIS may be influenced by collaborators' individual characteristics (e.g., personal beliefs, values, attitudes), their roles and relationships, group size, length of involvement, motivation, location, time, group structure, system support, cost and benefits of participation (Beamish, 2010; Morris & Teevan, 2010).

In general, the majority of empirical studies and conceptual models in LIS focus on individual rather than group or collaborative information behaviour (Foster, 2010; Hyldegård, 2006; Karunakaran et al., 2013; Reddy et al., 2010; Shah, 2014). This focus is shifting, but more knowledge is needed to define CIS, its conceptual field, and how it should be studied (McNeese & Reddy, 2017). Moreover, the factors influencing CIS need to be looked at more closely (Hyldegård, 2006; Shah, 2010). Unanswered questions include: how do participants engage in CIS, how to encourage and facilitate participation, and finally, how to evaluate the impact and innovation resulting from collaboration (Morris & Teevan, 2010). There is a growing interest in CIS, but the understanding of its mechanisms is still limited and does not extend to monitoring behaviour (Shah, 2010).

In 2016, eSRAP, a collaborative research trend monitoring system (i.e., supporting a type of CIS), was developed and implemented by the Quebec SPOR-SUPPORT Unit. Based on a search strategy, scholarly publications automatically populate the system as they become indexed in bibliographic databases (see Fig. 1). System users then share the ongoing tasks of reading and filtering new publications using shared relevance criteria. Potentially, users benefit from a crowdsourced identification and peer-appraisal of research publications and a reduced individual workload (Brown & Allison, 2014).

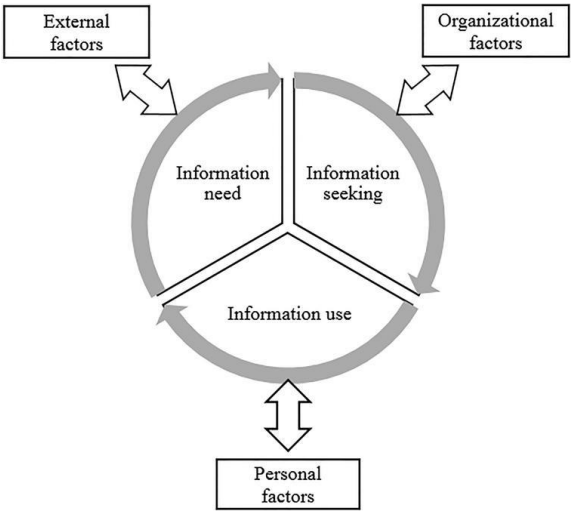
Figure 1. Workflow of eSRAP, a Research Trend Monitoring System



This study addresses the knowledge gaps identified in the literature and answers the following research questions: (RQ1) How do users engage with the eSRAP system? (RQ2) What factors influence collaborative research trend monitoring from the perspective of eSRAP users? (RQ3) What are the outcomes of collaborative research trend monitoring from the perspective of eSRAP users? The eSRAP system is innovative and unique but has not been evaluated yet. The study focusing on eSRAP is justified by the researcher's access to the system and user groups. This work will contribute to knowledge, methods, and practice in LIS, specifically related to information monitoring and collaborative information behaviour.

This research study is situated within human information behaviour research, looking at information seeking (monitoring and filtering), use, and potential outcomes linked to information use (Pettigrew et al., 2000; Wilson, 1997). The specific conceptual framework guiding this work is that of environmental scanning (Choo, 1999) (see Fig. 2).

Figure 2. Conceptual Framework for Environmental Scanning (adapted from Choo, 1999)

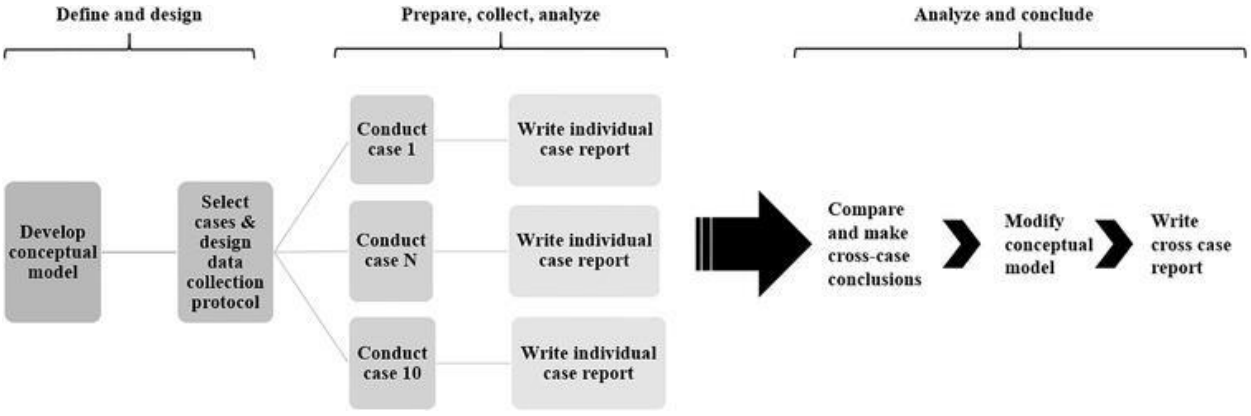


Choo's framework identifies three types of factors influencing environmental scanning but does not include factors related to collaboration. A systematic mixed studies review with a framework synthesis will be conducted to adapt Choo's framework to collaborative monitoring (Carroll et al., 2011, 2013; Hong & Pluye, 2018; Pluye et al., 2016).

Methodology and Methods

Overview

Figure 3. Multiple Case Study Overview (adapted from Yin, 2013)



The proposed methodological approach is that of a multiple case study (Yin, 2013) (see Fig. 3). Each interest-based group of eSRAP users (i.e., monitoring the same research topic) will constitute a "case". Current eSRAP users will be invited to participate in semi-structured interviews. Specifically, critical incident and journey mapping techniques (Flanagan, 1954;

Samson et al., 2017; Westbrook et al., 2007) will be used to understand users' experience, system use, perceived factors and outcomes related to use. Data will be collected and analyzed for each case (i.e., intra-case analysis); subsequently, the cases will be compared to draw cross-case conclusions (i.e., inter-case analysis) (Yin, 2013). The current study combines a pragmatist and a social constructivist worldviews by being "problem centered" and interested in "multiple participant meanings" (Creswell & Plano Clark, 2011, p. 40).

The case study approach is recommended for investigating a contemporary phenomenon in-depth and in a real-life setting, especially when the boundaries between phenomenon and context are unclear (Yin, 2013). It is thus appropriate for the study of information seeking behavior that takes place in a specific context, from which it cannot be separated (Courtright, 2007; Pettigrew et al., 2000). This is particularly true in monitoring behavior, which is highly dependent on the information environment (i.e., context) (Choo, 1998). The multiple case study approach will facilitate developing a more comprehensive and in-depth understanding of collaborative monitoring that is contextualized and transferable. Ethical approval will be obtained from the Institutional Review Board (IRB) of McGill University prior to starting the data collection.

Participants

According to Yin (2014), cases should be carefully selected to replicate or contrast data. The present study will employ maximum variation purposeful sampling, selecting heterogeneous information-rich cases for in-depth study of their uniqueness and commonalities (Patton, 2002). Maximum variation sample is appropriate as this study aims to gain an understanding and produce detailed descriptions of each case and shared patterns across cases. Moreover, purposefully seeking heterogeneity allows to overcome the problems related to small samples (Patton, 2002).

Table 1. Matrix Sample of eSRAP User Groups

Group topic	**Group age (old/new)**	**Group size (small/big)**	**Group membership (voluntary/required)**
1. Mixed methods	Old	Big	Required
2. Community based participatory research	Old	Small	Required
3. Data access	Old	Small	Required
4. Patient engagement	Old	Small	Voluntary

5. Critical appraisal tools	New	Small	Voluntary
6. Practice facilitation	New	Small	Voluntary
7. Organizational participatory research	New	Big	Voluntary
8. Artificial intelligence	New	Big	Voluntary
9. Design science	New	Big	Voluntary
10. Child psychiatry research methods	New	Small	Voluntary

Each eSRAP group monitoring a topic will constitute a case. Each case will be selected based on the following characteristics: group age (under a year/over a year), group size (small: two members or less/big: more than two members), group membership (voluntary/required) (see Table 1). All eSRAP users within a group, regardless of their role (e.g., researcher, patient partner, clinician, student) will be included in a case and will be invited to participate in the interview. Each one of the selected cases will offer a different situation for contrasting results and theoretical replication (Yin, 2013).

Data Collection

Data will be collected with semi-structured interviews to explore participants' views of and experiences with the eSRAP system, the perceived factors influencing their experience, and outcomes associated with system use (negative, positive, or lack of). The interview guide will be developed based on the conceptual model and will be tested with the researcher's supervisors. The researcher will conduct the interviews in person, or on Skype when necessary. The interviews will last between 60 and 90 minutes and will ideally take place at participants' workplace (if unavailable, at a meeting room in the researcher's department).

Each interview will be organized in three parts. The first part will include open questions on participants' experience with collaborative monitoring in general, guided by the conceptual model adapted with the literature review. The second part will involve journey mapping to understand and visualize how eSRAP users interact with the system, identifying their perceived needs and pain points. Participants will be asked open questions about their actions, thoughts and emotions related to system use (Nielsen Norman Group, 2018).

The final part of the interview will be guided by the critical incident technique (Flanagan, 1954). A critical incident will be conceptualized as a recent session of using eSRAP, which can be

recalled in sufficient detail and has a sufficiently clear effect (positive or negative) on the participant (Choo, 1999). A critical incident will be operationalized by the following question: "Please try to remember a recent instance of using the eSRAP system, when eSRAP was helpful (or unhelpful). Would you please describe that session to me in as much detail as you can?". All interviews will be digitally recorded, with a back-up recording, and transcribed by the researcher. In addition, the interviewer will collect personal observation notes from the interviews.

Data Analysis

All textual data will be analyzed using inductive and deductive thematic analysis (Fereday & Muir-Cochrane, 2006) with NVivo 12 qualitative data analysis software. The six stages of data coding and identification of themes outlined by Fereday and Muir-Cochrane (2006) will be followed: (1) developing the code manual, (2) testing the reliability of codes, (3) summarizing data and identifying initial themes, (4) applying templates of codes and additional coding, (5) connecting the codes and identifying themes, (6) corroborating and legitimizing coded themes. Data will be coded using existing concepts from the conceptual model (deductive coding), while being open and alert to emerging themes (inductive). Analyzed data (i.e., transcribed individual interviews) will be converged for each case (i.e., intra-case analysis) to produce in-depth case reports.

As a secondary analysis for each case, interview verbatim will be used to develop profiles of typical users (i.e., personas) and their respective journey maps. In other words, for each eSRAP user type, the experience, goals, actions, thoughts and emotions will be mapped chronologically, creating a narrative and a visualization of how users interact with eSRAP. Following intra-case analysis, case reports, typical user profiles, and journey maps will be compared to identify emergent themes and draw cross-case conclusions (i.e., inter-case analysis) (Yin, 2013). Moreover, the initial conceptual model will be revised to incorporate the themes that emerged from data analysis.

Expected Limitations

As with all studies, potential challenges and limitation face the proposed research. First, the generalizability of results may be questioned, as this investigation focuses on one system. There are no similar systems, which makes eSRAP unique and innovative. Moreover, the goal of qualitative research is not to generalize beyond the case (i.e., sample to population), but to

understand the case in depth and in its complexity (Creswell, 2007). Generalizations such as case-to-case transferability or analytical generalization to theoretical propositions are more appropriate for case studies and qualitative research in general (Polit & Beck, 2010; Yin, 2013).

The study of outcomes of information faces its own challenges. For example, it is difficult to control for secondary effects acting as confounding variables and outcomes may be intangible and long-term, meaning that there is a time lag for them to appear (Gainor & Bouthillier, 2014; Poll, 2012; Poll & Payne, 2006; Tenopir, 2011). To overcome these challenges, the current study uses a multiple case study approach with maximum variation sampling to purposefully include heterogeneity of cases.

Finally, all qualitative data collection and analysis will be carried out by the researcher, who is familiar with the eSRAP system. She has also been working with researchers for over a decade and is very familiar with the challenges they experience associated with keeping up to date. Therefore, her preconceptions may introduce bias. To limit investigator bias, the researcher will maintain a reflexive research diary, which will be analyzed for potential sources of bias and subjectivity. In addition, member checking will be used to add credibility to the findings (Pickard, 2013).

Significance of Expected Results

The proposed research will address the gaps identified in the literature and contribute to knowledge, theory, methods, and practice in the field of LIS. More knowledge is needed on CIS and specifically on collaborative monitoring. This research will contribute needed knowledge on the factors and mechanisms influencing collaboration during information seeking, going beyond designing technology, and evaluate the impact and specific processes involved in CIS (e.g., making relevance judgements by a group) (Foster, 2006; Hyldegård, 2006; Reddy et al., 2010; Shah, 2010, 2014). The expected findings will shed light on how to encourage participation in CIS and how to evaluate the impact and innovation resulting from it (Morris & Teevan, 2010). Furthermore, the findings will be used to propose a revised conceptual model, as well as in-depth contextualized understanding of the factors and outcomes linked to collaborative monitoring of research publications, to be studied in future research.

Some CIS studies have been conducted in a laboratory (McNeese & Reddy, 2017; Shah, 2013). However, real-life settings are deemed more appropriate for the study of human information

behaviour (Case & Given, 2016; Pickard, 2013). The research presented here will investigate collaborative monitoring and filtering behaviours in a real-life setting.

This research will benefit and guide information professionals who support researchers and scholars and provide current awareness services, thus, contributing to evidence-based library and information practice (Eldredge, 2014). The findings will also be relevant to system developers working on collaborative monitoring systems. For example, in addition to gaining a better understanding of the user experience, journey mapping may help developers to optimize the experience of system users. Finally, collaborative monitoring has the potential to save time and enable multidisciplinary teams of POR stakeholders to keep up to date with research publications, contributing to the advancement of POR, evidence-informed health practices and health systems.

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Bridging Chapters 4 and 5

Chapter 4 consists of Manuscript 2, namely the published protocol for the qualitative multiple case study. Chapter 5 consists of Manuscript 3 and reports the conducted case study, in which a revised protocol was followed. In this transition section, I explain the methodological challenges and changes between Manuscripts 2 and 3. The key differences concern case and participants selection, data collection, and analysis.

Selection of Cases

For studying social phenomena, in general, and conducting case studies specifically, a careful selection of cases is key (Miles, Huberman, & Saldaña, 2020; Yin, 2013). Since eSRAP was in its beta testing phase, not all the anticipated cases described in the research protocol were available at the time of conducting the research study. At the end, five out of ten cases anticipated in the protocol (Chapter 3) and two additional cases were included in the case study reported in Manuscript 3 (Chapter 4). Aligned with the study aim to understand and produce detailed descriptions of each case and common patterns across cases, a maximum variation purposeful sample is recommended (Patton, 2002).

While the cases described in Manuscript 3 were heterogeneous, the heterogeneity was not purposefully pursued. Instead, all available cases (i.e., monitoring projects implemented in eSRAP) except one were selected. The excluded case concerned a monitoring project implemented in the context of a graduate course where students used the system as a class activity. Therefore, given this difference in context, it is possible to say that the entire population was included in the case study. The included seven cases were information-rich and heterogenous. Their unique characteristics, similarities, and differences allowed me to make valuable comparisons and to overcome potential limitations related to small samples (Patton, 2002).

Data Collection and Analysis

As a secondary analysis for each case, I planned to develop profiles of typical users (i.e., personas) and their respective journey maps. Typically, journey mapping involves chronologically mapping users' experience, goals, actions, thoughts, and emotions, creating a narrative and a visualization (Nielsen Norman Group, 2018). Journey mapping is typically used to understand users' experience with a system and across stages of system use. While study participants were asked open questions about their actions, thoughts and feelings related to system use, I was not

able to incorporate the journey mapping technique to visualize how they interacted with eSRAP. Some of my participants did not use the system at all, and those that did, did not do it regularly. Several participants were unable to provide specific examples or descriptions. As a result, journey mapping and typical user profiles were not used in data collection and analysis. Furthermore, this choice was coherent with the principal focus of this research, being the factors and outcomes of collaborative information monitoring and not the eSRAP system. Instead of comparing typical journey maps and typical user profiles, inter-case analysis was based on comparing case types to identify emergent themes and draw cross-case conclusions (Yin, 2013).

Chapter 5. Exploring the factors and outcomes of collaborative information monitoring: A multiple case study – Manuscript 3

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Keywords: Collaborative information monitoring, collaborative information seeking, multiple case study

Abstract

This multiple case study explores collaboration in the context of keeping up to date. Specifically, we investigate the factors and outcomes of collaborative information monitoring (CIM) from the perspective of patient oriented research stakeholders (i.e., researchers, trainees, clinicians, research professionals, and managers), who have implemented a monitoring system called eSRAP. Data were collected in semi-structured individual interviews and verified with documents and system logs from the monitoring projects. Data from the interview transcripts were analyzed using a hybrid deductive and inductive thematic analysis, within- and across-cases. Based on seven included cases (i.e., implemented monitoring projects), participants either engaged in CIM with eSRAP, without eSRAP, used eSRAP individually (i.e., did not collaborate), or did not collaborate and did not use eSRAP. Our analysis confirmed the *a priori* themes related to factors (i.e., personal, group, organizational, environmental, information sources, system, task) and outcomes (i.e., performance, behavioural, cognitive, affective, relational) and identified new sub-themes that represent the factors and outcomes of CIM. Our findings provide theoretical and empirical contributions to knowledge on collaborative information behaviour (i.e., seeking and monitoring). Finally, we offer explicit recommendations for practice, on how to support and sustain collaborative information projects.

Introduction

Keeping up to date by monitoring current information is essential for researchers, decision- and policy-makers in all domains. However, this task remains challenging as researchers struggle with time constraints, information overload, and evaluating publications for quality and relevance (Blummer & Kenton, 2014; Pain, 2016; Pontis, Blandford, Greifeneder, Attalla, & Neal, 2017). While services and tools exist to monitor the scientific literature (e.g., alerting services), the growing number of options may further contribute to information overload (Barr, 2006). It is particularly challenging in complex multidisciplinary fields, such as Patient Oriented Research (POR), who need to scan different disciplines to identify few relevant studies (Bates, 1996; Pontis et al., 2017). Moreover, systems and tools may not allow "the same level of customization" as exchanging with peers and relying on them for finding and filtering relevant information (Pontis et al., 2017, p. 34).

Peers and social connections, also referred to as the 'invisible college', are known to be valuable information sources that help researchers keep up to date (Al Shboul & Abrizah, 2016; Bates, 2002; Case & Given, 2016; Choo, 2001; Foster, 2004; Meho & Tibbo, 2003; Pontis et al., 2017; Talja, 2002; Wang et al., 2007). In general, people prefer to seek information from those with whom they are close and/or those that are similar to them (Harris & Dewdney, 1994). Indeed, monitoring, networking and collaboration are integral elements of scholarly work (Palmer, Teffeau, & Pirmann, 2009). While collaboration among peers may help overcome the challenges of keeping up to date, more research is needed to investigate if that is the case. Motivated by the practice-based need to help POR stakeholders (i.e., researchers, trainees, clinicians, research professionals, and managers) keep up with scholarly publications, the current study explores the factors and outcomes of collaborative information monitoring (CIM) in a real-world setting. For this study, CIM is conceptualized as two or more group members who share the work of monitoring distinct information sources for the purpose of keeping up to date.

Conceptual Background

The two main concepts informing this study are information monitoring and collaborative information seeking (CIS). Information monitoring is intrinsic to keeping up to date and was initially conceptualized by David Ellis in his model of information seeking. Based on studying different professional groups, including scientists and academic researchers, Ellis et al. defined

monitoring as maintaining awareness of developments in a field of interest by monitoring distinct information sources (1989, 1990, 1993; Ellis, Cox, & Hall, 1993; Ellis & Haugan, 1997).

Since then, several studies using Ellis's model confirmed monitoring as an important information seeking activity (Bronstein, 2007; Choo, Detlor, & Turnbull, 2000a; Makri, Blandford, & Cox, 2008; Meho & Tibbo, 2003; Savolainen, 2017). Bronstein (2007) placed monitoring in the Current Awareness Phase, along with citation tracking and networking, which was previously added to Ellis's model by Meho and Tibbo (2003). Makri et al. (2008) separated monitoring strategies into active (e.g., regularly conducting searches in distinct sources or "pull") and passive ones (e.g., receiving regular alerts or "push"). While there is disagreement on whether monitoring is passive or active, in our view it is both, involving "occasional continuing searching … carried out to update or expand one's framework" (Wilson, 1997a, p. 563) and "back-of-the-mind alertness" (Bates, 2002, p. 5). Overall, the elaborations of Ellis's model (e.g., placing networking alongside monitoring) reinforce the importance of colleagues in keeping up to date and support our interest in collaboration, particularly in CIM.

Before turning to CIS, it is important to address collaboration in general. While collaborating is seen as a 'natural' behaviour and possibly a go-to solution for complex problems at work and daily life (Denning & Yaholkovsky, 2008), the term collaboration may have different meanings in different contexts or be used interchangeably with other terms (Shah, 2015). For example, in the context of Computer-Supported Cooperative Work (CSCW), collaborative activities have been conceptualized as having three levels: co-ordinated (i.e., individual actors working on a common object while having scripted roles, being only externally connected to each other, and without a shared objective), co-operative (i.e., to individual actors working on a common object and sharing a common objective), and co-constructive (i.e., the object of work is co-constructed by the individual actors through their interaction (Bardram, 1998).

Going beyond these three levels, in the context of CIS, Shah (2015) proposed five nested sets of activities (i.e., communication, contribution, coordination, cooperation, collaboration), where each set is essential to, and supports, the 'broader' set. According to Shah, communication refers to the exchange of information and is a central (i.e., core) requirement. Contribution refers to individual actors helping each other to accomplish personal goals. Coordination refers to connecting individual actors for 'harmonious action'. Cooperation means working together to accomplish shared goals. And finally, collaboration represents creating a solution that is more than

merely the sum of each participant's contribution. While the conceptualizations put forward by Bardram (1998) and Shah (2015) overlap and differ, they both indicate that there are distinct levels or degrees that are important to consider in analysing collaborative activities.

Returning to CIS, people increasingly look for information together or collaboratively, which is reflected in the expansion of CIS research (Hertzum & Hansen, 2019). CIS has been studied in the context of education (Wu, Liang, & Yu, 2018), health (Hertzum, 2010), and other organizations (Fidel, Pejtersen, Cleal, & Bruce, 2004; Hansen & Järvelin, 2005), as well as in everyday information seeking, like travel planning (Tao & Tombros, 2017). While there is still no consensus on one definition of CIS and the definitions evolve over time (Hertzum & Hansen, 2019; Shah, 2014), at its core, it is a process of more than one person looking for information in collaboration with others and having a shared goal (Morris & Teevan, 2010). Shah (2010) provides a more nuanced conceptualization, defining CIS as a "process involving various individuals who may see different aspects of a problem. They engage in a process that goes beyond their own individual expertise and vision to complete a task or project" (p. 6).

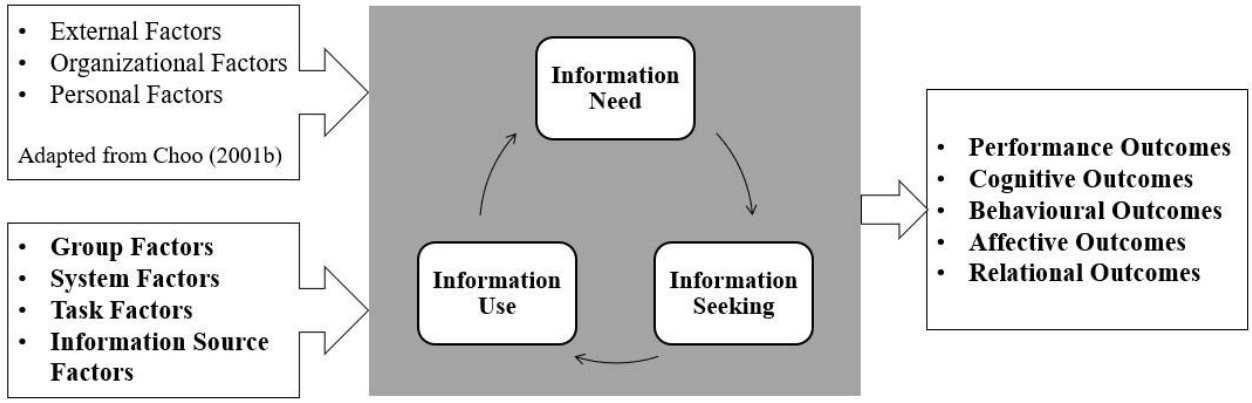
In terms of factors influencing CIS, studies have focused on the human aspects of collaboration, for example, personality profiles (Hyldegård, 2009), or the number of collaborators (Shah, Hendahewa, & González-Ibáñez, 2017), as well as system factors, such as awareness features (Shah, 2013). In terms of outcomes, various collaboration benefits have been identified; for example, a higher number of collaborators could lead to greater recall of search results (Moraes, Grashoff, & Hauff, 2019). At the same time, collaboration may lead to negative outcomes, such as feeling confused or frustrated (Kim & Lee, 2014).

Earlier CIS researchers were calling for studies looking closely at the factors influencing CIS (Hyldegård, 2006; Shah, 2010). For example, how participants engage in CIS, how to encourage and facilitate participation, and finally, how to evaluate the impact and innovation resulting from collaboration (Morris & Teevan, 2010). More research is still needed on social, technical, and cognitive aspects of CIS activities (McNeese & Reddy, 2017). A recent literature review concluded that few studies investigate the reasons (i.e., triggers and barriers), experiences and outcomes associated with CIS (Hertzum & Hansen, 2019). Additionally, while collaboration has the potential to solve complex problems and lead to new knowledge discovery (Hara, Solomon, Kim, & Sonnenwald, 2003; Karamuftuoglu, 1998; Shah, 2014), empirical investigations have not

extended CIS to information monitoring and CIM has not been explored in the context of research practice.

Addressing the above-mentioned knowledge gaps and the call for CIS studies to "build on each other in a cumulative manner" (Hertzum & Hansen, 2019, p. 156), a systematic mixed studies review with a framework synthesis was conducted (Granikov, El Sherif, Bouthillier, & Pluye, 2022). We synthesized 51 empirical CIS studies and identified seven categories of factors (i.e., personal, group, organizational, environmental, information sources, system, task) and five categories of outcomes (i.e., performance, behavioural, cognitive, affective, relational). The resulting conceptual framework is presented in Figure 1.

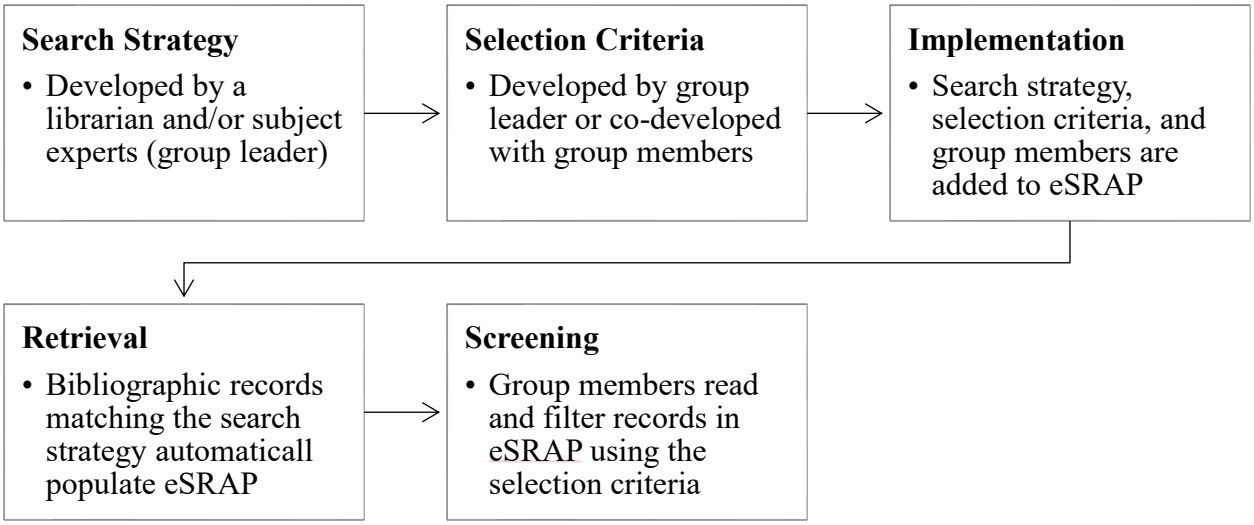
Figure 1. Conceptual Framework for Factors and Outcomes of Collaborative Information Seeking



Note: Original figure reproduced from an open access article (Granikov et al., 2022).

This framework informed our case study, which aims to identify and understand the factors and outcomes of CIM from the perspective of health researchers and trainees engaged in a unique monitoring system called eSRAP (hereinafter referred to as eSRAP members). The eSRAP system was developed to help members of POR communities keep up to date collaboratively. The CIM process in eSRAP is illustrated in Figure 2. Ultimately, the system enables eSRAP members to read newly added bibliographic records and select those that are relevant using predetermined selection criteria.

Figure 2. Collaborative Information Monitoring Process in eSRAP



The current study explored CIM by bridging the concepts of information monitoring and CIS. We define CIM as intentionally monitoring distinct information sources, for the purpose of maintaining awareness of developments in a field of interest, pursued by a group of members (two or more), who explicitly share an information need (e.g., a research interest), and who actively intend to collaborate (vs. implicit algorithmically based collaboration through recommender systems). Specifically, we addressed the following research questions.

- (RQ1) How do members engage in CIM with eSRAP?
- (RQ2) What factors influence CIM from the perspective of eSRAP members?
- (RQ3) What are the outcomes of CIM from the perspective of eSRAP members?

Methods

Study Design and Case Selection

We employed a multiple case study approach, recommended for investigating a "contemporary phenomenon in depth and within its real-world context," without controlling events, relying on multiple sources of evidence, and using prior theoretical propositions to guide data collection and analysis (Yin, 2014, p. 16). This approach helped us better understand the cases, capture their context, and compare them. eSRAP was used to select and "bound" the cases. A case was defined as an eSRAP project implemented in the context of POR involving eSRAP members. Included cases satisfied three criteria: (1) the intention to use eSRAP for CIM, (2) the

completion of preparatory work, e.g., deciding on a search strategy and selection criteria, and (3) project implementation in eSRAP. All eSRAP members involved in a project were invited to participate in the study. Given that eSRAP is a new system designed to support CIM, all implemented projects (i.e., cases) were included. Moreover, it was deemed valuable to include system users and non-users, as well as different uses of the system (i.e., collaborative and individual). The Institutional Review Board of the Faculty of Medicine and Health Sciences at McGill University approved the research protocol (study approval #A03-E11-16B, See Appendix 4). All participants received information explaining the study and consented prior to data collection.

Data Collection

In-depth semi-structured individual interviews were the primary source for data collection, supplemented by project documentation and system archives (i.e., logs). Project documentation provided data on each implemented project (e.g., the bibliographic search strategy and screening questions). System logs provided data on members' engagement in CIM via eSRAP (i.e., system use). In addition, the first author made field notes during and after each interview.

All interviews were conducted online and were audio-recorded using video-conferencing platforms (GoToMeeting or Zoom). Each interview lasted approximately one hour and was conducted in the respondent's language of choice (English or French) by the first author. The Interview guide (see Appendix 5) was initially developed in English and then translated into French. The guide was piloted in both languages prior to administration. During the interviews, participants were first asked general open-ended questions about how they keep up to date. They were then asked about CIM, eSRAP implementation and use, influencing factors, actual and anticipated outcomes. The same interview guide was used in all interviews to collect similar data across cases and enable cross-case analysis (Miles, Huberman, & Saldaña, 2020).

Data Analysis

All interviews were transcribed verbatim in the original language by a bilingual transcription professional. Project documents (i.e., search strategies and selection criteria used in the implemented monitoring projects) and archives (i.e., eSRAP system logs) were used to verify the interview data. For example, project documents could confirm the number of screening questions, which would suggest ease of screening, or the exhaustivity of a search strategy, which

may lead to a higher number of retrieved records. Interview transcripts (i.e., raw data) were imported into NVivo qualitative data analysis software (version 10) to ensure a systematic approach to data organization, management, and coding (Saldaña, 2016). While raw data were in English or French, data analysis was performed in English. Cases were identified by numbers and participants' names were replaced with pseudonyms to protect their identities.

Data were analysed in two stages using a hybrid deductive and inductive thematic analysis (Fereday & Muir-Cochrane, 2006). Within-case analysis was followed by cross-case analysis. The analytical codebook (see Appendix 6) was used to improve the credibility and replicability of the study (Fereday & Muir-Cochrane, 2006; Roberts, Dowell, & Nie, 2019).

Within-case analysis focused on exploring what happened in the bounded context of each case (Miles et al., 2020). Segments of data were deductively coded to the *a priori* broad categories (i.e., themes related to the factors and outcomes from the conceptual framework in Figure 1). Through careful rereading of data, inductive sub-categories were assigned to segments of data that described new sub-themes (Fereday & Muir-Cochrane, 2006). Codes (i.e., labels) were added, revised, reorganized, and clustered in an iterative manner until no new themes were identified. Coded segments were organized by theme into case summaries (Miles et al., 2020) to build logical chains of evidence (Yin, 2014).

Subsequently, cross-case analysis examined patterns, similarities, and differences across cases to develop a deeper understanding and more powerful explanations of case types (Miles et al., 2020). The first author (VG) carried out thematic analysis of the interview transcripts and the within-case analysis. The second and third authors (FB, PP) validated the initial coding manual and the data analysis plan, read the case summaries, and provided guidance during the cross-case analysis. For publication, when needed, we have translated all quotations from French into English.

Results

Description of Cases

Eleven participants were interviewed, representing the seven cases included in this study. Out of 11, seven (64%) interviews were conducted in French and four (36%) in English. Eight (73%) participants were female and three (27%) were male. The number of members per case ranged from one to three. eSRAP implementation did not always lead to CIM or use of the eSRAP system, as illustrated in Table 1.

Table 1. Characteristics of Included Cases

Case #	Case Setting	Interviewed members	Engagement in CIM	Use of eSRAP
C1	University (Canada, France)	1 researcher (Anna) 1 research professional (Cedric) 1 research trainee/clinician (James)	Yes	Yes
C2	Hospital-affiliated research centre (Canada)	1 manager (Jennifer) 2 research professionals (Ellen, Kristi)	Yes	Yes
C3	University-affiliated research centre (France)	1 researcher/clinician (Jeremy)	Yes	No
C4	Hospital-affiliated research centre (Canada)	1 manager (Gina)	No	Yes
C5	University (Canada)	1 research professional (Rachel)	No	Yes
C6	University (Canada)	1 medical trainee (Claire)	Yes	No
C7	Knowledge network (Canada)	1 manager (Susan)	No	No

The seven cases represent four types of engagement in CIM with eSRAP (RQ1): CIM with eSRAP ('CIM/eSRAP''), CIM without eSRAP ('CIM/no-eSRAP'), individual monitoring with eSRAP ('no-CIM/eSRAP'), and no monitoring and no use of eSRAP ('no-CIM/no-eSRAP'). The included cases are summarized below. More detailed case profiles are presented in Appendix 7.

Case 1

"Working as a group helps to avoid individual cognitive work that takes much more time" (James). After setting up the project in eSRAP, Anna looked for people to help her monitor incoming records. James and Cedric, who do not know each other, responded even if the topic was not their research interest. In eSRAP, James and Cedric do the initial screening, which Anna finalizes. She also resolves disagreements in ratings when needed. In fact, the main CIM difficulty experienced by all three members, was reaching a shared understanding of the selection criteria, even if the project involved only two screening questions. To overcome this challenge, James and Cedric wished they were involved in the initial development of the project, specifically, deciding

on the selection criteria. While members described some shortcomings of the eSRAP system, these were overcome by Anna's availability and responsiveness.

Case 2

"It helps us progress as a group, to read together rather than individually" (Jennifer). With the approval of the research director, Jennifer, Ellen, and Kristy co-developed the eSRAP project. Ellen and Jennifer have been working together for a year, with Kristy joining the team more recently. Kristy used the system the most, followed by Ellen. When asked about reaching agreement in selecting what is relevant, Ellen replied that they "pretty good," possibly because she trained Kristi and 'passed on' her understanding of the criteria to Kristi. Jennifer visited eSRAP but did not rate any records. Given the low number of incoming records, Jennifer saw no pressing need for new eSRAP members.

Case 3

"Knowing people is important for working together" (Jeremy). Jeremy and a colleague (who declines the interview invitation) are health professionals, who also do research. Jeremy heard about eSRAP, liked the idea, then found a research topic he could use it with. The objectives were developed "in action" as Jeremy says. The two met to co-develop the monitoring project and tested the selection criteria by screening bibliographic records on paper. Their eSRAP project has 11 screening questions, some of which in involve "personal judgement," which made it more difficult to reach agreement on the ratings and necessitated more discussion. The key barriers to using eSRAP for CIM were time constraints and difficulty retrieving records from specific bibliographic databases.

Case 4

"I am not able to go through all these articles, even if it is only to read the abstract and then to see if it is relevant" (Gina). Gina manages a division of a research centre. Her predecessor implemented the project in eSRAP with the goal of producing an informational newsletter. The eSRAP project consists of a comprehensive bibliographic search strategy, regularly retrieving a high number of records, and eight screening questions. Gina is the only person using eSRAP – a low uptake she explains by existing workload, reluctance to change when it comes to new technology, and colleagues not seeing "what's in it for them."

Case 5

"Selecting articles in systematic reviews takes a method that is the same for everyone. eSRAP allowed for that" (Rachel). Rachel, a research professional, was the contact person for implementing several eSRAP projects following topic-specific literature reviews. Different people worked in eSRAP, with one person per project (i.e., topic); there was no collaboration within monitoring projects. eSRAP was appreciated for allowing them to be systematic, follow the same monitoring process, and centralize everything in one place.

Case 6

"The benefit of working in a team is that you can subdivide the work, discuss things, make less biased decisions, and it's a lot of fun" (Claire). Claire, a medical student, led a newsletter project helping clinicians keep up to date. She was the contact person for eSRAP, which was implemented but never used. Due to the fast-growing number of publications on their topic of interest, eSRAP loaded slowly and, as Claire explained, they were already using "a deconstructed eSRAP", which functioned well. Even if eSRAP was not used, co-developing the screening questions for eSRAP, improved their selection process with previously implemented CIM tools. Claire attributed CIM's success, outside of eSRAP, to an effective distribution of tasks and weekly check-in meetings.

Case 7

"It comes back to the capacity of our team and what the need is" (Susan). Susan manages a knowledge network and keeps up to date through newsletters and what others share with her. Upon her request, the eSRAP project was implemented, but remained unused. Not using eSRAP, Susan explains by not building it into her calendar and not becoming comfortable with the system. While Susan hoped that CIM with eSRAP would help her group work better together, she also pondered "I think the idea is good but are all groups ready to participate, to what extent and with who? I don't know."

Preparation for Cross-Case Analysis: Themes and Subthemes

Cases were classified according to the seven factors and five outcomes (i.e., themes) in a deductive manner. No new factors or outcomes (i.e., unanticipated in the framework) emerged. Table 2 summarizes the themes described by eSRAP members and corroborated by eSRAP project

documentation and system logs (RQ2 and RQ3). In addition, Table 2 illustrates the sub-categories of factors and outcomes (i.e., sub-themes) were suggested by the cases.

Cross-Case Analysis

Cross-case analysis revealed the similarities and differences between case types. Guided by the cross-case matrix (Table 2), the following sections present the observed characteristics (i.e., factors and outcomes) of CIM. The characteristics are organized as common (i.e., present across all cases and case types), specific (i.e., present in all cases of the same case type), and idiosyncratic (i.e., present in some cases regardless of case type). Specific characteristics were observed only for case type 'CIM/eSRAP' and for combined case types 'CIM/eSRAP' and "CIM/no-eSRAP'. Specific characteristics were not observed for case type 'no-CIM/eSRAP' or 'no-eSRAP/no-CIM'. Idiosyncratic characteristics are reported, despite being case-specific, because members perceived them as important to CIM.

Table 2. Cross-Case Matrix of Factors and Outcomes of CIM

		'CIM/eSRAP'		'CIM/no-eSRAP'		'No-CIM/eSRAP'		'No-CIM/no-eSRAP'
Themes	**Subthemes**	**Case 1**	**Case 2**	**Case 3**	**Case 6**	**Case 4**	**Case 5**	**Case 7**
1. Factors								
1.1. External	1.1.1. Volume of new publications	+	+	+	+/-	+	+	+
1.2. Organizational	1.2.1. Culture		+	+		+		+
	1.2.2. Top management support		+			-		
1.3. Information sources	1.3.1. Peers	+	+	+	+	+	+	+
1.4. Task	1.4.1. Co-development	-	+	+	+	+		
	1.4.2. Screening process	+	+	-				
	1.4.3. Selection criteria	-	+	-	-			
1.5. System	1.5.1. Satisfaction with performance	+	+	-	-	-		
	1.5.2. System as a central repository	+	+	+	+	+	+	+
	1.5.3. System as chunking	+	+					
	1.5.4. System as process		+		+		+	+
1.6. Group	1.6.1. Formation	-	+	+	+	-		-
	1.6.2. Communication	+/-	+	+	+			
	1.6.3. Leadership	+	+	+	+	-	-	-
	1.6.4. Division of work	+	+	-	+	-		
	1.6.5. Confidence in peers	+	+			-		
1.7. Personal	1.7.1. Skills	+	+	+	+	+	+	+
	1.7.2. Personality traits	+	+	+	+	+		

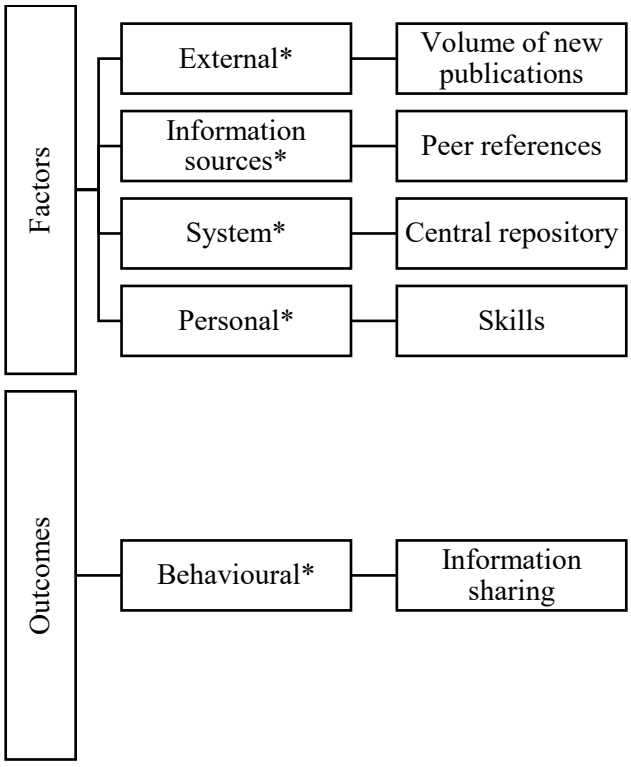
	1.7.3. Time blocking strategy	+	+	-		+		+
2. Outcomes								
2.1. Affective	2.1.1. Motivation	+	+	+	+			
	2.1.2. Worry	-	-					
	2.1.3. Confidence	+	+					+
2.2. Cognitive	2.2.1. Deeper reflection	+	+					+
	2.2.2. Shared understanding	+/-	+	+/-				
2.3. Behavioural	2.3.1. Discussion	+	+	+	+			
	2.3.2. Information sharing	+	+	+	+	+	+	+
	2.3.3. Information avoidance	+	+					
2.4. Relational	2.4.1. Internal ties	-			+			+
	2.4.2. External ties		+					+
2.5. Performance	2.5.1. Efficiency	+	+	+		+	+	
	2.5.2. Quality				+	+/-		+

Legend: The "+" and "-" signs indicate whether the factor or outcome was positive (e.g., a facilitator), negative (e.g., barrier), or both.

Common Characteristics

Some factors and outcomes of CIM were found across all cases and case types (Figure 3).

Figure 3. Common Characteristics Across Case Types



*Confirmed themes derived from the conceptual framework.

The included cases shared the external information environment characterized by a high volume of new publications. Jennifer (C2) acknowledged "What I find difficult is just that there is too much to read." To overcome the challenges of the ever-growing volume, members relied on peers as information sources, as well as social media, conferences, and organizational newsletters, which all offer peer-mediated filtering of information. As Claire (C6) succinctly said "experts function as filters."

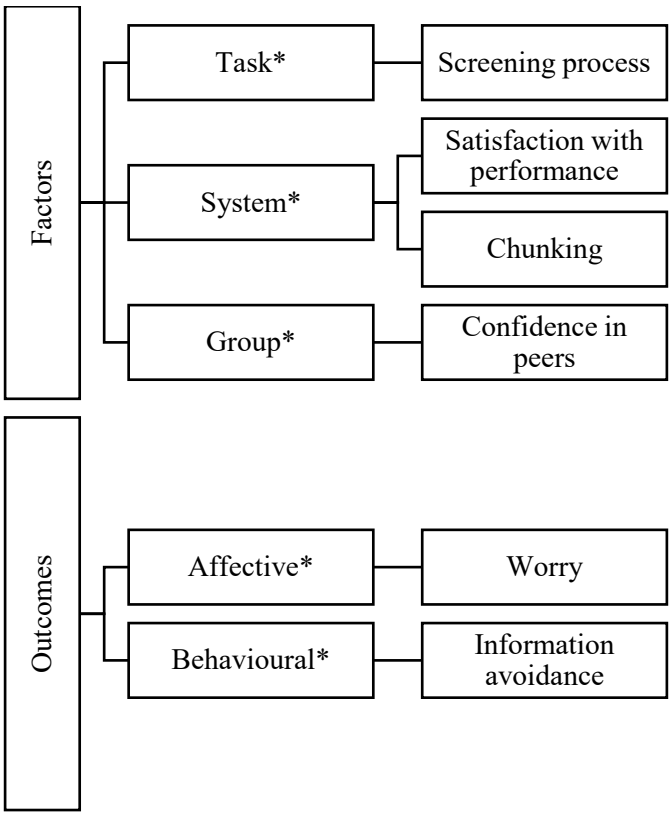
Regardless of eSRAP members' engagement in CIM, all valued the system as a central repository, a "hub for new scholarly publications" (Ellen, C2) and an "archive" (Susan, C7). All members described personal skills (e.g., technical, research training) and perceived their skill level as proficient or high. For example, Jeremy (C3) exclaimed "I like anything that has to do with computers." All members were familiar with searching in bibliographic databases (e.g., PubMed, CINAHL, PsycINFO).

In terms of behavioural outcomes, members described information sharing as an actual or anticipated result of CIM. Examples included using information identified through CIM and/or eSRAP to update a website (C1), produce newsletters (C2, C4, C6), publish articles with regular updates on a given topic (C3, C5), or for professional development activities (C7). Gina (C4) recalled "We used it (eSRAP) a lot for our newsletter. We are responsible for keeping up to date not only our team, but also other teams interested in our research topic."

Specific Characteristics

Specific characteristics refer to the factors and outcomes that were found in all cases of the same case type. Four specific factors and two specific outcomes were identified for case type 'CIM/eSRAP' and are presented in Figure 4.

Figure 4. Specific Characteristics for Case Type 'CIM/eSRAP'



*Confirmed themes derived from the conceptual framework.

The screening process, operationalized by the number of screening questions, was perceived as an important task-related factor. "We have few questions. It is agile. It is light" (Jennifer, C2). In terms of system factors, satisfaction with system performance (e.g., not having

formal requirements for additional features) acted as a facilitator. Members admitted not using many of the system's functions. As Jennifer (C2) laughingly remarked "Just because you can do something doesn't mean you have to." Additionally, the ability to chunk (or dose) the CIM activity into smaller chunks (e.g., a predetermined number of records) made it more manageable and helped them participate. Anna (C1) shared "I told myself each time that I will log into eSRAP, I will screen at least 5 papers." A specific group characteristic was related to confidence in peers (e.g., their ability to identify relevant records). "We know that we trust each other. We know that we are critical and rigorous towards the information we consume" (Ellen, C2). In contrast, Gina (C4) described the reverse – talking about colleagues who do not consult scientific articles for keeping up to date, Gina said "Part of the work is done, but not according to my criteria of quality."

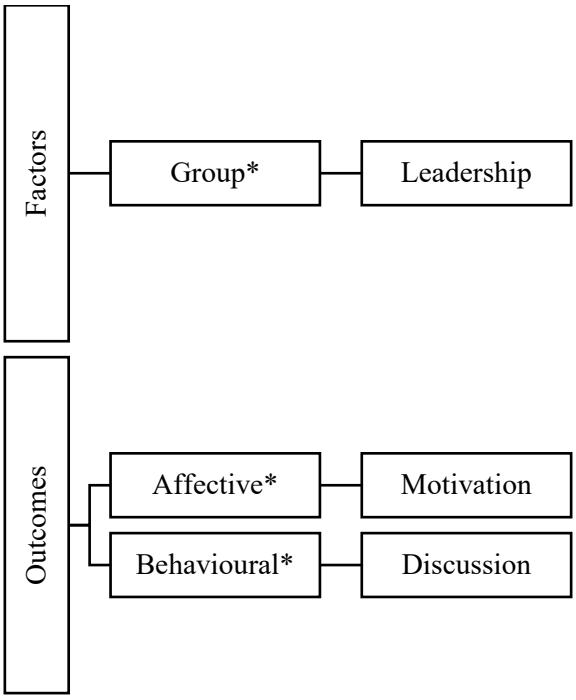
In terms of outcomes, the two 'CIM/eSRAP' cases reported negative affective outcome, namely feeling worried. James (C1) described:

> There was a moment, a short one, I felt helpless. I said to myself maybe it's better to say 'In the end I'm not going to help you because I'm going to make everything more complex and then it's going to be difficult for you. I'm not going to be useful and on the contrary, I'm going to bring negative elements.

The specific behavioural outcome was information avoidance. Cedric (C1) admitted "To be honest, sometimes I don't know how to rate. So, I skip because someone else will rate it and because I'm wasting a lot of time looking at the abstract."

Additional specific factors and outcomes were identified by combining case types 'CIM/eSRAP' and 'CIM/no-eSRAP', which are presented in Figure 5.

Figure 5. Specific Characteristics for Case Types 'CIM/eSRAP' and 'CIM/no-eSRAP'



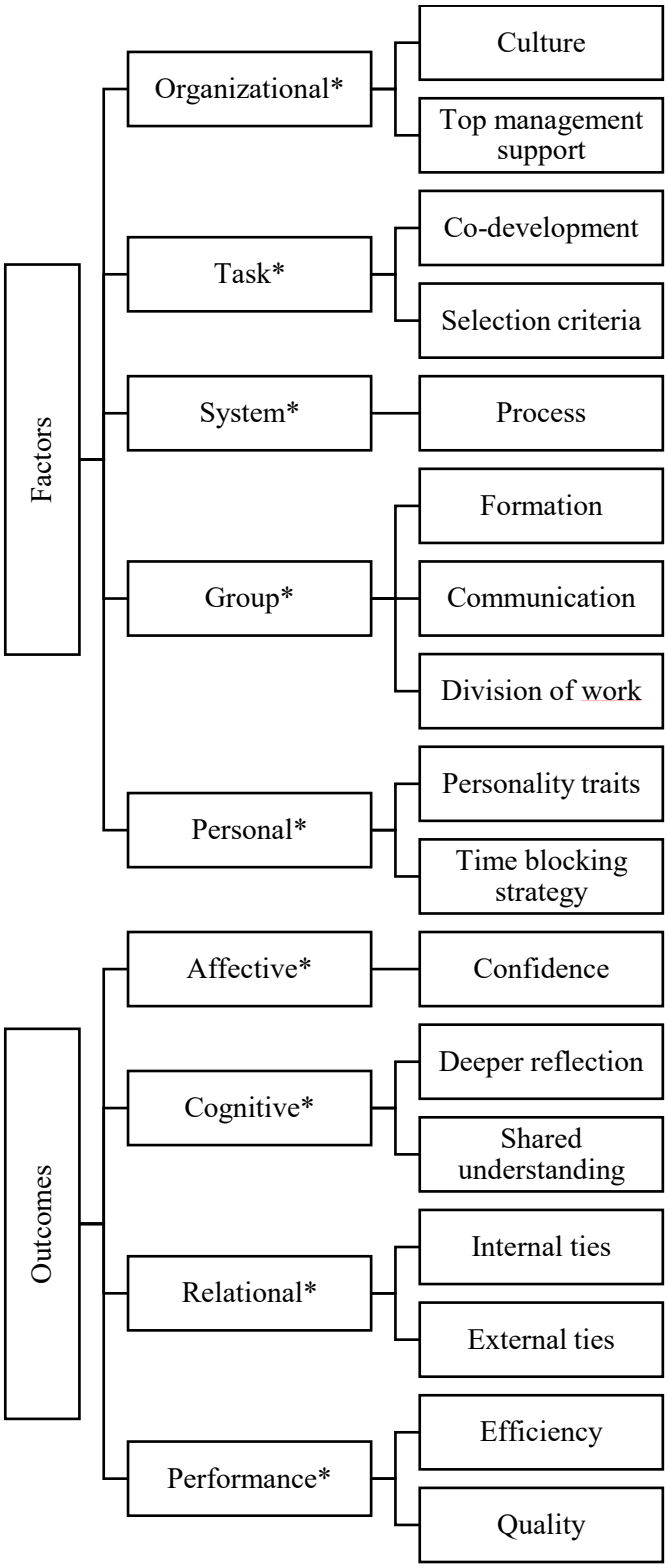
At the group level, a common specific factor was leadership (e.g., overseeing the implementation of eSRAP projects). For example, while Anna (C1) described herself as a "passive" leader, she remained responsive to members' needs. As James (C1) explained "What kept me motivated was that Anna would ask for changes based on what I asked her."

The affective outcome was related to feeling motivated and having fun because of being a group. "Having more people involved motivates me … The fact that there are people around encourages me to go, to log into eSRAP" (Anna, C1). Claire (C6) agreed saying that collaborating "made things more fun and more engaging." In terms of behavioural outcomes, members engaged in discussion to clarify the screening criteria or to talk about the identified articles. Jeremy (C3) mentioned "We exchanged several times, we got together to discuss what we did, what we didn't do, how we did it …"

Idiosyncratic Characteristics

Certain factors and outcomes were neither common nor type-specific yet were perceived by eSRAP members as important to CIM. These idiosyncratic (i.e., case-specific) factors and outcomes are presented in Figure 6 and explained below.

Figure 6. Idiosyncratic Characteristics Across Case Types



*Themes derived from the conceptual framework.

Five out of seven eSRAP projects (i.e., cases) were implemented in research organizations. Organizational culture valuing inclusion and exchange was perceived as a CIM facilitator. In Jennifer's (C2) words "I saw that it's (eSRAP) going to allow us to sort through the references in a different way, which is consistent with our objectives as a research team – to be inclusive." Top management support was also important. Jennifer (C2) described the reaction of her director to CIM with eSRAP as "We had discussed it a bit and he said: Oh yes, it's a great idea!" In contrast, Gina (C4) acknowledged "You really need to have good leadership internally. Maybe that's what we've been missing, strong internal leadership to say: Here 's a new tool, here's how to use it."

In terms of task-related sub-factors, participation in the co-development of CIM projects was seen as valuable. James (C1) explained "If you're not involved in the group dynamics, the group decisions, the construction of the group topic or the collaborative watch, I think you're less engaged in terms of depth, understanding of the topic." On the other hand, applying the selection criteria (i.e., making relevance judgements as a group) was challenging. Jeremy (C3) mentioned "We have two questions about relevance and usefulness which are subjective and which, therefore, may be a little different between us. That's where we disagreed at first, but then we agreed, and finally it worked."

System as process (i.e., eSRAP enabling a systematic way to filter records) was a system sub-factor observed in some cases. Based on only implementing the eSRAP project, Claire (C5) said "I think going through the process of structuring our thoughts and structuring our inclusion and exclusion criteria the same way we would have done for a formal literature review was a huge benefit of the platform."

In terms of group factors, formation (i.e., how the group came together) was seen as important. "When I know them, I know what interests them and so I can send them papers that interest them. So yes, knowing people is important for working together" (Jeremy, C3). Related to group formation was communication. James (C1) described communicating as "a way to see if people have done the same thing as you, if what you knew before was consistent with what they thought." Division of work (i.e., who does what) was also important to CIM. For example, in C1, either James or Cedric would read and rate records, one rater per record, which the group leader then "finalized". In contrast, Jeremy (C3) described the division of work and roles as "anarchy."

Idiosyncratic personal factors that facilitated CIM were related to personality traits (e.g., curiosity or desire to help). For example, James (C1) and Jennifer (C2) talked about being

interested in many subjects, wanting to learn about everything. In eSRAP, Cedric (C1) described his role as supportive "I was helping other people keep updated with new evidence." Not surprisingly, members described time constraints as barriers to information monitoring, in general, and collaboratively. To overcome them, intentionally blocking (i.e., setting aside) time for CIM with eSRAP facilitated at least system use, if not collaboration. Ellen (C2) described her strategy as "I would set up my time slot like 'OK eSRAP' and then I go for it." Conversely, not blocking time for CIM with eSRAP was seen as a barrier.

When it comes to case-specific outcomes, an affective outcome was related to feeling confident. Anna (C1) mentioned:

> I am maybe more confident in the response whereas if I was the only rater. Now that we are at least two people looking at each paper, I feel more comfortable with the decision that is made at the end.

As a cognitive outcome, members expected a deeper reflection to result from discussion and exchanges. According to James (C1), participating in collaborative monitoring, in contrast to individual reading, adds a critical thinking component to learning, made possible by the "confrontation" and knowledge sharing among team members. He said, "Collaboration allows to bring together what you know (as an individual) with what they know" (James, C1). Another case-specific cognitive outcome was developing and/or validating a shared understanding. Jeremy (C3) described:

> When we met, we said to ourselves, what are we trying to do? We talked about it and then we agreed and said yes, but neither of us was exactly on the same page so it didn't work. And we went around again and there we were better, much more, we were almost, almost good.

Two relational outcome sub-themes were identified. CIM was expected to strengthen ties within the research teams (i.e., internal ties) and with the larger community (i.e., external ties). Claire (C7) recounted "We hadn't collaborated on anything before. It was really neat that we all came together with a shared goal, and we made friendships along the way." While Ellen's (C2) words illustrate external ties "It's about growing the community."

Finally, performance outcomes were related to efficiency and quality. Members reported saving time (i.e., efficiency) by sharing the monitoring workload. "Time is saved because there is already someone who has done the work" (Ellen, C2). Members also described higher output

quality due to having at least two people read and rate each bibliographic record. In addition, Susan (C7) hoped that CIM, could help all involved make evidence-based decisions instead of being "very ad hoc right now."

Discussion

This multiple case study explored the factors and outcomes of CIM from the perspective of 11 eSRAP members representing seven cases. Four types of engagement in CIM with eSRAP were observed: 'CIM/eSRAP', 'CIM/no-eSRAP', 'no-CIM/eSRAP', and 'no-CIM/no-eSRAP'. Our findings confirmed the seven themes of factors and the five themes of outcomes from the initial conceptual framework. In addition, we identified 19 sub-themes of factors and 12 sub-themes of outcomes. Out of four observed case types, specific characteristics (i.e., factors and outcomes) were identified only for case type 'CIM/eSRAP' and combined case types 'CIM/eSRAP' and 'CIM/no-eSRAP'. Other characteristics were either common (i.e., present across case types) or idiosyncratic (i.e., case specific).

This section is organized as follows. We begin by discussing the common characteristics observed across cases and case types, which provide descriptive information about the cases and enhance the transferability of our findings. Second, given our focus on CIM, we discuss the factors and outcomes identified as specific to cases with CIM, either with or without eSRAP, and contextualize them in previous research. We then present a comprehensive synthesis of all factors classified as barriers and facilitators (Table 3) and outcomes classified as positive and negative (Table 4), which enables us to offer practical recommendations. We conclude with study limitations, contributions, and directions for future research.

Common Factors and Outcomes

All members described a shared informational (i.e., external) environment and preferred information sources. In line with previous studies involving academic researchers (Hemminger, Lu, Vaughan, & Adams, 2007; Jabri, 2008; Jamali & Nicholas, 2010; Pontis et al., 2017), all eSRAP members spoke of a high volume of new publications, which they hoped to overcome with the help of peers and collaboration. Our findings confirm long-established knowledge that researchers prefer informal information sources, such as peers, which allow them to save time and energy (Talja, 2002). Turning to collaboration is not surprising given that it is intrinsic to research, is believed to have the potential to solve complex problems and lead to knowledge discovery (Hara

et al., 2003; Karamuftuoglu, 1998; Shah, 2014; Sonnenwald, 2007). Concerning system factors, our findings confirm the value of having a central repository, to aggregate and compile information, accessible to remotely-distributed members (Attfield, Blandford, & Makri, 2010). As in earlier studies, common personal factors were related to skills and a higher sense of self-efficacy or personal mastery, which could lead to a higher use of information resources or systems (Choo, Detlor, & Turnbull, 2000b; Wilson, 1997b).

A common behavioral outcome was information sharing, which is considered integral to scholarly practices, as well as collaborative information behaviour (Talja, 2002). According to Capra et al. (2010), when sharing CIS results, researchers tend to share information that has been organized and even annotated (i.e., 'digested' to be useful to others). We observed this in cases that engaged in CIM to produce informational newsletters (i.e., digests) or to maintain an informational website. Meanwhile in other cases, the expected information sharing was traditional dissemination of research findings (e.g., publishing articles on methodological advancements). Even if information sharing was not a two-way exchange (e.g., disseminating a newsletter), it was nonetheless driven by mutual interests and benefits between information providers and information receivers (Bao & Bouthillier, 2013).

Factors and Outcomes Specific to Cases with CIM

Since keeping up to date is challenging, as described by study participants, as well as in the literature (Pontis et al., 2017), having a low-effort CIM task, operationalized as few screening questions, combined with the system's ability to chunk or dose CIM activities were seen as facilitators. These two factors offered members a sense of control in the context of information overload, which is typically associated with a loss of control over information and feeling overwhelmed. In fact, the loss of control may be "the single major symptom of overload" while "restoring control is the major step towards its remedy" (Bawden, Holtham, & Courtney, 1999, p. 253).

Furthermore, because online systems are essential to collaboration in the context of distributed and remote work (Lee, 2013; Ruan, 2011; Saleh & Large, 2011), satisfaction with system performance can facilitate collaboration (Leeder & Shah, 2016b; Paul & Morris, 2011; Reddy, Jansen, & Krishnappa, 2008). This is particularly true when it comes to introducing new systems and tools, while collaborators may accept the limitations of 'old' and already familiar systems, what Capra et al. (2010) call 'tools-at-hand'. Our findings show that overall satisfaction

with system features was a specific facilitator in "CIM/eSRAP" cases. While the opposite (i.e., dissatisfaction with eSRAP) acted as a barrier in "CIM/no-eSRAP" cases.

At the group level, the specific characteristics concerned leadership and confidence in peers. Group leaders play an important role in dividing and organizing collaborative work (Lee, 2013; Leeder & Shah, 2016b; McNeese, Reddy, & Friedenberg, 2014). Our cases that engaged in CIM support this claim. All four had group leaders who were interested in, and responsible for, CIM activities. Moreover, as observed by Wu, Liang, and Yu (2018), group leadership can compensate for lack of other potential facilitators (e.g., personal knowledge). Indeed, as observed in Case 1, the attentiveness and presence of the group's leader, helped to overcome limited group discussion, members not knowing each other, system usability issues, and low motivation. Looking outside of CIM and CIS, our findings related to leadership as a determinant that facilitates collaboration are consistent with the literature on interprofessional collaboration in healthcare (San Martín-Rodríguez, Beaulieu, D'Amour, & Ferrada-Videla, 2005).

Confidence or trust in colleagues is a requirement for effective collaboration (Shah, 2015). Kwon (2017) suggested that this kind of trust is built and gained through the peer review process, and applies to scholarly publications (i.e., hard information sources), as well as peers (i.e., soft information sources). Our findings related to group members' confidence in peers' selection of relevant information support this claim, as well as earlier work by Talja (2002), who found that scholars from different disciplines preferred to collaborate with colleagues and students they trusted to be knowledgeable in their fields.

Engaging in CIM resulted in mixed affective outcomes – feeling motivated and happy, as well as worried and stressed. The affective dimension is a fundamental element of CIS (González-Ibáñez, 2015). Our findings pertaining to positive and negative feelings related to CIM are congruent with previous CIS research (González-Ibáñez, Shah, & Córdova-Rubio, 2011; Leeder & Shah, 2016a; Reddy et al., 2008; Yue, 2014). Collaboration is often seen as positive and fun (Shah, 2015). At the same time, Kim and Lee (2014) proposed that the negotiation and communication involved in working together, in contrast to individual information seeking, can cause stress and even a desire to work alone. Echoing Kuhlthau (1993), members of cases with CIM described feeling stressed related to uncertainty in developing and applying screening criteria as a group. Hyldegård (2006, 2009), who used Kuhlthau's model to investigate information behaviour of students collaborating in an academic setting, also observed frustrations related to

reaching consensus and different individual approaches to work. Returning to the mixed affective outcomes, Hyldegård (2006, 2009) attributed it to personal factors, such as different emotionality profiles, individual motivations, and expectations.

A behavioural outcome specific to cases with CIM was discussion. Indeed, discussion or communication are integral to collaboration (Shah, 2015). In CIS, discussion occurs to exchange information or feedback, brainstorm, make decisions, and solve problems (Al-Thani & Stockman, 2018; Fidel et al., 2004; González-Ibáñez, Haseki, & Shah, 2013; Komlodi & Lutters, 2008; Reddy & Jansen, 2008; Reddy et al., 2008; Ruan, 2011; Shah & González-Ibáñez, 2012). In this study, working together was both facilitated by discussion (i.e., communication as a group factor) and resulted in more discussion (i.e., discussion as a behavioural outcome). However, discussion was identified as a specific CIM characteristic only as an outcome. For example, discussion was needed to come to a shared understanding regarding relevant records – an understanding necessary for filtering information as a group. Stated otherwise and in line with previous research, discussion allowed group members to exchange knowledge and establish a collaborative grounding, also essential to CIS (Hertzum, 2010; Hyldegård, 2006; McNeese & Reddy, 2017; Paul & Morris, 2011; Saleh & Large, 2011).

The other behavioural outcome specific to cases with CIM was information avoidance. Information avoidance refers to "any behavior intended to prevent or delay the acquisition of available but potentially unwanted information" (Sweeny, Melnyk, Miller, & Shepperd, 2010, p. 341) and is seen as a strategy to cope with, or counteract, information overload. For example, in examining information overload in the context of everyday information behaviour, Savolainen (2007) identified filtering and withdrawal as two major coping strategies. More recently, a study conducted during the Covid-19 pandemic, supported the relationship between information overload and information avoidance (Soroya, Farooq, Mahmood, Isoaho, & Zara, 2021). Moreover, the effect may be heightened when time pressures are present (Guo, Lu, Kuang, & Wang, 2020). This is the shared informational (i.e., external) context of our study participants. Being involved in POR, all members described feeling overloaded by the high volume of publications, meanwhile not having enough time. Engaging in CIM, with or without eSRAP, allowed them to avoid certain information because they knew someone else would look at it, thus reducing their personal workload.

The included eSRAP projects (i.e., cases) were implemented in diverse contexts. Indeed, information seeking behaviour of individuals and of groups, including CIS and CIM, takes place in a particular context, from which it cannot be separated (Case & O'Connor, 2016; Courtright, 2007; Pettigrew, Fidel, & Bruce, 2000; Shah, 2015). The different contexts in which eSRAP projects (i.e., cases) were implemented may explain the high number of idiosyncratic (i.e., case-specific) characteristics. Nonetheless, these characteristics offer useful insights for future CIM research and practice.

Synthesis of Factors and Outcomes and Implications for Practice

CIM involves a complex interplay of factors and outcomes. Factors can act as barriers or facilitators without having the ultimate influence on the case type. Stated otherwise, the presence of a facilitator cannot guarantee that CIM, with or without eSRAP, will occur. At the same time, some factors acting as facilitators may help overcome the challenges related to other factors (e.g., group leadership may 'offset' difficulties related to low personal motivation). Based on our findings, we do not intend to make predictions about necessary conditions for CIM or about CIM outcomes associated with specific factors. Instead, we classify all identified factors into barriers and facilitators (see Table 3) and outcomes into positive and negative (See Table 4) and propose actionable recommendations for practice (e.g., planning, implementing, or evaluating CIM projects).

Table 3. CIM Barriers, Facilitators, and Recommendations for Practice

Factors	Barriers	Facilitators	Recommendations
External	• Too many incoming new records (e.g., unsustainable over time).	• A high but sustainable volume of new records (e.g., enough new records to justify mobilizing members to engage in a CIM project).	• Work with an information professional to develop a bibliographic search strategy that (a) balances recall and precision, and (b) fits CIM members' resources.
Organizational	• Top managers are not involved or do not show visible	• An organizational culture that	• Create 'built-in' opportunities for dialogue and exchange

	support or enthusiasm for a CIM project. • A culture where resistance to change (e.g., changing practice or using new tools) is common.	encourages an open exchange of ideas. • An organizational culture that values and prioritizes different perspectives. • Top managers are present and show visible support or enthusiasm for a CIM project. • A CIM project 'fits' well with the organizational culture.	(e.g., regular meetings).
Information sources		• Common practice to rely on peers for keeping up to date and information sharing.	• Create channels to promote information sharing for keeping up to date.
Task	• Members are not involved in developing a CIM project. • The screening process is lengthy (e.g., many screening questions). • The selection criteria are complex, difficult to understand and/or apply.	• Members are involved in co-developing a CIM project. • The screening process is easy (e.g., few screening questions). • The selection criteria are easy to understand and/or apply.	• Involve members in co-development (e.g., the screening process and selection criteria are 'co-decided' to enhance shared understanding and increase task feasibility). • Prioritize low-effort screening tasks.
System	• Users need additional features (e.g., the system cannot retrieve records from a	• System performance matches performance expectations (e.g., users do not require	• Choose a system whose technical features match CIM needs.

	bibliographic database needed by the group).	any additional features). • All CIM-related information is stored in one place (i.e., central repository), organized and accessible to all users. • The system allows to break down (i.e., dose) the larger monitoring task into manageable smaller-sized chunks. • The system helps members follow the same (i.e., standardized) steps (i.e., actions) within the same CIM project.	• Choose a system that allows users to break down the monitoring task into smaller chunks.
Group	• Members do not know each other and have no opportunities to interact. • Lack of communication between group members (e.g., no group meetings, only one to one communication). • Lack of formal group leaders overseeing a CIM project and/or motivating members.	• Members know each other and have opportunities to interact together. • Open communication and opportunities for discussion and even debate (e.g., group meetings). • Engaged leaders overseeing a CIM project, who are attentive and receptive to members' needs and concerns. • Clear roles and division of work	• Identify or assign group leader(s). • Provide team building and skill-building professional development activities. • Clarify division of roles/work.

	• Unclear roles and division of work.	(e.g., who does what). • Group members trust each other's skills and abilities (e.g., trust peers to know which studies are relevant and of high quality).	
Personal	• Members lack some or many skills that are conducive to CIM (e.g., research training, bibliographic searching, organizational skills). • Members are reluctant to change. • Members lack time and do not 'block' dedicated time for CIM.	• Members possess some or many skills conducive to CIM. • Members' personality traits include curiosity, openness to innovation, change, continuous learning, working together and helping each other. • Consistently applying a time-blocking strategy for CIM.	• Engage in and encourage skill-building professional development activities. • Regularly block time for CIM.

Table 4. CIM Outcomes and Recommendations for Practice

Outcomes	Positive	Negative	Recommendations
Affective	• Members feel happy and motivated to engage. • Members feel confident (e.g., because relevant articles are identified collaboratively).	• Members feel worried (e.g., stress related to making mistakes not fulfilling CIM commitments, or living up to expectations).	• Being aware of possible negative feelings, group leaders should promote an environment where members feel safe to make mistakes and ask questions.
Cognitive	• Careful consideration of new information and ideas emerging from CIM activities. • Members understand CIM goals and processes (e.g., group members meet to discuss which records are relevant).	• Members do not understand CIM goals and processes.	• Provide opportunities for open communication, discussion, and information sharing, to promote both deeper reflection and shared understanding.
Behavioural	• CIM requires discussion to exchange and examine views, and to build relationships. • CIM involves information sharing (one- or two-directional). • Because of CIM, members may avoid certain information to reduce the work burden and/or the feeling of information overload (e.g., group members may skip complex records, knowing that		• Provide opportunities for open communication, discussion, and information sharing.

	someone else can screen them).		
Relational	• CIM, and the information sharing integral to it, promotes relationship building within the group and/or organization, as well as with the larger community.		• Provide opportunities for members to meet and exchange.
Performance	• By sharing the workload, CIM helps groups achieve their objectives while optimizing the required time and effort. • The 'product' or output of a CIM project is higher quality due to the involvement of different members (e.g., relevant records are selected by two independent reviewers).		• Engaged leadership and clear role division can enhance efficiency in a CIM project.

Limitations

This study faces three main limitations. First, the multiple case study was conducted by the first author (VG). To reduce the effect of individual biases on data collection, coding, and analysis, evidence from multiple sources was triangulated and an audit trail recording decisions and reflection was kept throughout the research process (Patton, 2014). Additionally, the initial coding manual and the data analysis plan were validated with the second and third authors (FB, PP).

Second, the study includes only seven cases, five of which did not engage in CIM with eSRAP. The eSRAP system was used to select and bound the cases; all available cases were included (i.e., the whole population). The 'non-CIM' cases act as contrasting cases, which enhance comparisons and suggest that a positive response bias was limited, despite participants' possible'predisposition' to CIM, manifested by their interest in using eSRAP collaboratively.

Finally, there may be language-related challenges. To overcome potential challenges associated with cross-language qualitative research, the following methodological recommendations from Squires (2009) were adopted: (1) we described what was done, when and by whom, (2) the interview guide was translated and pilot tested in English and French, and (3) the limitations related to cross-language research are acknowledged.

Contribution to Knowledge

Our research represents theoretical and empirical contributions to knowledge. Building on a systematic literature review and framework synthesis (Granikov et al., 2022), the qualitative data analysis supported the initial conceptual framework of CIS factors and outcomes (i.e., themes) and expanded it by generating sub-factors and sub-outcomes (i.e., new sub-themes). Exploring CIM in various contexts allowed us to enhance the generalizability of our findings compared to a single case (Miles et al., 2020). Using qualitative methodology allowed us to understand participants' views, experiences, and expectations related to CIM. The data collected from members and cases that did not engage with CIM and/or did not use eSRAP offered valuable insights and helped to deepen our understanding. Finally, we identified potential CIM outcomes, an area considered understudied in LIS and CIS research (Case & O'Connor, 2016; Hertzum & Hansen, 2019).

Future Research

This research opens several directions for future work. While our goal was not to seek universal causal generalizations, based on our findings, future research could employ a bigger sample and use statistical analysis (e.g., hierarchical linear models), to investigate which factor has more influence on CIM. Investigating more cases engaged in CIM could improve the ability to compare, explain, and predict (Bazeley, 2013). Furthermore, future studies could utilize a mixed methods approach to gain an in-depth understanding of CIM and improve generalizability of the findings. For example, qualitative findings could be used to explain and interpret the results of an earlier quantitative phase (Creswell & Plano Clark, 2018). Finally, longitudinal approaches could be used not only because CIS and CIM activities unfold over time, but also because groups evolve over time, for example, with members coming or leaving (Hertzum & Hansen, 2019).

Conclusion

Collaboration is believed to be a potential solution to problems that are too complex to solve individually, especially problems that involve seeking, evaluating, and using information (Denning & Yaholkovsky, 2008; Shah, 2015). Keeping up to date is that kind of problem. Our real-life study is the first exploratory step towards empirically investigating CIM. By examining the 'big picture' of CIM (i.e., factors and outcomes instead of focusing on CIM processes in isolation from its context) and not focusing on a system (i.e., using it only to bound the included cases), we are able to significantly extend current understanding of CIM. The factors and outcomes from the initial conceptual framework for CIS have been confirmed in the context of CIM and new CIM-specific sub-themes were identified.

Overall, because CIM involves a complex interplay of factors and outcomes and there is perhaps not a one-size-fits-all solution or formula, the proposed framework could be used to assess the various aspects of CIM groups and projects. Our study proposes actionable insights for encouraging and supporting CIM projects and helping POR stakeholders, as well as researchers and professionals in other fields keep up to date.

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Chapter 6. Discussion

This discussion chapter presents the integrated findings of the two studies that comprise this thesis. First, I summarize the overall purpose of the thesis and the results of the individual manuscripts (studies). Second, I present the comprehensive synthesis of my conceptual and empirical findings in a revised version of the initial conceptual framework. Third, I elaborate on the conceptual, methodological, and empirical contributions of my research and contextualize them with information from the literature. Finally, I address the strengths and the limitations of the dissertation, including the encountered methodological challenges.

6.1 Summary of Results

Working for over a decade as a research-embedded health information professional, I witnessed many researchers and clinicians who found it difficult to keep up to date. Most of them were technologically savvy and have set up various publication alerts (e.g., citation alerts, search alerts, table of contents alerts, etc.). However, the pushed alerts often remained unopened. Echoing the findings of Pontis et al. (2017), who studied how academic researchers keep up to date, I also observed that innovative solutions, other than just more technological ones, may be needed.

Turning to collaboration to overcome the challenges of keeping up to date offers a promising potential solution. Collaboration is intrinsic to research (Sonnenwald, 2007). It is also widely recognized that researchers prefer and rely on informal or soft information sources, such as peers, to identify new research developments and share emerging relevant information (Al Shboul & Abrizah, 2016; Bates, 1996; Meho & Tibbo, 2003; Pontis et al., 2017; Talja, 2002; Wang et al., 2007). In this context, the eSRAP system provides a novel technological solution to monitoring research trends, but most importantly, it supports collaboration and leverages the 'human touch' in monitoring. As one of my participants, Gina (Case 4), said:

> There is also a human side, in the sense that doing a search is very mechanical, it's very robotic. But there is a human side to it, and maybe artificial intelligence will be able to do that later, or even now. There is something human about: What was your impression of this article?

My research study is situated within human information behaviour research, looking at information behaviour (i.e., monitoring), use, and potential outcomes (Pettigrew et al., 2000; Wilson, 1997). The broad goal of the thesis is to explore collaborative information monitoring, and specifically, to identify and understand the factors and outcomes related to it. To achieve this

goal, I completed two studies, one conceptual (a mixed studies review reported in Chapter 3 – Manuscript 1) and one empirical (a multiple case study reported in Chapter 5 – Manuscript 3). Using a mixed studies review and a multiple case study approaches allowed me to leverage diverse data (e.g., quantitative and qualitative in the mixed studies review), diverse perspectives (e.g., complementary and contrasting cases in the multiple case study), and to gain a deeper understanding of the collaborative information monitoring phenomenon and a more complete picture.

6.1.1 Summary of Study 1

As the first step towards exploring the potential role of collaboration in keeping up to date, namely collaborative information monitoring, I conducted a systematic mixed studies review (i.e., a systematic review that includes quantitative, qualitative, and mixed methods empirical studies) with a framework synthesis. The review objectives were to identify the factors and outcomes of collaborative information seeking and adapt a conceptual framework for environmental scanning to a collaborative context. Due to the scarcity of studies on collaborative information monitoring, the review synthesized studies on collaborative information seeking.

Fifty-one empirical studies were included and analyzed using a deductive-inductive thematic synthesis. Out of 51, 23 (45%) studies employed mixed methods, 14 (27%) were qualitative and 14 (27%) quantitative. The factors and outcomes extracted from the included studies were used to revise the conceptual framework for environmental scanning (Choo, 2001), selected as the candidate *a priori* 'best fit' conceptual framework (Carroll et al., 2013). As a result, three types of factors from the *a priori* framework were confirmed (i.e., external, organizational, personal factors) and four new types were identified (i.e., group, information sources, system, task), as well as five types of outcomes (i.e., performance, behavioural, cognitive, affective, relational).

As demonstrated by the studies included in the review, the same factor can act as a facilitator and a barrier. For instance, in the context of collaboration, co-located collaborators may share information face-to-face, discuss and solve emerging problems, to be on the same page (Reddy & Spence, 2008; Saleh & Large, 2011). At the same time, face-to-face information exchange may contribute to collaborators feeling distracted and stressed, consequently increasing their cognitive and emotional loads (González-Ibáñez, Haseki, & Shah, 2013).

Similarly, the outcomes of collaboration in information seeking may be both positive and negative. It is the case with time efficiency. In some studies, pairs of collaborators were more efficient and required less time to complete tasks (Lazonder, 2005; Leeder & Shah, 2016a; Saleh & Large, 2011). In contrast, other studies found that groups required more time to complete tasks because members needed time to discuss, make sense of the information together, and reach consensus (Arif, Du, & Lee, 2015; Paul & Morris, 2011; Shah, Hendahewa, & González-Ibáñez, 2017; Wu, Liang, & Yu, 2018). Moreover, collaboration could lead to duplication of work, which would further decrease efficiency (Sun, Tian, & Cai, 2016; Wu, Liang, & Xiang, 2017).

In other words, collaboration involves a complex interplay of factors and outcomes, which need to be considered carefully and together when implementing or evaluating collaborative information projects.

6.1.2 Summary of Study 2

Guided by the conceptual framework developed in the mixed studies review (Study 1), I conducted a qualitative multiple case study. Study 2 aimed to identify and understand the perceived factors and outcomes of collaborative information monitoring from the perspective of eSRAP members (i.e., researchers, trainees, clinicians, research professionals, and managers). A case was defined as an eSRAP project implemented to monitor a particular research topic and collaboratively (i.e., together) select potentially relevant records (i.e., abstracts and bibliographic information representing scholarly articles). Data were collected with semi-structured individual interviews and triangulated with documents (i.e., the bibliographic search strategy and selection criteria comprising each eSRAP project) and archives (i.e., eSRAP system logs). Data analysis involved a deductive-inductive thematic analysis, which was carried out within- and across-cases.

The multiple case study included seven cases representing four case types: (1) collaborative information monitoring with eSRAP, (2) collaborative information monitoring without eSRAP, (3) individual monitoring with eSRAP, and (4) no monitoring and no use of eSRAP. This study confirmed the previously identified types of factors and outcomes of collaborative information seeking in the context of collaborative information monitoring. In addition, new sub-types (19 sub-themes of factors and 12 sub-themes of outcomes) related to collaborative information monitoring were generated. Out of the four observed case types, specific characteristics (i.e., factors and outcomes) were identified only for the case type of collaborative information monitoring with eSRAP (type 1) and combined case types of collaborative information monitoring with and without

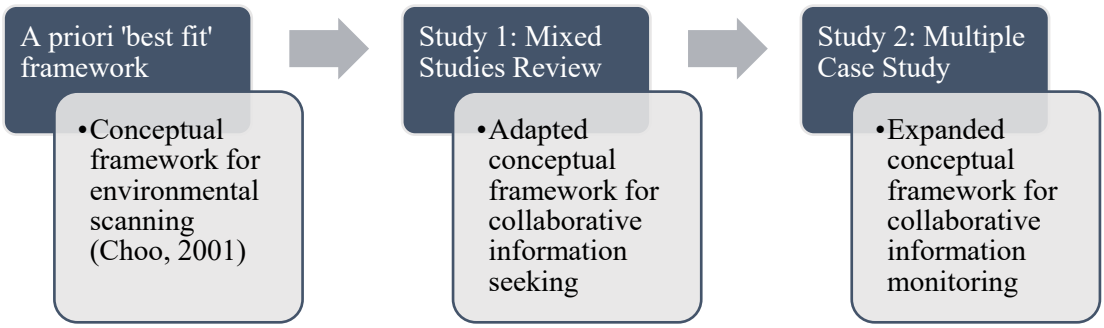
eSRAP (types 1 and 2). Other characteristics were either common (i.e., present across all case types) or idiosyncratic (i.e., case specific).

The specific factor identified in cases that engaged in collaborative information monitoring, with or without eSRAP (types 1 and 2), was engaged leadership overseeing the collaborative project, attentive and responsive to group members' needs. The specific outcomes identified for the same case types were related to motivation and discussion. Group members reported feeling happy and motivated because of being in a group. At the same time, collaborative information monitoring required discussion to exchange information, examine views, and to build relationships.

6.2 Comprehensive Synthesis of Factors and Outcomes of Collaborative Information Monitoring

The main steps describing the development (i.e., adaptation and expansion) of the conceptual framework are summarized in Figure 3.

Figure 3. Research Process for Conceptual Framework Development



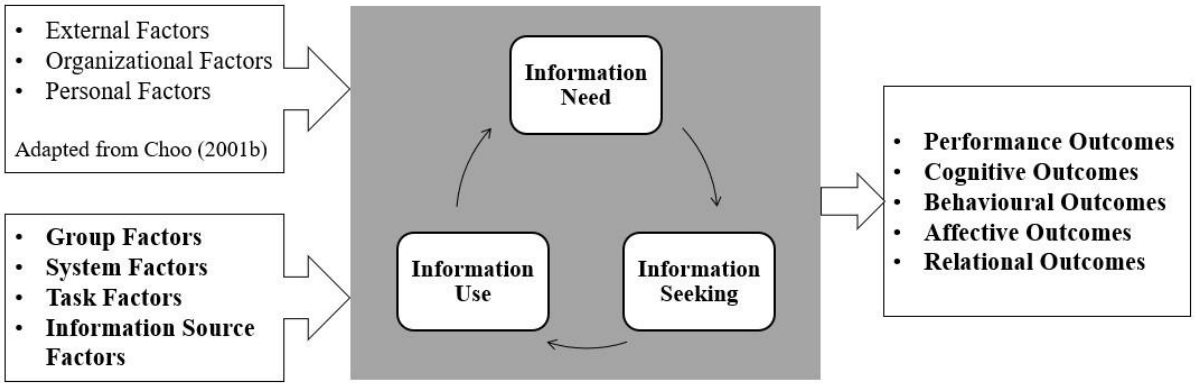
The *a priori* 'best fit' conceptual framework guiding this research is that of environmental scanning proposed by Chun Wei Choo. For Choo, environmental scanning refers to acquiring information (e.g., changes in an organization's external environment) and using it to guide future actions (Choo, 2001). This behaviour resembles Ellis's information monitoring, conceptualized as (researchers) keeping up with developments in their areas of interest (Ellis, 1989).

At the centre of environmental scanning Choo placed: information need, information seeking, and information use. In organizational settings, the types of factors influencing environmental scanning could be external (e.g., situational dimensions such as the complexity and

the rate at which the environment changes), organizational (e.g., organizational strategy and scope of scanning), and personal (e.g., traits of the 'scanner' such as cognitive style or knowledge) (Choo, 2001).

The mixed studies review confirmed the factor types proposed by Choo and identified four additional types of factors and five types of outcomes, which are depicted and bolded in Figure 4.

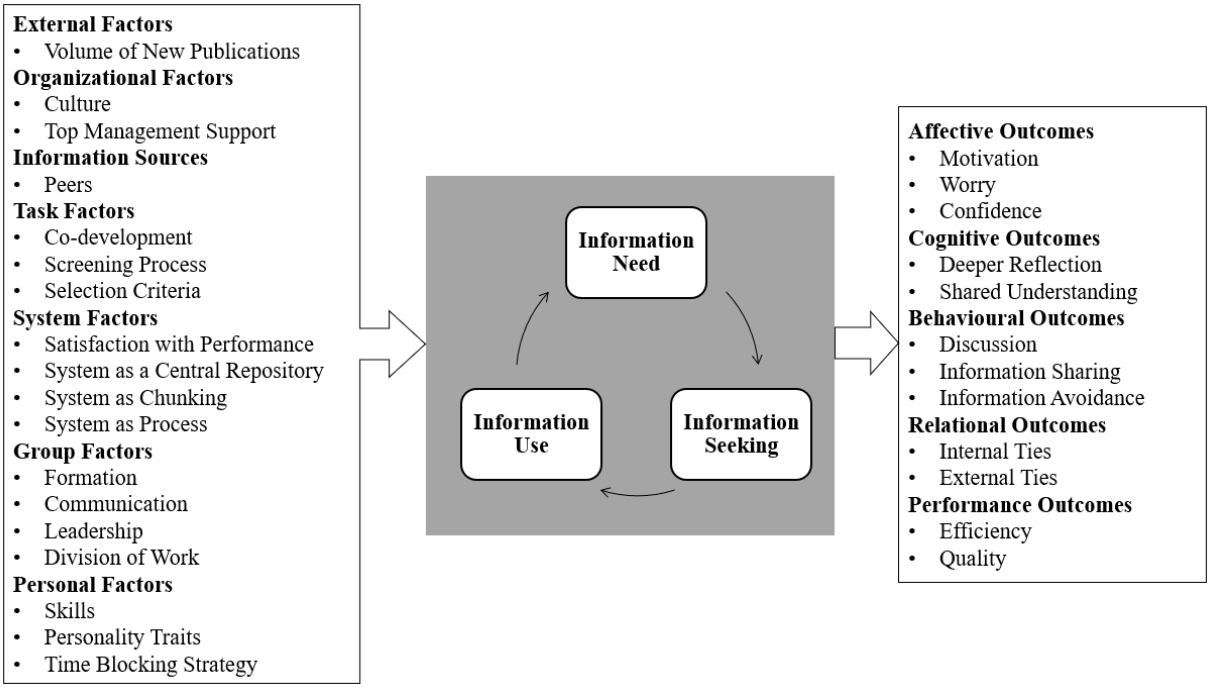
Figure 4. Conceptual Framework for Factors and Outcomes of Collaborative Information Seeking



Note: Original figure reproduced from an open access article (Granikov, El Sherif, Bouthillier, & Pluye, 2022).

In the subsequent multiple case study, investigating seven cases (i.e., monitoring projects implemented in eSRAP), thematic analysis confirmed the above-listed themes and generated 31 sub-themes, representing 19 sub-themes of factors and 12 sub-themes of outcomes. The expanded conceptual framework for collaborative information monitoring is depicted in Figure 5.

Figure 5. Conceptual Framework for Factors and Outcomes of Collaborative Information Monitoring



While the focus of this research is on the factors and outcomes of collaborative information monitoring, the scanning process elements proposed by Choo (2001), namely information need, information seeking, and information use, were also observed in the case study. Aligned with Choo, an information need was the scope of each collaborative monitoring project. Information needs were explicitly shared and formalized as bibliographic search strategies and selection criteria implemented in eSRAP. Choo (2001) conceptualized information seeking as the sources, methods, and systems used to monitor the environment. In this study, seeking was operationalized by the eSRAP system automatically retrieving records from a given bibliographic database using a predetermined search strategy. Finally, while for Choo information use could be related to decision making, strategic planning, and organizational learning (Choo, Detlor, & Turnbull, 2000a; Choo, 1999, 2001), in this study the general high-level information use was related to keeping up to date and helping peers keep up to date.

There is some disagreement in the literature on whether monitoring is a passive or an active behaviour, or both. For instance, Marcia Bates (2002), who has also studied the behaviour of academic scholars, classified monitoring as passive, being available to absorb information without actively seeking it, a "back-of-the-mind alertness for things that interest us, and for answers to

questions we have" (p. 5). Stated otherwise, she juxtaposed active information seeking with passive information monitoring. On the other hand, Wilson (1997) described monitoring as an "occasional continuing search […] carried out to update or expand one's framework" (p. 563). Other scholars conquered, characterizing monitoring as active and purposeful (Bronstein, 2007; 1993; Ellis et al., 1993; Foster, 2004). Turning back to Choo (2001), information seeking is located at the centre of his environmental scanning framework.

In this research, monitoring with eSRAP involved developing a tailored bibliographic search strategy and then intentionally accessing the system to screen new records. In fact, this resembles receiving search alerts by email that match a given search strategy, which constitutes a typical example of a current awareness service (Attfield & Blandford, 2011; Barr, 2006). At the same time, when participants were asked about how they monitor new information in general (besides with eSRAP), they described active searches as well as passively receiving information from peers. Thus, based on and in coherence with both Ellis and Choo, in this thesis collaborative information monitoring is both active and passive.

Finally, the conceptual framework presented in Figure 5 suggests a linear progression starting with influencing factors (i.e., barriers and facilitators) and ending with outcomes of collaborative information monitoring. Indeed, the outcomes are depicted to be outside the influence of factors. It is therefore a simplification based on chronology only, for example, outcomes are conceptualized as a 'result' of collaborative information monitoring. In other words, there are potential iterative interrelations that are not represented graphically, and which are addressed in recommendations for future research.

6.3 Significance of the Research

The key knowledge gaps identified in the literature concern limited research on collaborative information behaviour (vs. individual), information monitoring (vs. searching), information outcomes, extending knowledge on collaborative information seeking to collaborative information monitoring, and finally understanding how collaboration could help to overcome the challenges of keeping up to date. This thesis addresses the gaps and presents conceptual, methodological, and practical contribution to the discipline of LIS.

6.3.1 Conceptual Contributions

As described above, a systematic mixed studies review with a framework synthesis was conducted to develop a novel conceptual framework of collaborative information seeking (described in Chapter 3). The review builds upon existing knowledge, specifically the work of Choo (2001) on environmental scanning. The resulting conceptual framework bridges previous research on environmental scanning (information monitoring) with that on collaborative information seeking. Moreover, it represents the first attempt to synthesize empirical studies on collaborative information seeking in a comprehensive manner. Subsequently, the types of factors and outcomes comprising that conceptual framework, were all confirmed in by a qualitative multiple case study (described in Chapter 5) in the context of collaborative information monitoring. Stated otherwise, the conceptual framework for collaborative information seeking is transferable to collaborative information monitoring, therefore contributing to theoretical growth in both areas, and advancing information behaviour and information practices theory in general.

Specifically, the resulting conceptual framework (Figure 5) represents the first stage and the base of theoretical development. Although information behaviour research may still be in a 'modeling' or pre-theoretical stage (Savolainen, 2017), the proposed framework represents a novel theory for analyzing collaborative information seeking and monitoring (Gregor, 2006). Such a framework can be called an analytical theory, as it describes and classifies specific characteristics of collaborative information seeking, in Gregor's words, presenting "what is" (Gregor, 2006, p. 622). According to Gregor (2006), analytical theories are valuable when little is known about a phenomenon, and for guiding future interventions and action. Indeed, while the volume of research on collaborative information seeking is growing, most empirical studies in LIS still concern individual information behaviour and practices (Foster, 2006; Hertzum & Hansen, 2019; Shah, 2014a).

Moreover, previous research investigations have not extended collaborative information seeking to collaborative information monitoring. In other words, conceptual contributions such as analytical theories are not only appropriate but are valuable in exploring phenomena such as collaborative information seeking and monitoring. Analytical theories or frameworks provide insights into phenomena and can increase the likelihood of successful implementations (Nilsen, 2015). I elaborate on this later in this chapter, under Practical Contributions.

Finally, the conceptualization of collaborative information seeking and monitoring outcomes is a valuable conceptual contribution. Outcomes, or "what happens after information is found or received" (Case & O'Connor, 2016, p. 653), remain understudied in LIS research (Case & Given, 2016) and in collaborative information seeking research, specifically (Hertzum & Hansen, 2019). In this thesis, outcomes are conceptualized as the results or consequences of collaborative information seeking and monitoring. These can be tangible or intangible, immediate or long-term, intended or unintended, actual or potential (Poll, 2012).

6.3.2 Methodological Contributions

The methodological contributions of this thesis to LIS are three-fold. I conducted a systematic review of the literature, specifically, a mixed studies review, and a framework synthesis. While these methodologies and methods are rapidly gaining popularity across disciplines, they remain less common in LIS.

"Gathering research, getting rid of rubbish and summarizing the best of what remains captures the essence of the science of systematic review" (Grant & Booth, 2009, p. 42). Systematic reviews of the literature are considered to be "an important source of information because they both synthesize the existing research on a topic, as well as critically appraise it and try to draw conclusions from the total body of quality research evidence" (Koufogiannakis, 2012b, p. 91). In addition to being comprehensive, systematic reviews are recognized and valued for their explicit, transparent, and reproducible approach. Several guidelines for reporting systematic reviews exist, with PRISMA being the best-known one (Page et al., 2021). Ultimately, using this review methodology is meant to minimize potential sources of biases (Boutron et al., 2021). However, the use of systematic reviews is rare in LIS (Koufogiannakis, 2012b; Xu et al., 2015). Moreover, while the use of this methodology may be on the rise, there is still considerable room for improvement in how systematic reviews are conducted and reported (Xu et al., 2015).

Mixed studies reviews is a type of systematic review that includes quantitative, qualitative, and mixed methods studies (Pluye & Hong, 2014). The number of articles reporting mixed studies reviews having grown exponentially since 2010 (Hong et al., 2017). This type of a systematic review is highly appropriate for synthesizing empirical research in LIS, which is known to involve quantitative, qualitative, and mixed methods (Chu, 2015; Julien, Pecoskie, & Reed, 2011; Ma & Lund, 2021; Ullah & Ameen, 2018). In fact, Urquhart (2010) proposed that this diversity of research methods makes systematic reviews difficult to apply in LIS research, which may explain

the high number of narrative literature reviews (Xu et al., 2015). In this context, mixed studies reviews are an important alternative that fits the methodologically diverse evidence base in our discipline, while leveraging the key strengths of systematic reviews (i.e., being explicit, transparent, and reproducible). Moreover, like collaborative information seeking and monitoring, many topics in LIS can be described as complex phenomena. Mixed studies review methodology can significantly contribute to LIS research and represents a valuable addition to the methodological toolbox of LIS researchers.

Finally, to create a new expanded conceptual framework, I used the 'best fit' framework synthesis method. It is based on deductive-inductive analysis and provides a structured and transparent process to integrate concepts from the *a priori* 'best fit' framework, which are confirmed by the data, with new concepts that emerge (Booth & Carroll, 2015; Brunton, Oliver, & Thomas, 2020). This synthesis method was chosen for two reasons. First, there was no existing framework for collaborative information monitoring, but there was a 'best fit' framework for environmental scanning proposed by Choo et al. (2001), which could be developed and built upon. Second, given the considerable number of information seeking models (Case & Given, 2016), a decision was made to use a systematic and replicable method to build upon an existing framework and revise it for a new context (i.e., collaborative monitoring).

As with systematic reviews and mixed studies reviews, framework synthesis method is becoming increasingly popular in other disciplines, yet remains rare in LIS (Blasco-Arcas, Hernandez-Ortega, & Jimenez-Martinez, 2014; Dixon-Woods, 2011; Van Den Beemt, Thurlings, & Willems, 2020). LIS studies that use a framework synthesis tend to be related to health information research (Appleton et al., 2021; El Sherif, Pluye, & Ibekwe, 2022; Liu et al., 2019; Pluye et al., 2019; Veinot, Senteio, Hanauer, & Lowery, 2018). My work does not only promote these methodologies and methods among LIS researchers, trainees, and practitioners, but also contributes to the overall development of research methods in the discipline.

6.3.3 Practical Contributions

In addition to conceptual and methodological contributions, this research is valuable for informing practice. The main practical contributions are the following. First, the proposed conceptual framework can be used by information professionals, team leaders, and system designers in implementing and evaluating collaborative information projects, taking into account the potential influencing factors and outcomes. This framework provides insights into the

phenomena of collaborative information seeking and monitoring and may increase the likelihood of successful implementations (Nilsen, 2015). Group leaders or decision makers can use the conceptual framework as a basis for a questionnaire to either assess the readiness of a group before project implementation, or as a quality assurance measure post implementation. Moreover, the multiple case study allowed me to classify the identified factors into barriers and facilitators, and outcomes into positive and negative, as well as make actionable recommendations for practice. These recommendations can help practitioners involved in planning, implementing, or evaluating collaborative information monitoring projects.

Specifically, out of all influencing factors, the two that were brought up the most by study participants and deserve practitioners' attention are leadership and communication. Data analysis revealed that these group factors played a role in relation to other factors, as well as to potential outcomes. For example, the presence of a group leader was perceived as important for division of roles (group factor), communication (group factor), personal motivation (affective outcome), and efficiency (performance outcome). Indeed, according to Henri Mintzberg (1989, 2009), the activities that constitute a leader role involve motivating and energizing individuals, building and maintaining a team, organizing the work (e.g., hiring and training staff), and being responsible for the work of the people (e.g., employees in a unit).

The case study findings are also consistent with those reported in studies on collaborative information seeking. Leaders play a key role in organizing the work, delegating tasks, and ensuring (equal) participation (Lee, 2013; McNeese & Reddy, 2017; McNeese, Reddy, & Friedenberg, 2014). Moreover, leaders can help to overcome other barriers. As seen in the multiple case study, a leader who is present and engaged can overcome challenges related to personal motivation, or technical barriers related to the information system. This potential of present leadership to compensate for other barriers is also found in the literature. For instance, Wu, Liang, and Yu (2018) observed that a group leader who can effectively divide the work can compensate for lack of personal knowledge among collaborators. At the same time, it is important to remember that leadership is not "the be-all and end-all" and operates alongside other contextual factors (Mintzberg, 2009, p. 65).

The other key factor is communication. In the context of collaborative information seeing, communication, defined as "a process of sending or exchanging information" is considered to be a core requirement for collaboration (Shah & Leeder, 2016, p. 610). Case study participants

described its importance to building internal and external ties (relational outcomes), contributing to a deeper reflection, and developing a shared understanding (cognitive outcomes). While communication "takes time, a great deal of time," it is also how people "combine their knowledge to develop new ideas" (Mintzberg, 1989, p. 218). In the context of scientific researchers, communication is necessary "to acquire information, to select, distill, and modify ideas" (Meadows, 1998; Talja, 2002, p. 10). In addition, communication plays an important role in creating a shared project, a research topic, or a shared culture – what Carey (2008) calls the 'ritual view of communication.' These roles of communication certainly resonate with the participants' perceptions.

In fact, the two factors are interrelated. Engaged leaders are in the position to create opportunities and establish communication channels that enable interaction and exchange, which in turn can facilitate learning. James from Case 1 shared his view on discussion and learning:

> Being able to discuss in a group is also a way of seeing if people have done the same thing as you, if what you knew before was in line with what they thought, if it was different, and therefore to readjust your knowledge.

James's words echo the ones by Peter Senge on 'learningful conversations' "where people expose their own thinking effectively and make that thinking open to the influence of others" (Senge, 1990, p. 9). Since research is ultimately about learning, and so is keeping up with new research developments, recognizing the role of leadership and communication in the context of collaborative information monitoring is most relevant.

Finally, the findings can be applied by library and information professionals in designing services for research communities rather than individuals, developing tools to support collaborative information monitoring, and offering training on collaboration and social networking in addition to as push-based current awareness services.

6.4 Strengths and Limitations

The standards, or the criteria, for judging the quality of research conclusions differ for quantitative, qualitative, and mixed methods studies. Miles, Huberman and Saldaña (2020) suggest that because "qualitative studies take place in a real social world and can have real consequences in people's lives", we need to approach our work with "rigor, integrity, ethics, and accountability" (p. 311). The criteria used to evaluate the trustworthiness and rigour of qualitative studies are

related to credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985; Miles et al., 2020).

6.4.1 Credibility

Credibility addresses the question of "do we have an authentic portrait of what we are looking at?" (Miles et al., 2020, p. 312). Stated otherwise, credibility refers to how well the researchers' interpretation of the data represents reality and the original data collected from participants (Lincoln & Guba, 1985). I employed the following strategies to ensure credibility.

Many collaborative information seeking studies are conducted in a laboratory (Granikov et al., 2022; Hertzum & Hansen, 2019). The current study was carried out in a naturalistic setting during participants' real-life work and research activities, which is deemed more appropriate for the study of human information behaviour (Case & Given, 2016). The identified factors and outcomes are based on triangulated data collected from several sources (i.e., interviews, documents, archives). All phases of the research were scrutinized by my doctoral co-supervisors, both experienced in qualitative research and serving as examiners or auditors. To maintain a reflexive stance and be aware of potential researcher bias, I recorded my thoughts in a research journal throughout the research process.

Moreover, "negative evidence" (Miles et al., 2020, p. 919) was sought in both studies. The mixed studies review includes studies reporting negative outcomes of collaboration (e.g., feelings of frustration or uncertainty). On the other hand, the multiple case study includes case types without collaboration and/or without eSRAP use (i.e., negative implementation outcomes). Case members also reported different negative outcomes related to collaborative information monitoring or the eSRAP system (e.g., increased worry). Such "negative evidence" was "accounted for in the analysis" and clearly reported in the corresponding articles (Miles et al., 2020, p. 313). According to Patton (2014), negative cases can provide opportunities for new learning. Having such cases in the multiple case study, offered insights into different eSRAP implementation outcomes. For example, even if the shared intention to collaborate was initially there, 'negative cases' shed light on why eSRAP was used individually or what outcomes were gained from merely implementing an eSRAP system, even if it was never used.

6.4.2 Dependability

Dependability refers to the quality and transparency of research processes (e.g., data collection, data analysis), their consistency and stability over time (i.e., reliability), across researchers and methods (Bazeley, 2013; Miles et al., 2020). For example, Yin (2014) recommends to researchers conducting case studies to document the procedures and the steps involved as much as possible, therefore making it possible for others to follow the procedures.

First, my research questions are aligned with the chosen study designs. The findings in both studies comprising this thesis are organized in a clear and systematic way according to the conceptual framework (i.e., themes and sub-themes related to identified factors and outcomes). To ensure dependability in both studies, I described, in detail, the steps I undertook. Regarding the review, I used the PRISMA guideline for systematic reviews and meta-analyses of quantitative evidence (Page et al., 2021) and the ENTREQ statement for reporting syntheses of qualitative evidence (Tong, Flemming, McInnes, Oliver, & Craig, 2012). In fact, the approaches of mixed studies review and framework synthesis were selected precisely for their integrated requirement to be systematic, rigorous, explicit, and transparent.

For the multiple case study, the same protocol was used across cases to ensure that the same procedures were followed at all research sites, which also strengthens study reliability (Yin, 2014). Changes from the original protocol were documented and reported. Furthermore, data were collected across settings (i.e., cases) using the same interview guide, enabling comparison. All interviews were transcribed by a professional bilingual transcriber and checked against the audio recording prior to coding by the interviewer.

To ensure that there was no "drift in the definition of codes" (Creswell & Creswell, 2018, p. 202), a codebook was used in both studies. The codes were revised continuously in relation to the data; the changes in their definitions were documented by writing memos. To ensure a consistency of coding and establish intercoder agreement, in the mixed studies review, all records and full text articles were screened and selected by two independent reviewers. Moreover, 30% of coded articles were cross-checked, to determine if another coder would code the same passage of text with the same or similar code (Creswell & Creswell, 2018).

Finally, as an audit trail (Patton, 2014) and to document my thinking process, I recorded personal observations, thoughts, and decisions throughout the research process in a research journal (notebook). As suggested by Bazeley (2013), "this kind of writing is like having a

discussion with yourself", which helps to "capture ideas while they are present in your mind" and deepen analytical thinking (p. 131-132). In addition, I have kept all the research data and documents – audio recordings of the interviews, interview transcriptions, methodological and analytical memos, as well as signed consent forms, and draft versions of this dissertation.

6.4.3 Confirmability

Confirmability refers to limiting, or at least acknowledging, "the inevitable (researcher) biases that exist" (Miles et al., 2020, p. 311). In qualitative research, it is considered impossible to have "uncontaminated knowledge with all biases removed" (Braun & Clarke, 2013, p. 21). Therefore, since it is impossible to completely remove bias, research methods and procedure should be described explicitly and in detail, linking conclusions to data (Lincoln & Guba, 1985; Miles et al., 2020). While two studies comprise this thesis, one secondary (i.e., a mixed studies review) and one primary (i.e., a multiple case study), both employed qualitative methods. To ensure confirmability in both studies, I reported the study procedures explicitly, describing in detail how data were collected, processed, and analysed, contributing to "a complete picture, including backstage information" (Miles et al., 2020, p. 311). The conclusions I draw are grounded in the data and are logical.

Moreover, given that the investigator is a key research instrument in qualitative research (Creswell & Creswell, 2018), as much as possible, I acknowledge and discuss my personal assumptions and biases, and how they could have influenced this study (Miles et al., 2020). As recommended by Patton (2014), I present myself, my orientation as a researcher, professional training and experience that may have influenced this research (i.e., data collections, data analyses, and interpretations). Acknowledging bias in this thesis speaks to the researcher's (my) understanding of the phenomena – patient oriented researchers engaging in collaborative information monitoring, the challenges, and the complexities they encounter. At the same time, borrowing the words of Patton (2014) "qualitative inquiry depends on, uses, and enhances the researcher's direct experiences in the world and insights about those experiences" (p. 51).

Patton (2014) recommends considering alternative explanations and conclusions, as another way to prevent findings from being shaped by predispositions and biases. Throughout the studies, I documented and kept track of alternative themes and explanations that were considered during the data analysis. In addition, 'negative cases' were included in both studies as described above, and many of the identified factors and outcomes of collaborative information monitoring

did not fit within a pattern (referred in the multiple case study as idiosyncratic/case-specific characteristics, which were not specific to a case type).

6.4.4 Transferability

Transferability in qualitative research is opposed to statistical generalization of quantitative results (i.e., external validity). In this thesis, the aim is not to generalize findings to individuals or sites outside the research study. Instead, in the words of Creswell and Creswell (2018) "the value of qualitative research lies in the particular description and themes developed in the context of a specific site" (p. 202), what Patton (2014) refers to as "keeping findings in context" (p. 563). As Braun and Clarke (2013) suggest, it is the reader that "has to decide whether their circumstances and setting are enough like those of the original study to 'warrant' a safe transfer" (p. 282).

To ensure transferability, I provided rich and detailed descriptions of the studied cases, individuals involved in each case, settings, and circumstances, enabling readers to assess the "appropriateness for their own setting" (Miles et al., 2020, p. 314). The descriptions and themes were developed from the collected data. Short and long quotes are embedded in the text to convey the multiple perspectives of study participants. Moreover, I report limits related to sample selection and suggest setting to which my findings may be transferable.

When it comes to case studies, especially multiple case studies, transferability is related to what Yin (2014) calls analytical (theoretical) generalization – generalization "at a conceptual level higher than that of a specific case" (p. 41). In line with Yin's recommendation, my multiple case study sheds "empirical light" (p. 40) on theoretical concepts related to collaborative information monitoring. Specifically, the typology of factors and outcomes of collaborative information monitoring, including types and sub-types that were either confirmed or newly generated, goes beyond the cases included in the study. The practical recommendations I propose based on empirical findings may potentially apply in other "concrete" situations or cases, even populations of "like-cases" (e.g., groups outside of patient oriented research or research in general) (Yin, 2014, p. 40).

Overall, integrating the above quality criteria allowed me to strive towards ensuring rigour in my research. These criteria also enhanced my reflexivity in line with Bloor's (1997) statement that "validation techniques are not tests, but opportunities for reflexive elaboration" (p. 49).

6.4.5 Limitations and Challenges

As with all studies, this research faced several limitations and challenges. These have been detailed in the discussion sections of the manuscripts comprising the thesis. In this section, I elaborate on the main limitations.

In a literature review, potential biases can occur in the identification, selection, and analysis of the included studies. Moreover, publication bias is a common risk in literature reviews due to the under-reporting of negative outcomes in published scientific articles. To mitigate these biases in the mixed studies review, several strategies were employed. A comprehensive search strategy for three bibliographic databases (LISA, LISTA, ERIC) was developed and peer-reviewed by specialized librarians. Systematic searches in these databases identified published articles, conference proceedings, and dissertations (i.e., papers that were and were not published in scholarly journals). Two independent reviewers blindly screened all records and full text articles. One third of included studies was checked by a second reviewer. Finally, the negative outcomes of collaboration identified in the included studies suggests that a publication bias was minimized, possibly due to the comprehensive approach to identifying potentially relevant studies.

In terms of delimitations of the mixed studies review, only studies exploring explicit collaboration defined as "purposive sharing and generating of information" were included (Foster, 2010, p. xiii), in contrast to implicit machine-based collaboration (e.g., recommender systems). Studies investigating other kinds of collaborative information behaviour such as social searching (e.g., using our social networks to ask questions in order to discover new and relevant information) were also excluded. While these methodological decisions were made in line with systematic reviews requirement to pursue a specific and focused review question, additional insights may be found in studies that are outside or more peripheral to collaborative information seeking.

Turning to the multiple case study, according to Patton (2014) three kinds of sampling limitations are common in qualitative research: limitations related to people selection, the time periods of observation (i.e., temporal sampling), and the situations sampled for observations (e.g., critical incidents). In terms of people selection, the multiple case study avoided limitations related to purposeful sampling, as all available cases were included in the study.

The challenge I encountered was related to being acquainted with many of the users and non-users of eSRAP involved in this study (i.e., eSRAP members). At the same time, they were not selected based on our acquaintance (all available cases were included). During the interviews,

participants were informed that their participation (e.g., if they decline to participate or decide to withdraw) and their responses will have no effect on their access to eSRAP or system support. Participants' responses related to negative outcomes of collaborative information monitoring with eSRAP (e.g., increased stress and worry) suggest that they felt comfortable sharing 'negative' experiences and results, despite or because of our acquaintance.

In addition, the transferability of findings may be questioned, as this investigation focused on one system, which was used to identify potential participants. This could have biased the type of participants – those who were interested in and intended to engage in collaborative information monitoring with eSRAP. Other potential eSRAP users were not contacted. To overcome this potential bias, in addition to eSRAP-related questions, participants were asked general questions about keeping up to date and working together outside of eSRAP.

The case study included 11 participants representing seven cases (i.e., implemented monitoring projects in eSRAP). While this sample size may seem small, there is no consensus on a sufficient sample size for qualitative studies (Boddy, 2016). The sampling strategy in this study is justified by using eSRAP to bound the cases and interviewing the entire population (i.e., collaborative users, individual users, non-users). While the findings of a multiple case study may be less detailed than those of a single case study, comparing and contrasting the cases allowed me to examine the patterns, similarities, and differences between cases and case types, contributing to a deeper understanding and more powerful explanations of the factors and outcomes of collaborative information monitoring (Miles et al., 2020).

While I engaged with research participants in their natural real-life (work) settings and not in a laboratory at a specific moment in time, the case study still faces some temporal limitations. Namely the engagement with participants was not prolonged. The interviews explored the factors and outcomes at a cross-sectional moment in time. In general, a prolonged engagement with research participants and the research setting is recommended to improve credibility. To minimize this limitation, I have corroborated different types of collected data (e.g., eSRAP system logs documenting system use over time) and sought multiple perspectives on collaborative information behavior in a variety of situations.

The limitations related to the situations sampled for observation such as critical events or incidents were avoided as the critical incident technique (Flanagan, 1954) was not used. Using this technique was planned in the protocol and built into the interview guide. In line with Choo (1999),

a critical incident was defined as a recent session of using eSRAP, recalled in sufficient detail and having had a sufficiently clear effect (positive or negative) on the participant. However, when asked during the interviews, participants were not able to describe such a session.

All qualitative data collection and analysis were carried out by one researcher. Prior to the study, I had been working with health researchers for over a decade, making me aware of the challenges we experience associated with keeping up to date. I am inclined to collaboration; I have worked on numerous participatory research projects and have implemented collaborative information tools such as wikis. I was also familiar with the eSRAP system and certain usability issues (i.e., features needing improvement). My experiences and preconceptions about collaboration and the system could have introduced bias to how I asked questions and during data analysis. To mitigate this form of investigator bias, the same semi-structured interview guide was pilot-tested and used in all interviews. Moreover, I kept a research journal throughout the study to document self-reflection and be able to separate my thoughts and pre-conceptions from the collected data during analysis. In the manuscripts comprising this thesis, and the thesis as one whole, I explicitly acknowledge my role and potential bias, which could affect the trustworthiness of the study. Finally, my data analysis was not purely inductive. Instead, it was deductive-indictive, guided by a conceptual framework developed during the systematic mixed studies review.

Given the importance of representing participants' views and experiences as closely as possible, a commonly recommended approach is that of member checking, which also functions as a credibility check (Lincoln & Guba, 1985). At the same time, there are several practical difficulties with member checking (Bloor, 1997; McLeod, 2011). Participants may be unable to engage in member checking or a follow-up conversation due to personal time constraints. Others may be reluctant to disagree or critique the analysis due to a perceived researcher 'authority'. In addition, Braun and Clarke (2013) raise concerns related to resolving contradictory feedback that may be obtained during member checking or knowing when the stop as the process of checking which may be potentially limitless.

After considering the benefits and the difficulties of member checking, it was not included in the study design for the following reasons. Asking participants to reread the transcripts of their interviews requires a considerable time commitment and could lead to retention problems due to a delayed availability of the transcripts. Since my study is about helping people save time, I did not want to ask them for even more of their time. Instead, to make sure I understood the meaning

of participants' statements during the interviews, I paraphrased what they said and asked them if I captured and understood their ideas. Moreover, my co-supervisors peer-checked my case reports and themes.

The primary source for data collection was semi-structured interviews with members of implemented eSRAP projects. As initially planned, the interviews explored participants' views of and experiences with collaborative information monitoring, allowing me to hear their 'stories' regarding the perceived factors and outcomes. While I asked participants open questions about their actions, thoughts and emotions related to system use, I was not able to incorporate the journey mapping technique to better understand and visualize how they interacted with the eSRAP system (Nielsen Norman Group, 2018). This can be explained by the fact that not all participants used the system and those who did, did not use it regularly and did not have specific examples or descriptions to provide. Consequently, journey mapping was not used considering the types of engagement in collaborative information monitoring and the general research focus on the factors and outcomes of information monitoring and not on the system as a technical artifact. This change is coherent with the constructivist approach taken in this research, which allows for emergent design and methodological changes to occur during the study, in response to changes in the research context (e.g., participants' circumstances) (Lincoln & Guba, 1985).

Chapter 7. Conclusion

Driven by the potential of collaboration to help researchers keep up to date with new scholarly publications, this thesis explores the factors and outcomes of collaborative information monitoring from the perspective of patient oriented research stakeholders. The main results of this research can be summarised as follows.

- Mixed studies review with a framework synthesis (Chapter 3): A novel conceptual framework for collaborative information seeking that includes seven types of factors and five types of outcomes.
- Multiple Case Study (Chapter 5): A revised conceptual framework for collaborative information monitoring and actionable recommendations for practice.

The identified types of factors of collaborative information monitoring can be personal, related to the group, organization, informational environment, information sources, system, or task. Potential outcomes of collaborative information monitoring can be performance-related, behavioural, cognitive, affective, or relational. Despite the intention and the implementation of monitoring projects in eSRAP, study participants either engaged in collaborative information monitoring with the system or without it, used eSRAP for individual monitoring, or did not use it at all.

The cross-case analysis identified the sub-types of factors and outcomes that were specific to cases that engaged in collaborative information monitoring with and without the eSRAP system. They are presented in Table 4 below.

Table 4. Factors and Outcomes Specific to Collaborative Information Monitoring (With or Without eSRAP)

	Type	**Sub-type**
Factors	Task	• Easy screening process (e.g., few screening questions)
	System	• Satisfaction with system performance (e.g., users do not require any additional features) • Ability to break down (i.e., dose) the larger monitoring task into manageable smaller-sized chunks

	Group	• Engaged leaders overseeing a CIM project, who are attentive and receptive to members' needs and concerns • Group members trust each other's skills and abilities
Outcomes	Affective	• Feeling motivated • Feeling worried
	Behavioural	• Discussion to exchange and examine views, and to build relationships • Avoiding certain information to reduce the work burden and/or the feeling of information overload

Overall, the selected research approach, described in Chapters 3, 4, and 5, allowed me to address the objectives of identifying and understanding the factors and outcomes of collaborative information monitoring, and all available cases (i.e., implemented eSRAP projects) were included. Despite the encountered challenges and research limitations, detailed in Chapter 6 (i.e., a comprehensive discussion of all the findings), this thesis presents valuable conceptual, methodological, and practical contributions to knowledge on collaborative information monitoring, also elaborated in Chapter 6. Finally, my findings inform and enable avenues for future research, presented below.

7.1 Recommendations for Future Research

This research focused on identifying and understanding the factors and outcomes of collaborative information monitoring, a phenomenon little is known about. A first version of a conceptual framework was developed by conducting a mixed studies review with a framework synthesis. This version was confirmed and extended following a multiple case study with eSRAP members. Thus, this thesis represents the first exploratory step of investigating collaborative information monitoring and informs several avenues for future research.

First, there is a need to further test and validate the transferability or applicability of the framework developed in this study to other contexts, for example, outside patient oriented research groups. Such a study could investigate collaborative information monitoring behaviour of researchers from other disciplines or professional groups outside of academia and science who nonetheless need to monitor new information (i.e., environmental scanning). Findings from such

a study could be useful to the individuals involved, as well as information professionals who support information monitoring or environmental scanning activities. In addition, the participants in the current study were in Quebec (Canada) and France. Thus, it could be valuable to test the framework in other countries.

Second, a longitudinal study would provide the opportunity to collect data over a sustained period and prolong the engagement with participants. Such a study could not only increase the credibility of findings, but also allow the researchers to observe and investigate the changes that happen in the collaborative information monitoring groups over time. The findings could "provide us with a short- and long-term understanding of how the rhythms of life or work may proceed" (Miles et al., 2020, p. 209). In addition, future research could examine how to sustain collaborative information monitoring projects over time, for example examining the respective influences of actors, events, standards and social mechanisms (Pluye, Potvin, & Denis, 2004).

Third, future work could investigate the interdependence between factors, between outcomes, and between factors and outcomes. Such a study, aimed at testing and explaining the possible associations, could use systems thinking methodologies (Cabrera, Colosi, & Lobdell, 2008; Somerville, 2009). Consequently, the findings could contribute to developing explanatory and predictive theories of collaborative information monitoring (Gregor, 2006).

While this research focused on the factors and outcomes of collaborative information monitoring, an avenue for future research could be a detailed investigation of information needs and the processes involved in monitoring (e.g., outside the eSRAP system). Moreover, a broader investigation could compare the collaborative information monitoring behaviour of researchers with their everyday information behaviour and practices.

Finally, it is evident from this research and the literature that collaborative information monitoring requires one or more technical solutions, or platforms, to support it. It could be eSRAP as the case in this research, or a combination of cloud-based shared folders (e.g., Google Drive) and online videoconferencing applications (e.g., Zoom). Previous studies assess collaborative information seeking systems and specific system features (Leeder & Shah, 2016b; Shah, 2013; Wu, Liang, Dong, & Qiu, 2018). Future research could focus on systems supporting collaborative information monitoring and determine what the core or essential features are from the users' perspective. The findings could inform system developers and render the development process more efficient.

7.2 Final Remarks

This thesis is important not only for its original contributions to knowledge on collaborative information behaviour (seeking and monitoring), but also for its potential to inform practice. As seen in the literature and experienced from my own professional practice of working with health researchers, keeping up to date is a common challenge. At the same time, working collaboratively is a common research practice, especially when it comes to patient oriented research, which places collaboration at its core (Canadian Institutes of Health Reasearch, 2017). This research brings the two together and in doing so demonstrates that most often collaborative information monitoring leads to positive outcomes.

While collaboration in information monitoring is not a magical solution and can face various barriers, as observed in this thesis, the findings suggest that the positive outcomes outweigh the negative. Collaboration can lead to discovery of new knowledge, solutions to complex problems, and better task performance. It can also contribute to a deeper reflection, relationship building, and joy in working together. Borrowing the words of Wu, Liang, & Yu (2018), collaboration can create a "virtuous circle" (p. 16) where collaboration can lead to positive outcomes, which in turn lead to more collaboration.

At the same time, collaborative information monitoring may not occur, even if the intention is there, or a dedicated system to enable it. This thesis presents a broad inventory of possible factors and outcomes of collaborative information monitoring. Those interested in, and responsible for, developing collaborative information monitoring projects in the LIS field and beyond should be guided by these valuable potential outcomes, while being aware of the factors that can act as barriers or facilitators.

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Appendices

Appendix 1. Summary of Bibliographic Searches

Search Strategy	Database	Limited to	Records Retrieved
noft("collaborative information seeking" OR "collaborative information behavior" OR "collaborative information behaviour" OR "collaborative search" OR "collaborative information retrieval" OR "collaborative navigation" OR "collaborative browsing" OR co-browsing OR co-searching OR "social search")	LISA (ProQuest)	Peer-reviewed, After January 1990; Language: English, French	148
noft("collaborative information seeking" OR "collaborative information behavior" OR "collaborative information behaviour" OR "collaborative search" OR "collaborative information retrieval" OR "collaborative navigation" OR "collaborative browsing" OR co-browsing OR co-searching OR "social search")	LISTA (EBSCO)	Scholarly (peer reviewed) journals, since 1990, in English	117
noft("collaborative information seeking" OR "collaborative information behavior" OR "collaborative information behaviour" OR "collaborative search" OR "collaborative information retrieval" OR "collaborative navigation" OR "collaborative browsing" OR co-browsing OR co-searching OR "social search")	ERIC (ProQuest)	Peer-reviewed, After January 1990; Language: English, French	15

Note: The command NOFT searches anywhere except full text (i.e., abstracting and indexing metadata).

Appendix 2. Mixed Studies Review: Coding Guide (v2)

Themes	Definitions	Data-Based Examples
1. Factors	Perceived conditions, barriers, or facilitators, that may influence collaborative information seeking (CIS). Factors influencing CIS, can be personal, technical, or situational.	See bellow
1.1 Personal	Traits and characteristics of an individual collaborator (e.g., age, gender, work responsibilities/experience, prior collaborative experience, personal domain knowledge, personality, preferences, and priorities).	Collaborators' prior knowledge and experience had influenced collaborative planning and information searching (Arif, Du, & Lee, 2015).
1.2 Group	Characteristics of the group engaged in CIS (e.g., group size, familiarity, trust among members, division of roles, governance, norms, interaction, location, timing of CIS.	Having well-defined tasks and clear division of work facilitated collaboration among team members (Bruce et al., 2003).
1.3 Task	The activity that the participants are asked to do, a specific information seeking task (e.g., an exploratory search on a given topic) or a general task that involves information seeking (e.g., an academic project) on which group members are expected to work together. Task factors may include task complexity, structure, boundaries, how "dividable" the task is, the time available.	Informational tasks that do not require making personal judgements and selecting, considered to be objective, were easy to divide and more suitable for collaboration (Wu, Liang, Dong, & Qiu, 2018).
1.4 System	Hardware and software features that enable and support CIS activities, including internet connection, interface features, communication tools (e.g., instant chat or email), and multimodal	When the tool provided awareness information via dedicated features, participants needed to communicate and coordinate less, which resulted in better team performance (Al-Thani & Stockman, 2018).

	awareness information (text, audio, visual).	
1.5 Information source	Characteristics of the information sources (e.g., format, availability, access, organization of information).	Collaboration was facilitated when team members wanted to access additional and different information sources, as well as when it was difficult to understand how the information was organized (Fidel, Pejtersen, Cleal, & Bruce, 2004).
1.6 Organizational	The overall organizational strategy, specific administrative or management characteristic that would influence CIS activities (e.g., organizational culture, administrative structure, pace of work).	Management has an important impact on the focus, scale, and pace of collaborative projects, specifically, management view and support for information exchange within teams, among teams, and with outside partners (e.g., vendors) (Bruce et al., 2003).
1.7 External	Situational dimensions and elements that influence CIS activities from the outside of the group or the organization (e.g., subject discipline, complexity, rate at which the informational environment changes).	Healthcare professionals find it difficult to keep up with developments in their areas of specialty. As a result, team members rely on each other to obtain and to share the information needed for patient care (Reddy & Spence, 2008).
2. Outcomes	Perceived consequences or results of a CIS activity. Outcomes could be immediate or delayed, expected or unexpected, actual or potential, as well as positive, negative, neutral (i.e., lack of outcomes), or unclear.	See below
2.1 Performance	Performance refers to "a task or operation seen in terms of how successfully it is performed" (www.oxforddictionaries.com. Retrieved 2020-04-06.). Performance is defined as the execution and attainment of goals; it includes effectiveness (i.e.,	Compared to individuals, pairs had better search outcomes. Specifically, they were faster (more efficient) and found more correct responses for the search tasks (Lazonder, 2005).

	results) and efficiency (i.e., time). Performance outcomes could be specific to the information seeking activity (e.g., number of search queries, information retrieval measures, diversity and/or number of explored information sources) or to team performance (e.g., coordination efforts, distractions).	
2.2 Cognitive	Cognition is defined as "the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses" (www.oxforddictionaries.com. Retrieved 2020-04-06.). Cognitive outcomes refer to the products of cognition processes such as learning (new knowledge or skills/abilities), understanding, forming new ideas, identifying knowledge gaps, shifting focus. In this review, cognitive outcomes are conceptual effects of CIS that are 'passive' (in contrast to active effects such as decision making or problem solving due to CIS).	"Cognitive overload was the main drawback of CIR in this instance because the collaboration added cognitive processes to Neil's task of information retrieval." (Fidel et al., 2004, p. 947)
2.3 Affective	Feelings experienced by CIS participants in relation to collaboration, their task, towards each other, such as satisfaction, frustration, certainty/uncertainty, disappointment, pessimism/optimism, stress, safety, pride, confidence, motivation, etc.	"So after a statement "This isn't working. Why don't you work on your computer….", the participants separated and worked on their own tasks. The "This isn't working." seems to imply that a level of frustration had been reached that made working separately seem more attractive than continuing to work jointly." (Yue, Walker, Lin, & He, 2008, p. 8)
2.4 Behavioural	What people do, intend to do, or have done because of CIS. In other	"Brainstorming: Chatting with another person leads to shared

	words, the observable/tangible or intended actions reported by CIS participants. These include decision making, information/knowledge sharing, problem solving, networking, mutual help, feedback provision/exchange.	problem solving in which all the team members spontaneously contribute ideas by generating a variety of possible solutions." (Reddy, Jansen, & Krishnappa, 2008, p. 4)
2.5 Relational	Relation is defined as "the way in which two or more people or groups feel about and behave towards each other" (www.oxforddictionaries.com. Retrieved 2020-04-06.). In this review, relational outcomes refer to synergy, agreement, engagement, etc. among the collaborators.	"The students who significantly increased their perceptions of intimacy with group members were more likely to perceive a high degree of collaboration level. [...] Thus, as collaborators increased their faith and became more familiar with group members, it affected to generate more contributions and information sharing among each other throughout their group-based work." (Lee, 2013, p. 106)

Appendix 3. Mixed Studies Review: Characteristics of Included Studies

First Author (year)	Publication Type	Author Reported Design	Setting	Participants	Group Size	Collaboration Location / Timing	Duration of Observed Collaboration	Data Collection
Alarayedh, 2017	Dissertation	User study and controlled experiment	Field and lab	Pilot study: 29 undergrad students Main study: 36 participants (students and graduates), median age 28 yrs old (range 23-35), 20 male and 16 female, UK	3-4 (pilot), 2 (main study)	Remotely distributed (simulated) / synchronous, asynchronous	2-6 weeks (pilot), 3 session trials of 20 mins (main study)	Pilot study: Recorded interactions in the SearchAware tool, a reflective report Main study: queries, number of viewed (visited) results, number of rated results, engagement questionnaire, cognitive load measurement, activity awareness measurement questionnaire, questionnaire on perceived usefulness and ease of use
Al-Thani & Stockman, 2018	Journal article	Mixed methods user study	Lab	14 visually impaired participants, age range	2	Co-located, remotely distributed / synchronous	35 mins per task	Pre- and post-study questionnaires (experience with assistive

				21-59 yrs old, 8 male 14 sighted participants, age range 18-59 yrs old, 8 male				technology, familiarity with search engines and search partners, system satisfaction and ease of use) and interviews (satisfaction, interface usability and accessibility, encountered issues), video-recorded interactions between participants, screen-recorded interactions with interface
Arif et al., 2015	Journal article	Mixed methods user study	Lab	20 staff and postgraduate students, 17 male, 13 aged 26-35 yrs old, Australia	2	Remotely distributed / synchronous	Not specified	Task accomplishment, pre- and post-search questionnaires, web search logs, online chat/communication logs, post-search interviews
Bruce et al., 2003	Journal article	Qualitative case study	Field	Two design teams from Microsoft and the	Not specified	Not specified / not specified	Not specified	Interviews with team leaders and team members, observation at team

				Boeing Company				meetings, review of communication diagrams and email threads (for Microsoft only)
Fidel et al., 2004	Journal article	Qualitative case study	Field	Team of design engineers at Microsoft (about 10 people), employed at Microsoft for between 4 months and 7 years	10	Not specified / not specified	3 months	Interview with the team manager, observations of team member interactions at meetings, individual interviews with team members, observations of team members at work, review of communication network diagrams, e-mail threads, documents related to the team and the project
Foster, 2009	Journal article	Not specified	Lab	A class of 10 undergraduate students	10	Co-located / synchronous	9 face-to-face meetings	Videorecording and transcription of dialogues between students performing sub-tasks
Gazan, 2010	Journal article	Not specified	Field	Users of a social Q&A	2	Not specified / not specified	Over 10 months site observation,	Participant observation, 816

				site engaged in micro-collaborations (2 or more expressing a shared information need and mutual effort)			duration of each collab. not specified	expressions of mutual interest (text)
González-Ibáñez, Shah, & Córdova-Rubio, 2011	Conference proceedings	Experiment	Lab	30 students at Rutgers University, signed up individually or as pairs, with previous experience working together, 10 pairs randomly assigned to the collab. condition, 10 participants	2	Remotely distributed / synchronous	Approx. 30 mins per task	Pre-task questionnaire (demographic information and feelings right before starting the task), post-task questionnaire (feelings right after task completion and a simplified version of NASA's Task Load index for cognitive load), recordings of users' actions within the Coagmento system (e.g., visited pages,

				randomly selected as single users				queries, chat messages), desktop activity, participants' faces and voices
González-Ibáñez & Shah, 2012	Conference proceedings	Experiment	Lab	12 undergrad students from Rutgers University, age range 18-24 yrs old, 6 in individual condition, 6 in collab. condition, native English speakers	2	Remotely distributed / synchronous	10 mins and 25 mins	Electrodermal activity (related to affective responses), participants' facial expressions and eye fixations, search logs, questionnaires (used before, during, and after tasks), semi-structured interviews at the end of each session
González-Ibáñez, Haseki, & Shah, 2013	Journal article	Mixed methods user study	Lab	60 students at Rutgers University, signed up individually or as pairs (pairs had worked	2	Co-located, remotely distributed / synchronous	Not specified	Individual pre- and post-task questionnaires, participants' desktop activities (visited pages, bookmarks, queries, and chat messages),

				together before), each pair randomly assigned to 1 of 3 experimental conditions				faces recorded using Camtasia Studio 7.
Hansen & Jarvelin, 2004	Journal article	Observation	Field	9 patent examiners from Patent and Registration office, Sweden	9	Not specified / not specified	5 weeks	Semi-structured interviews, open-ended interviews, electronic diary, observations
Hertzum, 2010	Journal article	Mixed methods	Field	232 physicians, nurses, managers, coordinators from 2 wards of a Danish hospital	Not specified	Not specified / not specified	Not specified	Survey, follow-up interviews, observational data on Electronic Medical Record use at one ward
Htun, Halvey, & Baillie, 2018	Journal article	Experimental user study	Lab	20 students randomly assigned to groups, 5 female and	2	Remotely distributed / synchronous	3 sessions of 15 mins each	Information retrieval metrics (performance, collection coverage, etc.), questionnaires

				15 male, average age 28.2 yrs old (age range 18-44)				(assessing users' perception of search tasks), interviews on search experience and design recommendations
Hyldegård, 2009b	Journal article	Exploratory case study	Field	10 Danish graduate students, age range 23-48 yrs old, 9 female and 1 male	2 groups of 3 and 1 group of 4	Not specified / not specified	14 weeks	Questionnaires (a demographic questionnaire, a personality test and process surveys), diaries and interviews (at three points in the process: start, midpoint and end)
Hyldegård, 2006	Journal article	Qualitative longitudinal case study	Field	5 Danish students, age range 25-31 yrs old, 3 female and 2 male	1 group of 3 and 1 group of 2	Not specified / not specified	7 weeks	Questionnaires, diaries, and semi-structured interviews (questionnaire was the basis for the interviews)
Hyldegård, 2009a	Journal article	Exploratory case study	Field	10 Danish students, age range 23-48 yrs old, 9	two 3-person groups and one 4-	Not specified / not specified	14 weeks	Questionnaires (demographic questionnaire, personality test and process surveys), diaries, interviews,

				female and 1 male	person group			all data collected at three points: start, midpoint and end
Kim & Lee, 2014	Journal article	Not specified	Field	34 students at large US university, all had collab. experience with their classmates	4	Remotely distributed / asynchronous	12 weeks	Process surveys (about students' perceptions of knowledge and difficulty) administered in the initiation, midpoint, and completion phases of the project
Komlodi & Lutters, 2008	Journal article	Qualitative longitudinal case study	Field	Attorneys from a large metropolitan law firm, service engineers at an aircraft manufacturer's technical support centre	Not specified	Not specified / not specified	Not specified	Observation and interviews
Lazonder, 2005	Journal article	Between-subjects quasi-experimental design	Lab	25 students from a Dutch university, 9 male and 16 16 female,	2	Co-located / synchronous	4.3 mins mean time per task	Demographic questionnaire, Motivated Strategies for Learning Questionnaire

				mean age 20 yrs old, self-chosen dyads or individually (9 pairs and 7 singles)				(assessing self-regulation, including self-efficacy, task value, test anxiety, cognitive strategies, and metacognitive strategies)
Lee, 2013	Dissertation	Not specified	Field	43 students from large university, 35 female, with experience in collab. projects	1 group of 5, 5 groups of 4, 4 groups of 3, 3 groups of 2	Remotely distributed / not specified	Approx. 8 weeks	Behaviour survey administered at 3 points in time, online communication (messages exchanged in chat rooms and on discussion boards)
Lee & Cho, 2011	Journal article	Field experiment	Field	78 students from 2 universities in Singapore, 57 females and 21 male	Not specified	Remotely distributed / not specified	4 weeks (2 phases, 2 weeks each)	Social network survey administered before experiment, posted messages and replies collected during experiment
Leeder & Shah, 2016c	Journal article	Exploratory user study	Field	31 students working on in-class group research, in	Ranging from 3 to 6	Co-located, remotely distributed / synchronous, asynchronous	8-9 weeks	Server log data and questionnaires administered before and after project completion

				self-organized groups				
Leeder & Shah, 2016a	Journal article	Exploratory user study	Field	46 college students, 35 male and 11 female), working on an in-class for-credit group project assignment	2 groups of 3, 1 group of 4, 5 groups of 5, 2 groups of 6	Co-located, remotely distributed / synchronous, asynchronous	8 weeks	Pre-task questionnaire (demographics, questions on prior group work experience, satisfaction, topic knowledge, search experience, and motivation), 3 group work questionnaires (at two-week intervals), post-task questionnaire (on their experience using Coagmento system), log data of online activity (e.g., bookmarks)
Leeder & Shah, 2016b	Journal article	Library-based study	Lab	37 college students, 32 female and 5 male, 11 individuals and 13 pairs	2	Remotely distributed / synchronous	40 mins	Pre-task questionnaire, log data, time spent on each task, chat transcripts, and post-task questionnaires or an

								open-ended focus group discussion
McNeese, Reddy, & Friedenberg, 2014	Conference proceedings	Exploratory laboratory-based experimental study	Lab	40 students from a large US university, 64% aged between 18-20 yrs old, randomly organized into teams	8 groups of 3 and 8 groups of 2	Co-located / synchronous	30 mins for 3 tasks	Demographic survey, observations and video recordings of teamwork, audio recordings of semi structured cognitive interviews
McNeese & Reddy, 2017	Journal article	Exploratory laboratory-based experimental study	Lab	40 students from a large US university, 64% aged between 18-20 yrs old, randomly organized into teams	8 groups of 3 and 8 groups of 2	Co-located / synchronous	30 mins for 3 tasks	Demographic survey, observations and video recordings of teamwork, audio recordings of semi structured cognitive interviews
Moraes, Grashoff, & Hauff, 2019	Journal article	Experiment	Lab (online)	305 participants in 67 groups, randomly assigned to one of the	1 (single-user search), 2, 4, 6 membe	Remotely distributed / synchronous	On average 42 mins per task	Pre-task and post task questionnaires, log data

				search conditions	rs per group			
Paul & Morris, 2011	Journal article	Formative study	Lab	18 participants from Microsoft performing collab. web search task	3	Remotely distributed / synchronous	25 mins	Online questionnaire, system logs, and semi structured interviews
Prekop, 2002	Journal article	Qualitative	Field	28 members of a group performing command and control support at Australian Defence Forces	On average, 9 involved at any given time	Co-located / synchronous, asynchronous	40 group meetings, each 2 hrs on average	Minutes from the working group's meetings, semi-structured interviews with a sample of working group members
Reddy et al., 2008	Conference proceedings	User study	Lab	University students organized in 10 teams	2	Remotely distributed / synchronous, asynchronous	20-45 mins	Chat and system logs, interviews (structured, semi-structured and unstructured questions)
Reddy & Jansen, 2008	Journal article	Ethnographic field study	Field	Health professionals, surgical intensive care unit	Not specified	Co-located / not specified	100 hrs	Observation/"shadowing", formal and informal interviews, artifacts (screenshots and

				(large urban hospital) and emergency department (small rural hospital)				organizational policies)
Reddy & Spence, 2008	Journal article	Ethnographic field study	Field	Clinical and non-clinical staff in an emergency department (rural hospital)	Not specified	Co-located / not specified	100 hrs	Observation/"shadowing", formal and informal interviews, artifacts (screenshots and organizational policies)
Ruan, 2011	Dissertation	Qualitative	Field	25 Fire Academy field staff instructors, 24 male and 1 female, average 51 yrs old and 24 yrs in fire service	Range 2-to 25-person teams	Not specified / synchronous, asynchronous	2.5 months	Semi-structured interviews
Saleh & Large, 2011	Dissertation	Longitudinal qualitative study	Field	8 engineering students, 4 female and 4 male,	3 and 4 (groups included membe	Not specified / not specified	8 months	Main study (conducted in the consecutive year with a different cohort of students):

				from a Canadian university	rs who were not part of the study			bi-monthly semi-structured in-depth interviews with each participant
Shah & González-Ibáñez, 2010	Conference proceedings	Experimental user study	Lab	84 students and employees from US university, 27 male and 57 female, age range 17-50 yrs old	2	Remotely distributed / synchronous	2 sessions (60 mins each)	Online task progress questionnaires, exit questionnaires, group interview, log data
Shah & González-Ibáñez, 2011	Conference proceedings	Experimental user study	Lab	70 students from US university, 10 as single users and 60 as pairs, pairs randomly assigned to 3 experimental scenarios	2	Co-located, remotely distributed / asynchronous	25 mins per task	System logs

Shah, 2013	Journal article	Experiment	Lab	84 students and employees from US university, 27 male and 57 female, age range 17-50 yrs old	2	Remotely distributed / synchronous	2 sessions of 1.5 hrs each	Online progress questionnaires, chat messages related to coordination, log data, and group interview
Shah & González-Ibáñez, 2012	Journal article	Experimental user study	Lab	60 students from US university, age range 18-24 yrs old (20.38 average), with collab. experience	2	Co-located, remotely distributed / synchronous	25–30 mins per task	Post-task questionnaires, non-participant observations (offline video analysis), interviews (in pairs)
Shah, Hendahewa, & González-Ibáñez, 2015	Journal article	Experimental user study	Lab	68 students from US university, 40 female and 28 male, age range 18-24 yrs old	12 individuals, 10 groups of 2, 12 groups of 3	Co-located / synchronous	Approx. 35 mins per task	Demographic questionnaire, individual pre-task questionnaires, post-task questionnaires, brief interviews (about task, their experience, and feedback), audio-

								and video-recordings
Shah, Hendahewa, & González-Ibáñez, 2017	Journal article	Experimental user study	Lab	68 students from US university, 40 female and 28 male, age range 18-24 yrs old	12 individuals, 10 dyads, and 12 triads	Co-located / synchronous	Approx. 35 mins per task	Demographic questionnaire, individual pre-task questionnaires, post-task questionnaires, brief interviews (about task, their experience, and feedback), audio- and video-recordings
Shah & Marchionini, 2010	Journal article	Experimental user study	Lab	84 students and employees from US university, 27 male and 57 female, age range 17-50 yrs old	2	Remotely distributed / synchronous	2 sessions (1.5 hrs each)	Post-task questionnaires, exit questionnaire, group interviews (in pairs), log data
Soulier & Tamine, 2015	Journal article	"Log study" based on 2	Lab	150 university students from France and 20	2	Remotely distributed / synchronous	30 mins	Pre-task questionnaire, log data, post-task questionnaire

		experiments		university students from US, aged 18-30 yrs old				
Spence & Reddy, 2012	Conference proceedings	Ethnographic study	Field	60 IT employees (regional health system) and the 190 IT employees (teaching medical centre)	Not specified	Not specified / not specified	250 (1st site) and 240 hrs (2nd site)	Organizational artifacts, field notes, interviews, direct observation
Sun, Tian, & Cai, 2016	Conference proceedings	Observational study	Lab	6 undergrad students in US university	6	Remotely distributed / synchronous	Not specified	Observation, video recording of participants' activities, system logs, semi-structured interviews
Tamine & Soulier, 2015	Conference proceedings	Experimental user study	Lab	75 pairs of students, 18-30 yrs old, randomly assigned to	2	Co-located / synchronous	30 mins	Pre-task questionnaire, log data, post-task questionnaire

				search conditions				
Tao & Tombros, 2017	Journal article	Observational user study	Lab	In each study, 24 adults similarly distributed in age, 6 groups self-formed 2 groups formed by researchers	3	Remotely distributed / synchronous	1 hr	In each study included: screen recordings of each participant (overall process of collaborative sensemaking), chat transcripts (coordination and information sharing), post-task questionnaire, semi-structured interviews (perceptions about task and group work, reasons behind collab. sensemaking
Wu, Liang, Dong, et al., 2018	Journal article	Mixed methods user study experiment	Lab	12 undergrad students in Chinese university, who know each other	3	Remotely distributed / synchronous	3 tasks, 45 mins each	System logs recording experiment outcomes, collected webpages, queries, bookmarks, snippets, annotations and

								recommendations, questionnaires, and semi-structured interviews
Wu, Liang, & Xiang, 2017	Journal article	Mixed methods user study	Lab	18 students from Chinese university, classified in 3 groups types based on domain knowledge and mutual collab. experience	2	Remotely distributed / synchronous	3 tasks, 45 mins each	Questionnaires, Coagmento system logs, one-on-one interviews
Wu, Liang, & Yu, 2018	Journal article	Longitudinal study	Field and lab	20 undergrad students from Chinese University, in 5 self-formed groups	1 group of 3, 3 groups of 4, 1 group of 5	Co-located, remotely distributed / synchronous, asynchronous	3-month observation and a 3-hr experiment	Structured diaries, questionnaire, group interviews, system logs, chat messages
Yue et al., 2008	Conference proceedings	Observational laboratory study	Lab	3 graduate students	3	Co-located / synchronous	Not specified	Participants' notes, reports from weekly focus group meetings

Yue, 2014	Dissertation	Mix-method experiment design	Lab	54 students from US university, 26 female and 28 male, 36 signed up in pairs (knew each other), 18 assigned to individual condition	2	Remotely distributed, synchronous	2 tasks, 30 mins per task	System logs, chat messages (participants' behaviour and communications), questionnaires, short interviews (perceptions of the search experiences)

Appendix 4. Ethics Certificates and Consent Forms

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09 June 2020

Dr. Pierre Pluye
Department of Family Medicine
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RE: **IRB Study Number A03-E11-16B**
Assessing the use of a collaborative system to monitor research publications: a qualitative multiple case user study

Dear Dr. Pluye,

On 08 June 2020, at a meeting of the Institutional Review Board, the following amendment received a full Board review and approval:

- Amended Research Proposal (includes Interview Guide), submission 12 May 2020
- Consent Form version 29 May 2020.

The Investigators are reminded of the requirement to report all McGill IRB approved study documents to the Research Ethics Offices (REOs) of participating study sites, if applicable. Please contact the individual REOs for instructions on how to proceed. Research funds may be withheld and/or the study's data may be revoked if there is a failure to comply with this requirement.

Kind regards,

Roberta Palmour, PhD
Chair
Institutional Review Board

Cc: Vera Granikov
A03-E11-16B

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Appendix 2.

Consent Form

Assessing the use of a collaborative system to monitor research publications: A qualitative multiple case user study (IRB Study Number A03-E11-16B)

Co-investigators: Vera Granikov, Drs France Bouthillier and Pierre Pluye

Contact: Vera Granikov
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Funding Source: Doctoral Fellowship from the Fonds de Recherche du Québec - Société et Culture (FRQSC)

Introduction
Keeping up to date, also referred to as information monitoring, is essential for researchers. However, as the volume of information and the number of tools for staying up to date continue to grow, it remains challenging. There is too much information, not enough time, and it is not always easy to quickly identify relevant studies. This is particularly in complex multidisciplinary fields like Patient Oriented Research, where researchers need to scan sources from different disciplines to find potentially relevant high-quality studies.

The proposed multiple case study aims to explore the use and user perceptions regarding a collaborative research trend monitoring system, called eSRAP. This research will advance knowledge on processes and outcomes of collaborative monitoring of research publications. The findings will be useful to those providing monitoring services, studying collaborative information behaviour, training future researchers and information professionals, as well as to system designers.

Procedures
The online interview will be completely confidential, and audio-recorded for later transcription. All personal details will be omitted in the analysis. The interview should last 60 minutes.

The interview will be organized in three main parts: (1) general questions about your experience with collaborative monitoring, (2) open questions about your experience with eSRAP, actions, thoughts and feelings related to system use, (3) you will be asked to describe a specific time when using eSRAP had an effect (positive or negative) on you or your work.

Benefits and Risks
You will not directly benefit from taking part in this study. However, the results of this study may contribute to our knowledge on potential facilitators of keeping up to date with research trends. There

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is little risk to participating in this study. The researcher will replace your name with a pseudonym and transform any information that may identify you. The interview will be recorded to help the researcher clarify her notes as needed.

Voluntary participation
It is entirely your choice whether you participate in this study or not. You may decline to participate, or you may decide to withdraw from this study at any time. If you withdraw consent, any data collected up until the point of your withdrawal will be kept by the researcher with your permission. If you decline to participate or decide to withdraw, it will have no effect on your access to eSRAP and system support.

Compensation
There is no financial compensation for participating in the study. In this first phase of eSRAP implementation (i.e., beta test), access to eSRAP is provided at no cost to all users. If you decline to participate or decide to withdraw, you will still have free access to eSRAP and system support.

Confidentiality
The information will remain confidential. No identifying information will be published in scientific articles or disclosed during presentations. The researcher will replace names with pseudonyms, and transform any information that may identify interviewees, so that, apart from the researcher, no one can identify you.

All study data will be stored on the researcher's password protected external hard drive. Only the researcher and her supervisors will have access to this data. Any paper copies will be destroyed after analysis of the results. Members of the McGill Institutional Review Board, or persons designated by the McGill Institutional Review Board, may access the study data to assess the ethical conduct of this study. Data will be retained on an external hard drive for 7 years after publication as per University policy.

Contact
For any further questions about the study, please contact Vera Granikov (vera.granikov@mail.mcgill.ca).
For any questions about the rights of research participants, please contact the McGill Institutional Review Board: Ms. Ilde Lepore (ilde.lepore@mcgill.ca)

Conclusion
If you agree to participate in this study by being contacted for an interview, please reply to this email with the following statement: "I have read the above information and I consent to being interviewed for this study. My verbal consent will be given and audio-recorded at the beginning of the online interview."

The researcher will then email you to determine your availability for the online interview. A discussion on consent will take place at the beginning of the online interview, and your verbal consent will be audio-recorded.

Appendix 5. Interview Guide

Introduction:

Hello. Thank you for taking part in this online interview. I am a PhD candidate in the School of Information Studies at McGill University. My project is about collaborative monitoring of research trends. In other words, what happens when groups work together to keep up with new publications in their research areas, instead of doing it individually.

Keeping up with research publications is not easy. There is too much information, not enough time, and it is not always easy to tell which studies are relevant. Collaboration may be a solution and is the idea behind the eSRAP system. The purpose of this interview is to better understand your views and experiences with monitoring research trends collaboratively, enabled by the eSRAP system.

I will ask you general questions about keeping up to date and more specific questions related to ~~using~~ eSRAP. There are no right or wrong answers. The interview will take about 1 hour. Do you have any questions at this point?

Before we get started, please read the consent form. It states that I will be recording and that it's okay with you. It also states that you can stop at any time. Everything you say is confidential and all data will be anonymized (all names will be removed). What you say will not have a negative impact on your work or access and use of eSRAP.

Are you ok to begin?

Opening question

1. How do you usually keep up with publications in your field?
    - Prompts: Tell me more about your research area, for example, are there new publications all the time. How familiar are you
    - with your research area? How do you normally look for information? Does anyone help you or do you help someone else? …. What else would you like to say about that?

General experience with collaborative monitoring

2. What is it like keeping up to date as a group?
    - Prompts: What is easy or difficult about keeping up to date as a group? Could you say something more about that? Do you have an example you could share?
    - Why did you decide to try it?

3. What would change your experience?

General experience with eSRAP *(journey mapping to explore general experience and influencing factors)*

4. Please describe your eSRAP community/group and your role in it. *(actor/point of view)*
    - Prompts: Could you tell me more about how big your group is? How well do you know each other? For how long have you been working together? How do you divide up the work? How do you know what to do?
5. Can you tell me how you started using eSRAP? *(goal)* or why you wanted to use it?
6. What do you expect from eSRAP? *(expectations)*
7. How often do you use eSRAP?
    - Prompts: Do you use it every week? Are there times when you use it more often?
8. Now, please walk me through what you do in the system. What are your steps? Describe everything that comes to mind. *(phases and steps)*
    - Prompts: Which functions do you use? Who are the people you collaborate with?
9. Is there something else you would like to add about each step, for example, what you experience or feel at each step. *(thoughts and emotions)*
    - Prompts: What do you find easy about using eSRAP? What do you find difficult? In an ideal situation, what would be different?

Specific incident of using eSRAP *(critical incident technique to explore outcomes)*

10. Please think of a specific time when eSRAP had an impact on you or your group. It can be a positive or a negative impact. Put yourself back into the situation.
11. Can you tell me about that time in as much detail as possible?
    - Prompts: When was it? Where were you? What task were you doing at the time? Why did you choose to use eSRAP this time?
12. How did eSRAP impact your work at that time?
13. Any more thoughts, feelings, insights about this time?
14. Is there another time you can think of when eSRAP had an impact on you or your group?

Closing questions

- That's basically everything I wanted to talk to you about. Do you have any final thoughts or something you would like to add such as suggestions for improving eSRAP?

- I would like to make sure that the results resonate with your experience. After all interview data is analyzed, is it ok if I send you a summary of themes by email and ask for your feedback?
- Are you ok for the interview to end and the recording to stop?
- **Thank you for your time!**

Appendix 6. Qualitative Study Codebook

Themes	Definitions	Data-Based Examples
1. Factors	**Perceived conditions (barriers or facilitators) that may influence collaborative information monitoring (CIM).**	
1.1. External	Attributes of the information environment in which CIM occurs. These include dimensions and elements that influence CIM activities from the outside of the group or the organization, such as the subject discipline, the complexity, the rate at which the informational environment changes.	
1.1.1. Volume of new publications	The number of new publications that are potentially relevant (e.g., high volume of new publications may motivate people to engage in CIM).	"There is not much that is not relevant. We try to integrate different perspectives, so a lot is relevant." (Jennifer, C2)
1.2. Organizational	Attributes of an organization where CIM occurs and which could influence CIM, such as organizational strategy, organizational culture, administrative structure, governance, pace of work, information flow within the organization, etc.	
1.2.1. Culture	A shared framework of values, norms, and assumptions that guide organizational actions (e.g., a culture promoting dialogue and exchange may facilitate CIM).	"In a friendly discussion, we can exchange, ask our questions: And you, what do you think about it? Oh, I wasn't sure about that, or I don't agree. There is also: I don't agree with you." (Ellen, C2)
1.2.2. Top management support	Concrete actions by top managers to encourage CIM activities, helping workers develop CIM skills and abilities, and solving challenges when needed (e.g., providing workers with access to a dedicated	"And even above me, I need the bosses to encourage people to use it." (Gina, C4)

	CIM system and compensating training time).	
1.3. Information sources	Attributes of the information source(s), such as source quality, source format, availability, or access.	
1.3.1. Peers	Social connections and people who are close or similar are used for information seeking often because they are perceived as having a high probability of providing relevant and useful information (e.g., colleagues sharing relevant articles with research team members on a shared drive).	"I'm part of a big research team where we regularly share articles, so there you go. It can give you access to interesting things." (Jeremy, C3)
1.4. Task	Attributes of an activity or piece of work that the participants are asked to do. It can be a specific CIM task or a general task that involves CIM (e.g., producing a newsletter to share new articles identified via CIM). Task factors may include task complexity, structure, how "dividable" the task is, or the timeline for completion.	
1.4.1. Co-development	Co-conception of the CIM task with group members participating in developing the search strategy and the selection criteria (i.e., screening questions) for the monitoring project implemented in eSRAP.	"If you're not involved in the group dynamics, group decisions, the construction of the topic or the collaborative monitoring, I think you're less engaged in terms of depth, of understanding of the topic." (James, C1)
1.4.2. Screening process	The effort necessary for screening records operationalized as the number of screening questions.	"Now we have fewer questions, it's agile, it's light, it's easy to use, we have someone who does it and doesn't find it cumbersome to do so. I think it's a win-win for us." (Jennifer, C2)
1.4.3. Selection criteria	The effort necessary for collaborative filtering of records	"What is difficult is the clarity of the criteria. Everyone has a

	(i.e., making relevance judgements as a group).	different understanding sometimes of things, so you really need to define criteria that are very easy to understand, and not too much open to interpretation." (Anna, C1)
1.5. System	Hardware and software features that enable CIM activities (e.g., internet connection, interface features, communication tools), as well as the role of the eSRAP system in supporting CIM.	
1.5.1. Satisfaction with performance	The degree to which system performance matches performance expectations of the users (e.g., members do not require any additional features).	"I think we were getting somewhere with the eSRAP platform but unfortunately the system might have been a little bit too slow to absorb the growing number of publications." (Claire, C6)
1.5.2. System as a central repository	All information for the same CIM project (e.g., records and ratings), is stored in one place, are organized and accessible to all members.	"When you had several people working on the same thing, there was no confusion because everything was already integrated into the platform, everyone has access to the same list, everyone has access to the same criteria, you can see the work of others as well." (Rachel, C5)
1.5.3. System as chunking	eSRAP enables users to break down the larger monitoring task into more manageable smaller-sized chunks, which may render the task easier to accomplish and consequently facilitate CIM (e.g., each Monday a user rates 15 new records).	"I told myself each time that I will log into eSRAP, I will screen at least 5 papers." (Anna, C1)
1.5.4. System as process	eSRAP enables users to follow the same series of steps (actions) within the same CIM project (e.g., when screening records for relevance, all	"I think going through the process of structuring our thoughts and structuring our inclusion and exclusion criteria

	users have to answer the same screening questions).	the same way we would have done for a formal literature review was a huge benefit of the platform." (Claire, C6)
1.6. Group	Attributes of the group (i.e., two or more individuals) engaged in CIM (i.e., common objective) such as group size, familiarity, trust among members, division of roles, governance, norms, interaction, etc.	
1.6.1. Formation	How group members came together and how they interact with each other.	"When I know them, I know what interests them and so I can send them papers that interest them. So yes, knowing people is important for working together." (Jeremy, C3)
1.6.2. Communication	How group members exchange ideas and share information to accomplish their CIM objectives (e.g., communication channels, communication style).	"In terms of resources, we used Facebook Messenger initially, but then we found the conversation thread would often get lost (…) Zoom, Facebook and Slack were our main communication systems." (Claire, C6)
1.6.3. Leadership	Facilitating and guiding the actions of group members and is ultimately responsible for the CIM project (e.g., a present group leader who is available to trouble shoot and solve challenges related to CIM).	"I think it was very supportive because every time I had a question, I would ask the editor or the chief rater so I asked Anna and Anna would answer very rapidly and it would be very easy for me to do my part or to play my role." (Cedric, C1)
1.6.4. Division of work	Breakdown of roles and tasks among different group members, aimed at achieving the group's CIM goals.	"Because I wanted to have at least 2 people, what I decided to do is that there's at least one person that screens the records and I only look at those that were answered, and I finalize them." (Anna, C1)

1.6.5. Confidence in peers	Group members trust each other, specifically other members' skills and abilities (e.g., trust peers to know which studies are relevant and select studies of high quality).	"We know that we trust each other. We know that we are critical and rigorous towards the information we consume." (Ellen, C2)
1.7. Personal	Attributes and traits of an individual collaborator, such as their age, gender, work experience, personal domain knowledge, skills, and personality.	
1.7.1. Skills	Developed abilities to engage in CIM competently (e.g., sufficient research training to identify relevant and high-quality research).	"But not everyone on the team is trained in research either. (…) I have a very strong background in this area, and everything I have on a slide has to do with the literature." (Gina, C4)
1.7.2. Personality traits	Distinguishing attributes of an individual (e.g., curiosity, desire to help).	"I like to read everything to be able to understand everything and see everything and build my knowledge" (Cedric, C1)
1.7.3. Time blocking strategy	Setting aside dedicated time for CIM with eSRAP (e.g., blocking an hour every Friday afternoon to log into eSRAP).	"I had no choice but to block half a day to do this. Otherwise, it doesn't get done." (Gina, C4)
2. Outcomes	**Perceived consequences or results of a CIM activity, which could be immediate or delayed, expected or unexpected, actual or potential, as well as positive, negative, neutral (i.e., lack of outcomes), or mixed (i.e., positive and negative).**	
2.1. Affective	Feelings experienced by members in relation to CIM, their task, or towards each other (e.g., disappointment, stress, safety, pride, confidence, motivation, etc.)	
2.1.1. Motivation	Feeling driven to do well and continue with CIM (e.g., because working together is fun, members feel encouraged to stay engaged).	"Having more people involved motivates me." (Anna, C1)

2.1.2. Worry	Feeling unhappy and distressed because of something that is happening or could happen (e.g., feeling worried about making mistakes).	"I said to myself maybe it's better to say, 'In the end, I'm not going to help you because I'm going to make everything more complex and then it's going to be difficult for you." (James, C1)
2.1.3. Confidence	Feeling certain and positive about personal abilities, working together, CIM results (e.g., feeling confident in the articles identified as a group).	"Just to make sure, now that we are at least two people that look at the record, I feel more at ease with the decision that is made at the end." (Anna, C1)
2.2. Cognitive	Products of cognition processes related to CIM, such as learning (new knowledge or skills/abilities), understanding, forming new ideas, identifying knowledge gaps, and shifting focus.	
2.2.1. Deeper reflection	In-depth or careful consideration of new information and ideas emerging from CIM activities (e.g., exchanging perspectives on newly identified records in eSRAP, especially when contradictory, could help to enhance personal understanding).	"And then what is also useful when you do collaborative monitoring is the confrontation (…) you can select texts, topics, but if you don't also confront them (selected records) with the group and with the group's knowledge, the critical dimension of your learning will not be very important." (James, C1)
2.2.2. Shared understanding	Group members know the objectives, the rules, the spirit of their CIM project, which is often achieved through communication (e.g., group members often met to discuss which records found in eSRAP are truly relevant to them).	"When we met, we said to ourselves, what are we trying to do? We talked about it and then we agreed and said yes, but neither of us was exactly on the same page so it didn't work. And we went around again and there we were better, much more, we were almost, almost good." (Jeremy, C3)

2.3. Behavioural	Observable/tangible or intended actions reported by CIM members, such as information/knowledge sharing, problem solving, networking, mutual help, feedback provision/exchange.	
2.3.1. Discussion	The act of discussing, considering, and examining views related to CIM activities.	**“**It is more stimulating to keep up to date as a group [...] when several of us have read the same things, we can have enriching discussions about the content and go beyond the article.” (Jennifer, C2)
2.3.2. Information sharing	Information is passed (exchanged) from one another, which can be one directional or involve providing and receiving (e.g., the relevant records representing newly published articles were shared with network members by a monthly newsletter).	“We used it a lot for our newsletter.” (Gina, C4)
2.3.3. Information avoidance	The act of preventing or delaying the acquisition of information because of CIM (e.g., group members skipped records that were hard to rate, knowing that someone else can do it).	“To be honest, sometimes I don’t know how to rate. So, I skip because someone else will rate it and because I’m wasting a lot of time looking at the abstract.” (Cedric, C1)
2.4. Relational	The degree of closeness or distance among people because of CIM.	
2.4.1. Internal ties	Social relations and interactions within the group and/or organization.	"We hadn’t collaborated on anything before. It was really neat that we all came together with a shared goal, and we made friendships along the way.” (Claire, C6)
2.4.2. External ties	Social relations and interactions with the larger community, outside the group and/or organization.	“But it's always been interesting to us the idea that this was something we could integrate people who are more from the community and not in research,

		and then have their point of view." (Jennifer, C2)
2.5. Performance	The execution and attainment of CIM objectives, such as, effectiveness (i.e., results) and efficiency (i.e., time).	
2.5.1. Efficiency	Ability to accomplish CIM objectives with minimum waste of time and effort.	"Time is saved because there is already someone who has done the work." (Ellen, C2)
2.5.2. Quality	Producing or providing higher quality performance results because of CIM.	**"**And so certainly doing it as a group, I found that we had perhaps less biased opinion and we could flag inconsistencies (…)." (Claire, C6)

Appendix 7. Case Summaries

Case 1

"*Working as a group helps to avoid individual cognitive work that takes much more time. In a group it's more efficient, you put less energy and reach the goal more quickly, which is to learn*." – James

The idea to use eSRAP was suggested to Anna, a researcher, and she said "Ok, but I have to find friends." After setting up the monitoring project in eSRAP, Anna posted a call on her website looking for people to help her monitor new publications. James and Cedric, who know Anna but not each other responded as volunteers. James is a health professional and a PhD student from France, while Cedric is a research professional from Montreal, Canada. All three members have experience with research, systematic literature reviews, and eSRAP. Anna and James subscribe to table of contents and search alerts. Anna admits to not looking at the alerts that land in her inbox. James describes it as a lot of "noise" that causes him to pay less attention and potentially miss important and relevant information.

The members perceive the screening as feasible due to having only two screening questions to answer. In terms of role division, James and Cedric do the initial screening, which is then finalized by Anna. The main difficulty related to CIM reported by all three members, is reaching a shared understanding at the level of the selection criteria. As Anna explained "everyone has a different understanding sometimes, so you really need to define criteria that are very easy to understand and not too open to interpretation." Even after going over the criteria and explaining the definition, Anna still finds discrepancies between raters. Cedric and James agreed that having more discussion would have been beneficial, particularly in the early phase of the project – before even starting the eSRAP project. While members described some shortcomings of the system, they were overcome by Anna's availability and responsiveness.

Collaboration in screening records was perceived as efficient. Anna spent less time, being responsible for the "second pass" or "quality control." According to Cedric, "instead of doing it yourself, you're dividing between different people. Even if I'm doing 80%, at least I'm not doing 100." James specified that "working as a group helps to avoid individual cognitive work that takes much more time."

Case 2

"*It helps us progress as a group, to read together rather than individually*." – Jennifer

With the approval of the research director, Jennifer, Ellen, and Kristy co-developed an eSRAP project to stay connected to new publications and keep up to date after conducting a literature review. Their field of interest is broad. As described by Jennifer all "angles" need to be considered and so "there is not much that is not relevant." Ellen and Jennifer have been working together for a year. Kristy only recently joined the team. All three have research training and use eSRAP in the context of paid work activities. For Jennifer, Ellen and Kristi, colleagues are key information sources, helping them stay up to date. The team uses a shared gmail account and a Google Doc to share and save new relevant articles, which are also added to a shared agenda (on Google Drive) and discussed at weekly team meetings.

The implemented project in eSRAP re-uses the search strategy from the literature review, two simple screening questions, and a comments box. Kristy used the system the most, followed by Ellen. When asked about reaching agreement in selecting what is relevant, Ellen replied that they "pretty good," which she then explained by the fact that She is the one that trained Kristi and possible passed on her (Ellen's) understanding of the criteria to Kristi. Jennifer visited eSRAP but did not rate any records. Given the low number of new records added to eSRAP, Jennifer expressed no pressing need to involve more members.

The organizational values in which the team works are those of collaboration, diversity of perspectives, discussion, and partnership. As Jennifer described: "When the idea (of eSRAP) was presented, it made sense to me from the start. […] I saw that it's going to allow us to sort through the references in a different way, which is consistent with our objectives as a research team – to be inclusive." Collaborative information monitoring with eSRAP was intended to "feed" (with information) and consequently keep a connection with community partners around the project. In Jennifer's own words: "Our idea was not only to continue the literature review, but precisely, to nourish and retain a diverse community of people around our project, to keep them attached and interested."

Case 3

"*Knowing people is important for working together*." – Jeremy

Jeremy and a colleague are both health professionals, who also do research, and know each other. Despite trying to keep up to date, for example by subscribing to email alerts, Jeremy

says that he is “missing a lot” (publications). He jokes that a solution would be “a magician who drops only good articles in the inbox.” According to Jeremy, the human assessment or filtering new information in the context of keeping up to date (i.e., sorting and identifying what is relevant) is key and time consuming.

Regarding eSRAP, Jeremy admits that he went about it backwards. From another researcher, Jeremy heard about the system, liked the idea, and then tried to find a research topic he could use it with. The objectives were developed “in action” and as he says, the eSRAP project is still in the construction and testing phase. The two met to co-develop the monitoring project and tested the selection criteria by screening bibliographic records on paper. However, only Jeremy used eSRAP and his colleague declined the interview invitation. Their eSRAP project includes 11 screening questions, some of which in involve “personal judgement” and making them more difficult to answer collaboratively. For Jeremy, the main barrier to engaging more in CIM with eSRAP was lack of time and difficulty connecting eSRAP to specific bibliographic databases.

Working together involves discussion. Discussion is necessary to ensure a shared understanding. Jeremy and Anna met several times, to discuss what they were doing, what they were not doing, how they were doing it, showing articles to each other as examples of what is “good” and not. In the beginning, they screened 6 months worth of published article abstracts and discovered that “it didn't work at all”. This required asking themselves "What are we trying to do?”. They talked and agreed and said yes but were still not exactly on the same page so it didn't work. They talked and rated again and then they “much better… almost good”.

Case 4

“*I am not able to go through all these articles, even if it is only to read the abstract and then to see if it is relevant. I needed more hands*.” – Gina

Gina manages a division of a research centre. Within this role, she oversaw the monitoring project in eSRAP, which was implemented by her predecessor with a specific goal – to identify the latest pertinent publications to be disseminated via a monthly newsletter. The eSRAP project consists of a comprehensive bibliographic search strategy (composed of multiple keywords and synonyms), eight screening questions, and a box for written comments.

Gina is the only person using eSRAP, although she says colleagues were involved in co-developing the search strategy and the screening questions. She explains her colleagues’ lack of

uptake by existing workloads and not seeing “what’s in it for me.” She adds that not all team members have research training and may not have the instinct to base their professional activities on the latest research evidence. Moreover, Gina talked about human reluctance to change when it comes to technology. “Even if it's the best technology in the world, you have to take them by the hand, sit down with them, and say - here's the tool, here's how to use it, here is why we use it. Try it out. I'm going to be next to you, we're going to talk about it.” During the interview, she reflected on the importance of leadership: “Maybe that's what we've been missing, strong internal leadership to say: Here's a new tool, here's how to use it.”

A positive outcome Gina perceives related to monitoring with eSRAP is efficiency. Preparing the newsletter takes less time and it saves time in general. “If we keep up to date, we are more efficient in our work. It's a time saver as we do not have to go back every time to do a search. It's simple, everything is already set up. It's really easier.” Overall, for Gina, collaborative information monitoring brings together the mechanical side of searching in databases for new publications with the human aspect of asking "What was your impression of this article? Do you think it's interesting?"

Case 5

“*Selecting articles in systematic reviews takes a method that is the same for everyone. eSRAP allowed for that.” –* Rachel

Rachel, a research professional, was the contact person for implementing eSRAP to stay up to date following several systematic literature reviews. In total, seven eSRAP projects monitoring seven topics were implemented. Each project used a comprehensive search strategy and screening questions from the corresponding systematic literature reviews. Different people worked in eSRAP, but one person per project (i.e., topic). In other words, there was no collaboration within monitoring projects. Moreover, as Rachel explained, she did not add new users to eSRAP. Instead, she shared her personal login. As a result, all system usage data appears as Rachel’s, even when it was not her using the system.

Rachel appreciated the fact that the different users, working on different topics and representing different teams, were all using the same system and the same screening criteria integrated into the system. Also, eSRAP allowed them “to centralize everything that had been done and to update it easily and quickly.” Overall, a formalized process for keeping up to date,

enabled by eSRAP, took place while the group had the mandate to maintain the currency of the reviews. When the mandate was passed to another team, eSRAP use stopped.

Case 6

"The benefit of being a group is that this is not a task a single person could have done. We subdivided tasks and leveraged each other's strengths. We had people interested in website development, in reviewing and quality control, people that generally love to read and write. There was a space for everyone." – Claire

During the Covid-19 pandemic, a group of students decided to put their literature review skills and medical knowledge to use. Together, they produced a newsletter helping frontline clinicians keep up to date. The core team was composed of students from the same university, even if they often did not know each and did not collaborate in the past. Claire led the newsletter project and was the contact person for eSRAP. While the eSRAP project was implemented, it was never used by the group. Due to the fast-growing number of publications, new records loaded slowly and as Claire explained they were already using "a deconstructed eSRAP", which functioned well.

Claire attributes the project's success (outside of eSRAP) to an effective distribution of tasks (e.g., dedicated sub teams for newsletter creation, communication, etc.) and to weekly check-in meetings to ensure that everything was running smoothly and to identify what could be improved. In addition to this practice of continuous improvement, being a small team allowed them to stay agile. In Claire's words: "we were able to make dynamic changes", for example extending the review cycle to be 48 hours from 24, a change that was recommended midway through the process and instituted in a single Zoom meeting."

Even if eSRAP was ultimately not used, discussions related to it forced the group to come up with screening questions, which improved their selection process – "a process that was previously organic was now more methodological." Claire described the collaboration as fun and engaging. The enthusiasm of the team helped them attract new team members and keep the newsletter going. Claire felt a great sense of pride related to the newsletter and the collaboration, and while understanding why it happened, was sad when the newsletter project ended. When many of the founding members left, it was difficult to set up a leadership group composed of members from different institutions who did not know each other. Claire was the only group member to be interviewed.

Case 7

"*It comes back to the capacity of our team and what the need is. If there is a topic-related need, we will go look for things and build activities around it. Otherwise, I will probably remain fairly organic in terms of good articles sent by network members or what we find by chance and ad hoc searching."* – Susan

Susan is a manager in a large knowledge network. About keeping up to date, Susan said: "I realized with time how important it is to have good ways to stay connected to the literature, as a non-researcher even, working in this field." Upon Susan's request, an eSRAP project was set up, but was not used.

According to Susan the time to "digest the massive information" is hard to find, especially since she wishes to "not just scan and click and save, but really think about what this means, what the next step is, the implementation piece - what do we do with that knowledge?" Not using eSRAP, Susan explains by not building it into her calendar and not getting to the point where she understood and could use the system. When considering her group, Susan presumes that eSRAP will allow them to work better as a group but does not know if they (colleagues) would participate very much. "I think the idea is good but are all groups ready to participate, to what extent and with who? I don't know."

By engaging in collaborative information monitoring, Susan hopes to involve member networks in reflecting on the literature together. Taking time for collective reflection is important. "I think we can build it into our work plans and our activities, but it is not a simple process. It involves holding the knowledge and exploring it collectively, sitting with it, going beyond individual reflection."