Knowledge Transfer and Exchange in Work and Health Research

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Public Health and Health Systems

Waterloo, Ontario, Canada, 2016

AUTHOR'S DECLARATION

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

STATEMENT OF CONTRIBUTION

I hereby declare that I am the sole author of chapters 1, 2, 4, 5, 6 of this thesis.

I declare that I am the lead author of Chapter 3. The manuscript that makes up chapter 3 was published in the peer-reviewed journal Ergonomics. The manuscript was a result of a research project I led as principal investigator. In this project I led all aspects of the project with support from my co-investigators. I was solely responsible for the data analysis and writing the manuscript which forms Chapter 3 of this thesis.

ABSTRACT

Knowledge transfer and exchange (KTE) is the practice of preparing and disseminating research to those who can use it. The burden of workplace injury and illness can be great affecting workers, workplaces, the medical system, insurance systems and society as a whole. Occupational health and safety is an important aspect of prevention of workplace injury and illness. However prevention activities are varied and may not be based on the best available evidence, being therefore less effective than possible. The overall aim of the thesis is to examine and evaluate KTE activities and the conceptual basis for KTE in work and heath research. Specific objectives include i) providing an overview of the KTE approaches from the literature which target workplace audiences; ii) disseminating and documenting the uptake and use of an evidence-based tool (PE guide) across British Columbia; iii) document and describe the dissemination activities and the KTE experiences of research staff within work and health research organizations; and iv) examine the conceptual basis of the work and health KTE activities.

This thesis consists of four manuscripts that describe three studies: a narrative review of the literature summarizing KTE approaches in work and health research, a study exploring the dissemination and use of an evidence-based guide, and a survey study evaluating the KTE activities of work and health researchers. Though different methodologies were employed the three studies used an organizing conceptual framework by Lavis et al. (2003) comprised of five questions: (1) What (information disseminated), (2) To Whom (target audience, and context), (3) By Whom (messengers), (4) How (KTE approach), (5) What effect (outcomes, impact).

The review findings suggest a variety of KTE approaches to transfer work and health research knowledge to workplaces. The KTE approaches address various target audiences and workplace

contexts related to health and safety and tended to be guided by conceptual frameworks. The evaluation of KTE approaches is challenging and future research should be designed to allow for more rigourous evaluation.

The study describing the dissemination and use of an evidence-based tool reveals that respondents felt the greatest barrier to using the tool was a lack of time. However those that did use the guide reported using it for training purposes, sharing it, and integrating the tool into existing programs. In addition, new actions related to tool use included training, defining team responsibilities and suggesting program implementation steps. The dissemination study suggests that when evidence-based tools were used they helped work and health audiences overcome some challenges involved in using evidence in implementing injury reduction programs. The study provided a better understanding about the uptake and use of this type of tool.

Work and health researchers reported that KTE activities were important and they felt confident about interactions with knowledge users. Respondents reported engaging in various KTE activities that extended beyond the typical academic approaches of 'publish and present'. However they reported that processes supporting KTE as well as the promotion and evaluation of research use could be improved. The KTE activities of work and health research staff address the categories of two popular KTE conceptual frameworks. However, only one-third of respondents reported using guidance from conceptual frameworks in practice. Future research should examine whether KTE activities based on conceptual frameworks have greater impact than those that are not so guided.

Taken together the chapters provide a comprehensive picture of KTE in work and health research. The findings reveal important common elements of KTE from the literature as well as work and health research staff. The findings also provide some evidence that disseminating an evidence-based tool has impacts on practice. However work and health research staff KTE activities still focus on traditional academic avenues and often lack guidance form conceptual frameworks. Future research is necessary to further evaluate KTE practice in work and health.

ACKNOWLEDGEMENTS

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Knowledge and Wisdom

Knowledge and wisdom, far from being one, Have oftimes no connexion. Knowledge dwells   In heads replete with thoughts of other men; Wisdom in minds attentive to their own. Knowledge, a rude unprofitable mass, The mere material with which Wisdom builds, Till smooth'd and squar'd, and fitted to its place, Does but encumber what it means to enrich. Knowledge is proud that he has learn'd so much, Wisdom is humble that he knows no more.

William Cowper (1731-1800), *The Task*

CHAPTER 1: INTRODUCTION

The burden of workplace injury and illness can be great and affects not only individual workers but workplaces, the medical system, insurance systems and society as a whole (Murray et al., 2012; Vos et al., 2012; Woolf et al., 2004; Schneider and Irastorza 2010; Silverstein and Evanoff 2011). For example, in 2014 there were approximately 151,000 work-related injury and illness claims in Ontario. Approximately 41,000 of these claims were serious enough to require time away from work as accepted lost-time claims (WSIB, 2014). The total number of lost time claims in Canada in 2014 was approximately 240,000 (AWCBC 2016). These numbers are clearly indicative of a notable burden on individuals, the workplaces involved, and compensation, private insurance and medical systems.

Occupational health and safety is one important aspect of prevention of workplace injury and illness. In Ontario, there has been an increasing focus on preventing workplace injuries which is reflected in the findings of the Expert Advisory Panel on Occupational Health and Safety (EAP) report (EAP, 2010). The focus on prevention is a direct reaction to the level of burden that these injuries cause various systems and individuals. However approaches to prevention are varied and may not be based on the best available evidence. Using the best available evidence along with practical expertise may result in more effective interventions and programs to reduce injury and illness (Sackett et al., 1996).

Work and health research may encompass many fields. Researchers in work and health continue to produce and publish scientific evidence (Ferris et al., 2015; Harma et al., 2015; Li et al., 2015; Jackson-Filhbo et al., 2015; Sweileh et al., 2014; Gehanno et al., 2007; Navarro and Martin 2004). The scope of work and health research draws from various disciplines including occupational hygiene, engineering, biomechanics, ergonomics, psychology and sociology. These disciplines may focus on different risk factors and aspects of workplace health and safety.

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Practitioners may also focus on different risk factors and aspects of workplace health and safety as they design and implement prevention activities. Given the myriad of potential risk factors and perspectives, there are many different types of interventions that could be implemented in workplaces. However, workplace parties such as supervisors/managers, health and safety professionals, and workers must consider and choose approaches to reduce injuries and illness at work. It is not clear how workplace parties locate and evaluate the knowledge used to make decisions required to protect workers from risks present in workplaces. A Knowledge Translation and Exchange (KTE) perspective considers how workplace parties search for information about workplace health and safety. In addition, KTE approaches may help workplace parties to decide on the best available ways to reduce injuries and illnesses at work.

1.1 KNOWLEDGE TRANSFER AND EXCHANGE

Knowledge is a common term that may have different meaning for different people. In fact the meaning of knowledge has been under debate since the early Greek philosophers (McGrew et al., 2009). The Oxford English Dictionary (Compact Edition) (1982) provides 16 different possible definitions. The various definitions suggest knowledge is not a singular concept. Common to the definitions are concepts of being acquainted with facts or 'truths' or more broadly with a branch of learning (and therefore a number of facts or truths). There is also a sense in these definitions of understanding or at least awareness of facts or principles.

Knowledge is considered to be broader and deeper than data or information (Davenport & Prusak, 2000). Data and information may be considered as building blocks for knowledge. Data are discrete objective facts about events (Davenport & Prusak, 2000). Data are also the basic elements of information. Information is not as straightforward to define but can be considered as a message between two entities (a sender and receiver) (Davenport & Prusak, 2000). Knowledge

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is richer than information or data, and individuals who are knowledgeable can understand and interpret data and information as meaningful.

In KTE the "knowledge" transferred or translated is often defined as "research findings" (Gagnon, 2011; Graham et al., 2006; Strauss et al., 2009; Strauss et al., 2011; Thompson et al., 2006). KTE is concerned with generating, disseminating and implementing the best available evidence. There are a number of different terms used to describe KTE including knowledge translation, knowledge transfer, and knowledge exchange (Graham et al., 2006; Greenhalgh and Wieringa 2012; McKibbon et al., 2010). Graham et al. (2006) suggest the use of a definition promulgated by the Canadian Institutes for Health Research (CIHR):

> "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians …" (CIHR, 2015)

The CIHR definition is widely adopted across jurisdictions (Curran et al., 2011). The definition is broad enough to encompass a wide variety of activities considered to be KTE, while indicating there is a social system of interactions to accomplish KTE.

Given the variety of activities that could be considered KTE, I used the term 'KTE approach' consistently throughout this thesis to refer to the process of transferring knowledge. An approach is defined as "a way of dealing with a situation or a problem" (Oxford Dictionaries: http://www.oxforddictionaries.com/definition/english/approach). Therefore, in this thesis, a KTE approach is the way of dealing with the transfer of knowledge. In this view a KTE approach could entail a single activity or a combination of activities in the "process of applying knowledge" from the CIHR definition.

While many agree on a definition of KTE, there is no overarching theory or conceptual framework common to KTE practice or research (Estabrooks et al., 2006; Wilson et al., 2010a; Thompson et al., 2010, Graham et al., 2006). While there have been suggestions for a common theoretical underpinning that would allow for comparison of KTE approaches, the need for context and audience dependent approaches continues to drive new framework development (Estabrooks et al., 2006; Colquhoun et al., 2014; Nilsen 2015).

The terms conceptual frameworks, theories, and models are often used interchangeably (Rycroft-Malone 2010; Maxwell 2013; Tabak et al., 2012). Conceptual frameworks tend to be broad and descriptive, while theories and models are more specific and better suited for testing and comparison (Rycroft-Malone 2010). Conceptual frameworks are used for guiding practice and organizing research. Maxwell (2013) refers to conceptual frameworks as a model and a theory. Tabak et al., (2012) uses the term models to refer to theories and frameworks.

Regardless of terminology, there is a suggestion that KTE approaches should be guided by theory, conceptual frameworks or models (Tabak et al., 2012; ICEBeRG 2006; Thompson et al., 2010, Graham et al., 2006). A question of interest in this thesis was whether theory, conceptual frameworks or models were used to guide KTE approaches in work and health. The term conceptual framework was used consistently throughout the thesis when describing the conceptual basis or guidance for various KTE approaches. Since the terms are often used interchangeably I did not differentiate but instead sought to explain if and how KTE approaches were guided.

A conceptual framework developed by Lavis and colleagues (2003) considered to be useful to researchers and research organizations (Wilson et al., 2010a; Grimshaw et al., 2012) was used in

all studies presented in this thesis. This organizing framework provides practical guidance to designing knowledge transfer activities. It also provided an opportunity to evaluate an overall KTE approach as well as its specific elements. The framework is based on five key questions which provides a strategy to guide knowledge transfer: What should be transferred to decision makers (the message)?, To whom should the knowledge be transferred (the target audience)?, By whom should the knowledge be transferred (the messenger)?, How should knowledge be transferred (the knowledge transfer process and supporting communications infrastructure)?, With what effect should the knowledge be transferred (evaluation)?. The framework is based on an evaluation of the literature on knowledge transfer and was used to describe knowledge transfer activities in applied research organizations in Canada. The results suggested that these research organizations were aware of knowledge transfer approaches but current practices were not consistent with the optimal or desired approaches. More importantly the framework was useful in allowing this comparison and is therefore suited to evaluating KTE activities of research organizations.

Regardless of conceptual foundation, the key goal of KTE is to get "knowledge" into the hands of those that can improve practice (either directly or through policy change). This is true in the area of work and health. There have been calls to improve the transfer of knowledge with a goal of improving the prevention of work related illness and injury (Schulte 2002; 2003; 2006; Verbeek et al., 2002; Franco, 2001; 2003; 2005; Zardo et al., 2014; Chang et al., 2014; Welsh et al., 2015). KTE in work and health is challenging and more research on ways to accomplish effective KTE is necessary.

1.1.1 CONCEPTUALIZING KTE ACCORDING TO THE ORGANIZING FRAMEWORK OF LAVIS (2003)

I consider, based on the description by Lavis (2003), that each of the questions in the organizing

framework is an element of a KTE approach. It is therefore possible that elements may vary

within approaches however for each approach there should be some consideration for each

element. In Chapter 2, I consider each KTE approach found in the literature according to the

Lavis framework – i.e. I describe each approach according to these elements. In Chapter 3, the

elements of Lavis' framework were considered in the design of the study, the elements of what

(a guide), by whom (researchers/research institute), and how (web download of EB guide) were

held constant. Doing so allowed for descriptions of "to whom" (which workplace-based

audiences downloaded and used the guide), and "with what effect" (in this case we explored the

use of the guide with pre-defined categories and open ended questions, over nine months). In

Chapter 5 (Note Chapter 4 and 5 describe a single study), the Lavis framework was compared to

the knowledge to action framework (Graham et al., 2006). The comparison involved categorizing

the survey items according to each framework and then examining scores or endorsement of

items within each of the framework categories.

1.2 RATIONALE AND OBJECTIVES

To ensure research evidence moves from peer-review journal to practice, knowledge transfer and

exchange (KTE) is often integrated into the research process. This practice is encouraged, and at

times demanded, by various research funding agencies including those that fund research in work

and health. For example, in Ontario, the Workplace Safety and Insurance Board Research

Advisory Council had as one of its six research priorities to conduct "research on the transfer of

scientific knowledge to the workplace" (WSIB, 2012). Similarly, the Research Secretariat at

WorkSafeBC, the worker's compensation board in British Columbia, states that "transferring

research knowledge to the workplace" as one of its five research priorities (WorkSafeBC, 2012). More recently the Ontario MOL Research Opportunities Program (MOL, 2015) called for an integrated approach to KTE and looks for research proposals that "demonstrate a commitment to collaboration with occupational health and safety system partners, knowledge users, and relevant stakeholders".

Research in work and health is important due to the burden of occupational illness or injury on workers, workplaces, compensation systems, and healthcare systems. One aspect of work and health research regards prevention of workplace injury and illness. The focus on prevention is a direct reaction to the level of burden that injuries or illnesses cause various systems and individuals. However approaches to prevention are varied and may not be based on the best available evidence. Evidence about prevention practices may come from various disciplines which may focus on different risk factors, audiences, practices and outcomes. There is a need for more high quality research in the area of prevention (Van Eerd et al., 2015; Varatharajan et al., 2014; Nastasia et al., 2014; Montano et al., 2014; Verhagen et al., 2013; Tullar et al., 2010). There is also a need to better understand how to effectively "transfer" the knowledge gained from research to those parties that can make a difference in worker's health and safety (Schulte, 2006).

The overall aim of this thesis is to better understand KTE in work and health. To accomplish this the thesis compiles the reports of three research projects: a) a literature review of KTE approaches for workplace audiences, b) a study examining dissemination of an evidence-based guide to workplace audiences, c) an evaluation of work and health researchers KTE activities and the conceptual underpinning for the KTE activities.

The objective of the review of the literature (Chapter 2) was to review and compare KTE approaches relevant to work and health research and describe the conceptual basis (frameworks/models) of the various KTE approaches.

The specific objectives of the dissemination study (Chapter 3) were to: 1) to disseminate and document the uptake of an evidence-based tool across British Columbia, and 2) to evaluate the use of the tool with respect to intent to initiate and initiating prevention programs in workplaces.

For the work and health research KTE activities study (Chapters 4 and 5), the objectives were to 1) document and describe the dissemination activities and the KTE experiences of research staff within work and health research organizations; 2) identify opportunities for improving KTE in work and health research; 3) determine and describe the KTE activities of work & health researchers according to two common KTE conceptual frameworks; 4) examine how comprehensively the self-reported KTE activities represent the categories of the two frameworks; and 5) discuss which framework shows promise for work and health research and why. The findings from the survey of research staff were described and analyzed using categories created by Gholami and colleagues (Gholami et al., 2013; Maleki et al, 2014) in order to describe KTE in research institutes. The seven categories are: "priority setting, research quality and timeliness, resources for knowledge transfer, support for knowledge transfer, KTE capacities, interaction with research users, and promoting and evaluating the use of evidence". The analysis approach is exploratory but the categories are important to research organizations and future research could be guided by this type of approach.

The studies fit together to examine KTE activities in work and health research. The studies gather data about KTE from literature as well as from work and health research staff to describe

and compare the overall approaches. The literature review considered the practice of KTE and extracted details about various approaches according to the framework by Lavis. The findings reveal common elements of KTE regarding audience, activities, and impact. In addition the literature suggests that many approaches are guided by conceptual frameworks. The dissemination study described a KTE approach that was guided by a conceptual framework and reported on the impacts related to knowledge use and practice change. The work and health research KTE activities study revealed that research staff report a variety of KTE activities. However the predominant activities appear to relate to peer-review publishing and presentations. The KTE activities of work and health research staff represent well the categories of the Lavis conceptual framework, however only few research staff report their KTE activities are guided by conceptual frameworks.

The chapters fit together by examining the details about a variety of KTE approaches applicable to work and health. The literature review showed the breadth of approaches available, whereas the dissemination study described specific details in context, and a study of work and health research staff revealed important details about KTE activities as well as barriers and facilitators for KTE. Taken together the findings of the studies present a comprehensive picture of the KTE activities in the area of work and health. The findings move us toward a better understanding of KTE practice as well as how to better evaluate the impacts of KTE.

1.3 MY ROLE

The research projects that make up this thesis were all conceived by me. The literature review (Chapter 2), perhaps the largest project according to time spent, was an unfunded project. I was supported by the Institute for Work & Health to complete the review primarily by providing me

access to library resources. The initial database literature searches and updated searches were run by an information specialist. All other searches and review activities were done by me.

The dissemination study (Chapter 3) was a result of a research project I led as principal investigator. The project was funded by a grant from the WorkSafeBC Focus on Tomorrow grant competition. In this project I led all aspects of the project with support from my co-investigators. I was solely responsible for the data analysis and writing the manuscript which forms Chapter 3 of this thesis.

I was also the principal investigator for the work and health research KTE activities study (Chapters 4 and 5). This study was funded, in part, by the Workplace Safety and Insurance Board of Ontario (WSIB) Research Advisory Council (RAC). As principal investigator I led all aspects of the project with support from my co-investigators. I was solely responsible for data analysis and writing the chapters.

1.4 ORGANIZATION OF THESIS

The remainder of the thesis is divided into five chapters. Chapters two to five are written as journal manuscripts for peer-reviewed journals (either for submission or already published) and are structured with an abstract, introduction, methods, results and discussion/conclusions sections. Chapter 2 presents a review of literature on work and health KTE approaches. Chapter 3 reports on a study describing the dissemination and use of an evidence-based guide. Chapter 3 has recently been published in the peer-reviewed journal Ergonomics. Chapter 4 presents a survey study examining work and health research staff KTE activities. This chapter provides an in-depth description of work and health research KTE activities. Chapter 5 describes an exploration of the conceptual basis of work and health KTE activities by comparing work and

health research staff self-reported KTE activities to two KTE conceptual frameworks. Chapter 6 is a general discussion providing an overview of the thesis findings, their contributions to the literature and the implications for KTE in work and health.

CHAPTER 2: KNOWLEDGE TRANSFER AND EXCHANGE IN WORK AND HEALTH: REACHING WORKPLACE AUDIENCES

2.1 OVERVIEW

Workplace injury and illness can be burdensome and affects not only individual workers but workplaces, medical systems, insurance systems and society as a whole regardless of jurisdiction. The notion of research to practice is important in work and health research. Knowledge transfer and exchange (KTE) is the practice of preparing and disseminating research to those who can use it. The objective of this paper is to review the literature and compare KTE activities relevant to workplace programs and interventions in work and health research. Knowledge transfer and exchange is known by a number of different names and searching for KTE literature can be challenging. However using focussed literature searches revealed 34 documents that described 23 different KTE approaches (ways to transfer knowledge) designed for workplace programs and interventions.

A narrative review revealed a variety of KTE approaches to transfer work and health research knowledge to workplaces. The KTE approaches address various target audiences and workplace contexts related to health and safety. The various approaches were guided by conceptual frameworks many of which were newly created for the particular approach and context. There were many different outcomes described in the various KTE approaches and therefore it was challenging to determine the best way to evaluate the approaches. The variety of target audiences and workplace contexts requires different outcomes, making it challenging to compare the various approaches. There were however some common elements related to audience, activities and impact that can help to guide future KTE approaches. Improved evaluation of KTE approaches can ultimately lead to improved health and safety of workers.

2.2 INTRODUCTION

The burden of workplace injury and illness can be great and affects not only individual workers but workplaces, medical systems, insurance systems and society as a whole regardless of jurisdiction (Takala et al., 2014; Leigh 2011; Dragano et al., 2014; Park et al., 2013). Occupational health and safety is an important aspect of prevention of workplace injury and illness. However prevention programs and interventions are varied and may not be based on the best available evidence. Researchers in occupational health and safety, or more broadly work and health, continue to produce and publish scientific evidence (Ferris et al., 2015; Harma et al., 2015; Li et al., 2015; Jackson-Filhbo et al., 2015; Sweileh et al., 2014; Gehanno et al., 2007; Navarro and Martin 2004). Is the available evidence from the scientific literature getting to and influencing prevention programs and interventions at workplaces?

Work and health research draws from various disciplines including occupational hygiene, rehabilitation, biomechanics, ergonomics, psychology and sociology. These disciplines may focus on different risk factors and aspects of workplace health and safety. Given the myriad of potential risk factors and perspectives there are many different types of interventions that could be implemented in workplaces. There is a need for high quality research in this area. There is also a need to better understand how to effectively "transfer" the knowledge gained from research to those parties that can make a difference in worker's health and safety (Yoong et al., 2015; Schulte 2002; 2006; Schulte et al., 2003; Loeppke et al., 2015; Manzoli et al., 2014; Rondinone et al., 2010; Zardo et al., 2014).

The transfer of knowledge is known by a variety of terms including knowledge transfer and exchange, knowledge translation, knowledge utilisation, innovation diffusion, implementation research, and research utilisation (Graham et al., 2006). Knowledge transfer and exchange (KTE)

is concerned with generating, disseminating and implementing the best available evidence. In this paper I use the CIHR (2015) definition "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians …". Defined this way, KTE is a process of exchange between researchers and target audiences designed to make relevant research information available and accessible to stakeholders for use in practice, planning and policy-making. Effective KTE helps to ensure that research evidence moves from peer-review journal to practice. There are a variety of ways to deal with transferring knowledge or, in other words, approaches to KTE. I use the term KTE approach to refer to any combination of activities used in the process of transferring knowledge as noted in the CIHR definition.

The idea of research to practice is important in work and health research (Schulte 2003; 2006; Rondinone et al., 2010; van Dijk et al., 2010; Knave and Ennals 2002; Gillen 2010). Workplace audiences interested in prevention such as supervisors/managers, health and safety professionals, and workers must consider and choose prevention programs and interventions to reduce injuries and illness at work. However it is not clear how workplace audiences locate and evaluate the knowledge required to make decisions required to protect workers from risks present in workplaces. Recent studies suggest that workers do not feel they have consistent access to work and health information (Dragano et al., 2015; Rhebergen et al., 2012a). KTE approaches can help workplace audiences to decide on the best available approaches to reduce injuries and illnesses at work.

The objective of this paper is to review and compare KTE approaches relevant to workplace programs and interventions in work and health research literature. A secondary objective was to describe the conceptual basis (frameworks/models) of the various KTE approaches. A summary

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of KTE approaches will be useful for work and health researchers and KTE practitioners as a resource for future KTE activities.

2.3 SEARCHING FOR WORK AND HEALTH KTE LITERATURE

It is challenging to search for KTE literature due to the number of different terms used to describe the generation, synthesis, dissemination and use of knowledge (Graham et al., 2006; Greenhalgh & Wieringa 2012). The challenge relates to i) the variety of different electronic databases that index work and health KTE literature and ii) the variation in search terms (and combinations) required in search strategies of these databases (McKibbon et al., 2010). To address this challenge a number of focussed literature searches were done in a variety of electronic databases as well as hand-searching[1] a database maintained at the Institute for Work & Health (IWH) for KTE research (See Appendix A for details about the literature searches). The searches are guided by systematic methods described by McKibbon et al. (2010) and targeted a broad selection of literatures. While the literature searches were not limited to particular audiences, the focus of this review was on KTE approaches that included workplace audiences. Therefore KTE approaches addressing clinical or policy audiences that did not include workplaces were not included in the main part of the review. In addition, I focused on approaches that considered research evidence as knowledge to be transferred.

Despite the iterative nature and attempts at being comprehensive in the literature searches, systematic searches were not employed, therefore it is possible that some KTE approaches have not been captured in this review.

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[1] Hand-searching involves the non-electronic or non-mechanical examination of the contents of, in this case, a database of documents related to KTE to identify eligible documents.

2.4 KTE APPROACHES FOR WORKPLACE AUDIENCES

Overall there were 23 KTE approaches for work and health described in 34 reports mostly from

the peer-reviewed literature. KTE approaches relevant to work and health research or practice

which target workplace audiences were reviewed according to five questions posed by Lavis

(2003): (1) What (information disseminated), (2) To Whom (target audience, and context), (3)

By Whom (messengers), (4) How (KTE approach), (5) What effect (outcomes, impact) (See

Table 2-1). In addition the conceptual frameworks or models that inform KTE approaches are

described (See Table 2-3).

The framework put forward by Lavis (2003) was used because it is an organizing framework for

KTE strategies that allows comparison between the different approaches. The Lavis framework

was identified by Wilson (2010a) as a framework that could be used by researchers to guide KTE

activities. Recently Grimshaw and colleagues (2012) used the Lavis questions to summarize the

concepts and evidence to guide KTE activities for clinical and health services research. (See

Chapter 1, section 1.1.1 for more details about how the Lavis framework helps to guide KTE

approaches).

Table 2-1: KTE approaches for workplace audiences described according to the Lavis (2003) organizing framework. The table is organized according to type of audience (Q2: Workplace, OHS system, or Public) with reports in reverse chronological order in each section)

AUTHOR YEAR (jurisdiction)	Q1 What	Q2 To Whom (sector)	Q3 By Whom (organization)	Q4 How	Q5 With what Effect
Sinden 2013 (Canada)	*Scientific evidence, study findings, tacit knowledge*: Employer knowledge and reports along with researcher knowledge.	*WORKPLACE*: Municipal firefighting service in southwestern Ontario, Canada (Public Administration)	*Researchers and workplace parties*: Researchers and employer stakeholders (firefighters, health and safety reps, union reps, return-to-work (RTW) specialists, management, and on-site health care professionals).	*KTE Model:* Used the *Knowledge to Action (KTA) model* employing collaborative relationships between researchers and workplace stakeholders in a series of meetings related to a research project (from proposal stage to conducting and completing the research). Using the steps (adapted order) of KTA framework to describe the interactions…	Evaluated: employer feedback regarding utility of a risk assessment tool developed during the research project. Proposed: ''monitoring knowledge use'' and ''sustaining knowledge use'' as per the KTA framework.
Kramer 2013 (Canada)	*Translated scientific evidence*: about reducing musculoskeletal disorders in workplaces.	*WORKPLACE*: workplace stakeholders including workers, managers, labour, OHS practitioners or intermediaries (manufacturing, service sector, electrical utilities, and transportation sectors)	*Researchers and knowledge brokers*. Researchers were directly involved in all cases as they were research studies	*Face-to-face meetings*: collaboration between researchers and audience during research projects	*Evaluated*: knowledge use (conceptual, instrumental, and strategic). In addition, intermediaries impressions of: -collaborative process, -expectations, -involvement and influence, -barriers and facilitators, -lessons learned, and willingness to engage in collaborative research again.
Carlan 2012 (Canada)	*Evidence-based innovation*: a hydraulic lift to raise and lower ladders from service trucks	*WORKPLACE*: thirteen construction companies in Ontario Canada. (construction)	*Researchers + practitioners*: researchers along with health and safety consultants from provincial associations	*Social Networks:* Existing social networks and communication channels were facilitators of adoption	*Proposed*: adoption of the innovation.

Lortie 2012 [Lortie 2011 Lortie 2014] as supplemental (Canada)	*OHS knowledge*: Combination of explicit (including scientific) and tacit knowledge	*WORKPLACE*: three types of knowledge users described: 1. experienced users (able to use guide/tool), 2. users with broad interests (will use guides or tools and often uses many different types), 3. user in a company typically a member of the occupational health and safety committee but may not have experience or training to use guide/tool. (any)	*Knowledge brokers*: Focus on transfer agents: union representatives, consultants, occupational HS agents, and purchasers.	*Knowledge broker approach*: Proposed to include guides, guidelines and transfer agents.	No evaluation specified
Chapman 2011 [and 2010, 2009, 2008, 2004, 2003] (USA)	Evidence-based innovation(s) Related to agriculture practices	*WORKPLACES*: Market vegetable, Berry, Nursery crop, or Dairy farms (agriculture)	*Researchers*	*Diffusion of Innovation approach* using: - other growers/farmers - print mass media - public events - resource people - other media (radio, tv, internet)	Evaluated: which source were used, increased awareness, increased practice adoption, change in knowledge, information uptake, barriers to adoption
Guzman 2008 (Canada)	*Translated scientific evidence*: "the best available evidence to solve specific workplace health and safety problems"	*WORKPLACE*: The proposed approach appears to be adaptable to any type of workplace and OHS stakeholders. (any sector)	*Not explicitly stated*: potentially occupational health practitioners and researchers	Proposed *"learner-centered" KT approach*: Building stakeholder commitment and capacity to appraise and apply knowledge to solve problems using a "blueprint for action" called MAPAC which stands for Mobilize, Assess, Plan, Act, and Check.	No specific outcomes are proposed however the importance of evaluation was noted
Baines 2007: (Canada)	*Study findings*: Policy recommendations resulting from a research project	*WORKPLACE*: non-profit workplaces. Executive directors, union executives, managers, and frontline staff. (services sector)	*Researcher*	*Networking and researcher contact* with target audience based on action research. Plus report posted on website, news conference, booklet produced, workshop presentation, keynote presentation.	*Evaluated*: changes in attitude ("hope"), mobilization, changes in health and safety (through collective agreements)

Lehtinen 2006: (Finland)	*Translated scientific evidence*: OHS Information from a research organization (FIOH)	*WORKPLACE*: small workplaces (multiple sectors)	*Research organization*: FIOH	*Dissemination and Learning Network*: Four programmes described: - direct dissemination of guidelines, booklets and checklists to 900 enterprises - dissemination of a self-evaluation tool to initiate and implement health promotion programmes (includes support for training) - dissemination of OHS information (fact sheets) for agricultural workers, through a collaborative effort with local organizations (Farmers' Trade Unions) and use of internet - Learning network for small business, through a virtual workshop on the internet and an extranet to allow sharing of experiences.	Evaluated: Awareness and motivation to improve working conditions. Implementation of changes to improve conditions.
Kramer 2003 and 2004 [+ Kramer 2010] (Canada)	*Translated scientific evidence*: Thematic messages based on a body of research.	*WORKPLACE*: convenience sample of workplaces in Ontario participated in the study. (manufacturing)	*Knowledge broker* disseminated the research information.	*Knowledge broker* approach with two phases: -building relationships -active engagement of KB and the workplace parties, discussing thematic messages with management, union, and superintendents in meetings workshops and one-on-one.	*Evaluated*: knowledge utilization (conceptual use, effort to use, procedural use, and structural use of the thematic messages).
Elkind 2002 (USA)	*Information* about health and safety (in part from research evidence)	*WORKPLACE*: Hispanic farm workers (migrant) in Eastern Washington (agriculture)	*Researchers and community volunteers*. Network of growers, agricultural workers, healthcare providers, advocates, and safety and health experts	*Theatre*. Four one-act plays each lasting 40 minutes in Spanish. Each play presented on a single topic. (1) disease and illness prevention; (2) pregnancy/prenatal concerns and children at the workplace; (3) ergonomics—ladder safety, lifting, falls, etc.; and (4) pesticides and other chemicals.	*Evaluated*: knowledge, attitudes, and reported behaviours

Sinclair 2013 (USA)	*OHS information*: Tailored information about OSH from NIOSH	*OHS system*: Focused on small businesses and intermediaries (any - small business)	*Research organization* NIOSH - initiator	*Intermediaries*: Using a model based on diffusion of innovation and social exchange theory there are 8 steps: Step 1: Analyze Needs of Small Businesses and the Characteristics of Intermediary Organizations That Serve Them Step 2: Analyze How Intermediaries Perceive OSH Step 3: Develop Messages and Select Channels That Will Reach Intermediaries Step 4: Engage Intermediary Organizations Using Selected Strategies Steps 5–8: Delivery of OSH Services to Small Businesses by Intermediaries	*Proposed*: Not specified but suggests that the initiator (NIOSH) monitors steps 6-8. Potential outcomes include of OSH products developed, businesses engaged, products or services delivered, and prevention activities adopted.
Costa-Black 2011 (China)	*Study findings*: selected work disability prevention (WDP) research and associated evidence-based models and return to work (RTW) approaches	*OSH System*: occupational rehabilitation services in Mainland China - national standards committee (any)	*Researchers*: along with work injury rehabilitation panel from China	*KTE Model*: followed the *Ottawa Model of Research Use (OMRU)* to incorporate WDP research evidence into an existing occupational rehabilitation system (national).	Evaluated: 1) models of service delivery explored 2) opportunities for WDP research uptake were identified, related to i) government ministry guidelines, and ii) new regulations for work injury insurance
Gillen 2010 (USA)	*Translated scientific evidence:* NIOSH-generated research findings	*OHS System*: industry leaders, safety and health professionals, opinion leaders, and innovators. (construction)	*Research organization*: (NIOSH)	*Initiative*: Research to Practice r2p - information products tailored to specific audiences, - use of communication science to inform transfer efforts - researchers involved in the dissemination efforts	*Proposed*: "intermediate outcomes" concept of transitional steps between research and end outcomes. Intermediate outcomes occur when research is used by other researchers or by external stakeholders. The evaluation framework supports consideration of contributions via well-accepted intermediate outcomes as indication of impact.

Castillo 2006 (USA)	*Translated scientific evidence:* from basic and applied research from NIOSH. Plus evidence-based products	*OHS System*: various workplaces, policy makers, labour, regulators (any)	*Research organization* (NIOSH)	*Initiative*: Research to Practice (r2p) - partnerships (relationships and intermediary organizations) - web-based document distribution - guidelines - safety products - stakeholder collaborations in programs - training - story telling	*Proposed*: observing and measuring linkages between: a) NIOSH research and preventive information and products b) Preventive info/products and changes in workplace behaviours/practices c) changes in workplace behaviours/practices and changes in worker injuries d) prevention information and market penetration
Reardon 2006 – (Canada)	*Translated scientific evidence and scientific findings*: Three types of messages are described: Type 1: Credible facts and data. Type 2: Study findings and conclusions (supporting possible action) Type 3: Body of evidence (providing advice or directing action)	*OHS System*: decision-makers for OHS evidence. Target specific audiences who could use the research-based information. (any sector)	*Research organization*: Any research organization	*Exchange Model:* Encompassing multiple evidence-based KTE approaches from a systematic review were described: Academic detailing/Education outreach; Interactive education sessions; Reminder Messages; Interventions tailored to overcome identified barriers; Audit & Feedback; Opinion Leaders; Patient-Mediated Intervention There is an emphasis on active engagement, relationship building, packaging the message in a manner that makes it easy to apply in day-to-day practice.	*Proposed*: knowledge use - indirect, direct, and tactical
Kramer 2005 [+ Kramer 2010] (Canada)	*Translated scientific evidence*: booklet summarizing key research on participatory ergonomics (PE).	*OHS System*: OHS consultants and ergonomists from Health and Safety Associations from across Ontario. (multiple sectors)	*Knowledge broker*	*Knowledge broker and researcher:* transferred knowledge about the PE booklet directly to ergonomists and consultants through a series of meetings.	*Evaluated*: knowledge utilization (conceptual, political and instrumental use of research) was described.

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Roy 2003 (including Parent and Beliveau 2003) (Canada)	*Scientific evidence*: Research findings about workplace health and safety	*OHS System*: Atlantic Canadian researchers, community partners and workplaces. (any sector, though a focus was on rural and remote communities)	*Research organization*: IRSST researchers as part of the network. There is an explicit suggestion that knowledge users would participate at every phase of the KT process.	*Consortium (network) approach*: Consortium on Workplace Health and Safety a proposed knowledge network between provinces. Using virtual teaming and collaboration tools, they propose to involve both producers and users of new knowledge at every level of workplace health and safety research.	*Proposed*: "changes in knowledge or changes in performance of both producers and users of that knowledge."
Schulte 2003 (USA)	*OSH information* broadly - but notes that "scientific literature has served as the main venue to disseminate OSH research findings and surveillance data".	*OHS System (US)*: Including: health professionals, workers, OSH personnel, consultants, health and safety groups, employers, unions, trade and professional associations, coalitions, public health authorities, insurers, media and the public. (any sector)	*Research organization*: Though not explicitly stated.	*Multiple KTE approaches*: A variety of methods are listed: Education and training receive most attention. But also note targeted campaigns, social marketing, communities of practice (networking), research transfer. And possibly technology transfer, as well as risk and health communication Should also disseminate via product suppliers and trade associations	*Proposed*: access and knowledge use. Ultimately improved health and safety of workers. "the ultimate goal of research and dissemination is to continuously improve and promote the safety, health, and well-being of workers."
Schulte 2002 (USA)	*OSH information* including: scientific research, journal articles, standards, policies, published OSH documents	*Global OHS System*: multiple international recipients (any sector)	*Researchers and research organizations*: multiple parties but the focus appears to be on researchers and research organizations worldwide	*Multiple KTE approaches*: An inclusive list of existing methods were listed including: databases, research directories, web-based sharing (WHO, ILO etc), collaboration internationally (eg task forces), conferences, bilateral agreements, professional societies, unions, training, global portal	*Proposed*: improved access to knowledge, research use in OHS, improved research capacity (knowledge creation)

Mayhew 1997 (Australia)	*Translated scientific evidence*: OHS Information products and standards coming from Government agencies, professional associations and trade unions.	*OSH System*: small businesses in Australia: three type of users 1. professionals 2. OHS practitioners 3. workers (non-OHS) (any – small business)	*Government agencies and researchers* through intermediaries	*Multiple KTE approaches*: Five primary methods: 1) trade unions and employer associations 2) professional associations 3) seminars and conferences 4) printed brochures and other literature 5) face to face communication	*Proposed*: focus on reach and utilization
Hudson 2013 + Schill 2013 (USA)	*Translated scientific evidence*: Content included NIOSH TWH web page—a quarterly electronic newsletter called TWH in Action!—and case studies that illustrate employer approaches toward integrating health protection and health promotion called Promising Practices for TWH.	*OHS System and public*: a broader stakeholder base, beyond the traditional audience of occupational safety and health professionals (any sector)	*Research organization* NIOSH	*Social media*: Create social networks to share and exchange content, to create dialogue, and to foster partnerships with health protection and health promotion professionals interested in TWH. As a result, the Program created two social networks: @NIOSH_TWH on Twitter and the NIOSH TWH LinkedIn Group. The Program also aimed to further create interest and attract new audiences by working to include their content on other NIOSH channels (ie, NIOSH Science Blog) and third-party channels (ie, radio podcasts, Medscape, and Wikipedia)	*Evaluated*: The metrics include breadth and direct engagement. Breadth includes two components: community size (ie, followers, subscribers, and unique visitors to a web page) and community growth (eg, change in the community size). Engagement volume (ie, likes, mentions, retweets, e-mails, and Google alerts). In addition, a Google search was collected and compared at two points—June 2011 and May 2013—to estimate the on-line presence of TWH.
Sublet 2011 (USA)	*Scientific knowledge*: Blog postings written by NIOSH researchers. The topics change with each new researcher's expertise and projects.	*OSH System + Public*: Current audience included Safety and health professionals, Health care professionals, government, consultants, workers, academic, managers, industrial hygienist (any)	*Researchers* (NIOSH)	*Blog postings*. Short summary of completed research projects, publications, or topics at NIOSH providing readers an opportunity to comment and engage the researcher in a discussion. NIOSH researchers are now using it as a mechanism for seeking input and comments on current and future research.	*Evaluated*: value or usefulness. The Science Blog is viewed by respondents as a useful social media resource. Responses from survey participants (at least 69.4%) indicated that the Blog was a useful or very useful resource of information. Also 60% answered that they would definitely be using the NIOSH Science Blog in 6 months.

Schneider 2010	*Translated scientific evidence*: construction safety information (including research)	*The public + OHS systems* (construction)	*Researchers, research organizations, government agencies*: Health researchers and research organizations, government agencies, construction safety research and advocacy organizations	*Media approach*: Engaging the media (traditional, internet, and social media) effectively by: - assisting journalists to generate more extensive coverage of construction health and safety - optimize diffusion of health and safety practice through the media - expanding the dissemination and networking on construction health and safety through social media.	*Proposed*: to raise awareness and ultimately improve health and safety in construction

2.4.1 "WHAT" WAS TRANSFERRED?

There are a number of work and health KTE approaches that endeavoured to transfer research evidence (the focus of this review) to workplace audiences. Some KTE approaches transferred research evidence from single studies (often in the field or as part of participation in research studies e.g. Baines 2007; Roy et al., 2003; Sinden et al., 2014). There were also approaches that described transferring scientific evidence/knowledge from multiple studies (from research groups or organizations e.g. Kramer et al., 2003; Castillo et al., 2006; Sinclair et al., 2013), or via evidence-based innovations (e.g. Carlan et al., 2012; Chapman et al., 2011).

2.4.2 "TO WHOM" WAS THE RESEARCH KNOWLEDGE TRANSFERRED?

Across the work and health KTE approaches there were three broad categories of target audiences that included workplaces. Many approaches targeted workplace audiences directly - see Table 2-1 rows 1-10 (Sinden et al., 2013; Kramer et al., 2013; Carlan et al., 2012; Lortie et al., 2012; Chapman et al., 2011; Guzman et al., 2008; Baines et al., 2007; Lehtinen et al., 2006; Kramer et al., 2004; Elkind et al., 2002). Workplace audiences included workers and managers as well as health and safety personnel. Others targeted broader OHS system audiences that included workplaces, consultants, practitioners, and OHS policy makers - see Table 2-1 rows 11-20 (Sinclair et al., 2013; Costa-Black et al., 2011; Gillen et al., 2010; Castillo et al., 2006; Reardon et al., 2006; Kramer et al., 2005; Roy et al., 2003; Schulte et al., 2003; Schulte 2002; Mayhew 1997). Some of the approaches that targeted OHS system audiences focussed system wide (e.g. Gillen 2010; Castillo 2006; Schulte et al., 2003) while some focussed specifically on consultants (or other practitioners) (Kramer 2005; Mayhew 1997). There were a few approaches that described attempts to reach OHS systems as well as the public - see Table 2-1 rows 21-23 (Hudson et al., 2013; Sublet et al., 2011; Schneider et al., 2010).

2.4.3 "BY WHOM" WAS THE RESEARCH KNOWLEDGE TRANSFERRED?

Research knowledge was transferred by a number of different parties. Many approaches described researchers making direct contact with target audiences (Sinden et al., 2013; Baines et al., 2007; Carlan et al., 2012; Chapman et al., 2011; Elkind et al., 2002; Cost-Black et al., 2011; Schulte 2002; Mayhew 1997; Sublet et al., 2011). There were also approaches involving entire research organizations in transferring knowledge (research organizations might incorporate researchers plus other staff such as communications, KTE, and/or other technical staff) (Lehtinen et al., 2006; Sinclair et al., 2013; Gillen et al., 2010; Castillo et al., 2006; Reardon et al., 2006; Roy et al., 2003; Schulte et al., 2003; Hudson et al., 2013; Schneider et al., 2010). Some explicitly noted that knowledge brokers were involved in transferring the knowledge (Sinclair et al., 2013; Kramer et al., 2013; Kramer et al., 2004; Kramer et al., 2005). Knowledge brokering is about bringing people together, building relationships and sharing ideas and evidence that help stakeholders do their jobs better. Knowledge brokers facilitate the movement of knowledge from one place or group of people to another (Canadian Health Services Research Foundation, 2003). There were also some that described involving practitioners or workplace parties in transferring the evidence (Sinden et al., 2013; Roy et al., 2003; Elkind et al., 2002).

2.4.4 "HOW" WAS RESEARCH KNOWLEDGE TRANSFERRED?

Work and health research knowledge was transferred to target audiences using a great variety of methods. Most often KTE approaches consisted of multiple methods or steps of transfer and exchange. Overall there was an emphasis on using active methods including networking and relationship building, face to face meetings, participation in research projects, opinion leaders and training/education (see Table 2-1). When passive methods (such as website posting, printed

materials (reports, newsletters, pamphlets etc), guides or guidelines) were used they were often combined with other active methods (see Table 2-1). A few reports described the use of blogs and social media (Hudson et al., 2013; Sublet et al., 2011; Schneider et al., 2010) to reach broader audiences.

A common element of many approaches included face-to-face meetings involving the target audiences of knowledge users. This type of direct contact occurred because audience members were involved in research studies (e.g. Sinden et al., 2013; Carlan et al., 2012; Kramer et al., 2013; Kramer et al., 2004; Baines 2007) or meetings were specifically noted as part of the KTE approach (Chapman et al., 2011; Kramer et al., 2005; Roy et al., 2003; Mayhew 1997; Castillo 2006). The KTE approaches were tailored to the audience and context making each approach unique. While approaches were tailored and unique they were often guided by a (new or existing) conceptual framework or model. The dissemination of printed materials was also a common method of many of the KTE approaches. Knowledge brokers or transfer agents and networking were often mentioned elements and many approaches considered relationship building as key to the approach.

2.4.5 "WHAT EFFECT(S)" DID THE TRANSFERRED RESEARCH KNOWLEDGE HAVE?

All but one of the 23 approaches evaluated (or proposed the evaluation of) some aspect of KTE impact. The description of impacts evaluated (or proposed) varied considerably across the reports. The variability in impacts or outcomes is understandable given the diversity in KTE approaches and target audiences. For example it is reasonable to expect that important outcomes for policy makers are different from those of workers or practitioners. The most common outcomes noted were related to implementation (such as usefulness, behaviour change,

program/intervention implementation, adoption of innovation, utility of innovation, instrumental knowledge use).

Many KTE approaches included multiple dissemination outcomes such as reach, engagement, awareness, attitudes, uptake, access to knowledge, knowledge use (conceptual). The objective of the KTE approach, the conceptual foundation, the target audience, and the context dictated the types of outcomes sought and reported.

2.5 OVERVIEW OF KTE APPROACHES FOR WORK AND HEALTH

Viewed through the lens of the Lavis (2003) framework, the KTE approaches in the work and health research were quite diverse. The diversity of approaches reflects the variety of elements (audiences, messages, and desired impacts) of decision making related to work and health. However there are commonalities that are important to acknowledge. For example among approaches targeting workplace-based audiences most considered workers as a key audience while often including various additional workplace audiences that could also convey messages to workers (managers/supervisors, union reps, and consultants). The emphasis on reaching workers reflects the importance of individual or end-user decision-making in health and safety (Baker et al., 2015; Reardon et al., 2006). Targeting additional audiences acknowledges the complexity of workplaces with respect to organization, authority and autonomy (Schulte et al., 2003; Rhebergen et al., 2012).

Another common aspect of the work and health KTE approaches described in the literature was that researchers were often involved in the dissemination of the evidence. While researchers were often involved their dissemination role varied, at times researchers seemed to be the sole

transfer agent (Baines 2007; Sublet 2011), but most often they were one of a number of individuals involved. Researchers were part of the dissemination process to add credibility to the message. The concept of getting the message directly "from the horse's mouth" was often noted. Having the researcher involved in KTE is suggested to enhance the credibility of the message (Lavis et al., 2003; Graham et al., 2012; Lavis et al., 2002; Keown et al., 2008). Many approaches used some manner of intermediary to transfer the research knowledge to the target audience(s). The intermediaries could have formal roles in transfer (often called knowledge brokers) or may include individuals with more informal roles (i.e. where their primary role was not KTE) such as workplace parties (managers), consultant practitioners, and research organization personnel. Therefore while researchers have a KTE role they were most often supported in that role.

While there was great variation in how knowledge was transferred, there were also commonalities to note. Approaches most often included face-to-face meetings or other forms of direct interaction. The preponderance of meetings reflects the importance of building relationships which was also often noted (Bornbaum et al., 2015; Huberman 1989; Cousins and Leithwood 1993; Landry et al., 2001). Printed materials were also included as one part of most approaches described, though none used this as the sole dissemination activity. Another common element of the work and health KTE approaches is that they all used multiple dissemination activities. Reviews have shown that multiple dissemination activities are superior to single activities (Grimshaw et al., 2004; Grol and Jones 2000). The effects of the KTE approaches also varied however when they were reported tended to focus on knowledge use and practice change. Table 2-2 summarizes the common elements of KTE approaches extracted from the work and health KTE literature.

Table 2-2: Common elements of KTE approaches for work and health according to the Lavis (2003) organizing framework.

Lavis questions (2003)	Common elements from the literature
What	Scientific evidence, research findings (in lay language and translated ready for use)
To Whom	Workers and others who can disseminate to workers (managers/supervisors, union reps, OHS practitioners/consultants)
By Whom	Researchers as part of a team with intermediaries (knowledge brokers, workplace personnel, consultants/practitioners, KTE/communications staff)
How	Multiple methods which include direct interaction/communication with audience members as well as printed/posted materials (lay language), ongoing relationship building.
With What Effect	Knowledge uptake, knowledge use and if applicable practice change

2.6 CONCEPTUAL FOUNDATIONS OF KTE APPROACHES FOR WORK AND HEALTH

Estabrooks and colleagues (2006) noted that there was no one predominant theoretical or

conceptual framework for KTE in healthcare, organizational innovation, and social sciences

literatures. The same is true of the work and health literature. Nineteen of 23 KTE approach

descriptions provided some information about the conceptual basis for their approaches (see

Table 2-3). However there were over 20 different conceptual models or frameworks noted (Table

2-3). Many of the KTE approaches are based on more than one conceptual framework while very

few drew on the same frameworks or theories. For example, the concept of networking was

explicitly mentioned in four reports (Kramer et al., 2005, Kramer et al., 2003, Lehtinen et al.,

2006, Roy et al., 2003) however each study approached the concept from different literature

sources. It is important to note that networking may have been important in some of the other

reports as well. Diffusion of innovation (Rogers 1995, 2003, 2005) was also mentioned in four

reports (Chapman et al., 2011, Sinclair et al., 2013, Kramer et al., 2003, Gillen 2010).

The variety of conceptual underpinnings reported likely reflects the diversity of the approaches employed and the different contexts reported. However the fact is that a majority of reports stated the conceptual foundation of their approach is positive (Colquhoun et al., 2014; Tabak et al. 2012; Brownson et al. 2013). Many reports proposed new frameworks and models that were used to guide the KTE approaches. New frameworks may be developed and introduced because of the particular circumstances related to implementing prevention programs and interventions in workplaces (Zardo et al., 2014; Manzoli et al., 2014; Dragano et al., 2015; Tucek 2013). Theory is useful to guide the development of KTE approaches as well as provide a means for evaluating impact (Tabak et al. 2012; Brownson et al. 2013; Estabrooks et al., 2006; Graham et al., 2006). While a single overarching theory may make it easier to compare KTE approaches for work and health, contexts with varying numbers and disciplines of actors working with complex factors may require a number of theories (Estabrooks et al., 2006).

Table 2-3: Conceptual foundations of KTE approaches for work and health. (Presented in the same order as Table 2-1).

AUTHOR YEAR (country)	Conceptual foundations
Sinden 2013 (Canada)	Knowledge-to-action (KTA) framework (Graham et al., 2007; Graham et al., 2006).
Kramer 2013 (Canada)	The foundation for the proposed KTE evaluation method is based on three theoretical models: (a) the promoting action on research implementation of health services (PARiHS) model (Rycroft-Malone 2007, Rycroft-Malone et al., 2010); (b) the transtheoretical model (TTM) (Prochaska et al., 1983); and (c) knowledge utilization Huberman and Cox 1990, Huberman and Ben-Peretz 1994, Weiss 1999).
Carlan 2012 (Canada)	The Promoting Action on Research Implementation in Health Services (PARIHS) knowledge translation conceptual framework established by Kitson and colleagues (Kitson et al., 1998, Kitson et al., 2008, Rycroft-Malone 2002).
Lortie 2012 [Lortie 2011 Lortie 2014] (Canada)	The starting point for the KTE approach described is evidence-based practice, specifically guidelines (Grol 1997, Cabana et al., 1999) and knowledge management (organizational perspective) (Grant 2012, Boerner et al., 2001, Morrison and Mezentseff 1997). The authors develop a model combining knowledge management and transfer (2014) which incorporates the concept of opinion leaders (Hayward et al., 1997, Ulvenes et al., 2009).
Chapman 2011 plus… (USA)	Diffusion of innovation (Rogers 2003 [and previous editions])
Guzman 2008 (Canada)	The proposed approach is based on systems theory (Langley, Nolan and Nolan 1992), knowledge transfer theory related to 'active' approaches (Torjman et al., 2001, Levin and Greenwood 2001, Lomas 2000), and action research (CDC 2003, Reason 1994, Waterman et al., 2000). Combining these theories the authors propose a "blueprint for action" called MAPAC which stands for Mobilize, Assess, Plan, Act, and Check.
Baines 2007 (Canada)	The KTE approach was grounded in action research (Reason and Bradbury 2001, Levin and Greenwood 2001).

Lehtinen 2006 (Finland)	Authors describe a networking model used for virtual workshops. This model and the KTE approaches described appear to be "evidence-based practice".
Kramer 2003, 2004 [+ Kramer 2010] (Canada)	The authors proposed a conceptual model that describes the source and the knowledge transferred as well as the workplace context, describes how the KTE occurs and describes the knowledge utilization (KU). The theoretical basis of the conceptual framework presented in this article incorporates aspects of evidence-based practice (Walshe and Rundall 2001), diffusion of innovation (Rogers 1995) and knowledge utilization (Cousins and Leithwood 1993, Huberman 1994, Weiss 1979), as well as being informed by social networking (Landry et al., 2001) and two communities theory (Caplan 1979).
Elkind 2002 (USA)	Observational learning theory (Bandura 1986) was noted as the basis of the KTE approach.
Sinclair 2013 (USA)	"Extended model for small business OSH intervention research" proposed by authors. The model is based upon previous intervention research (Hasle and Limborg 2006) and programme theory (Olsen 2012) models. The current adaptation also considers social exchange theory (Miller 2005) and diffusion of innovation (Rogers 2005).
Costa-Black 2011 (China)	Ottawa Model of Research Use (Graham and Logan 2004)
Gillen 2010 (USA)	Reference "diffusion of innovation" (Rogers, 1995) and "stages of change" model (Prochaska and DiClemente 1982) as informing their approach.
Castillo 2006 (USA)	Authors reference various theories as informing their approach: communications theory (Shannon and Weaver (1947), and also touching on adult learning theory, theory of change, and cultural influence (Knowles et al., 1998, Bandura 1997, Zemke 2002, Patton 2002, Geertz 1983, Salzman 2001, Hofstede 1997).
Reardon 2006 – (Canada)	"Exchange model of knowledge transfer". Organizing framework for a knowledge transfer strategy containing five elements: What, To Whom, By Whom, How, With what effect (Lavis 2003).

Kramer 2005 [+ Kramer 2010] (Canada)	A conceptual framework "building interorganizational networks" was proposed by the authors. The framework was based on social interaction KT theory (Huberman 1990, Landry et al., 2001, Oh 1997), network theory (Barabasi 2002, Granovetter 1973, Krackhardt 1992, Lutz 1997, Argyris and Schon 1978, Krebs 1999–2003) and knowledge utilization (Huberman 1989, 1994, Landry 1999, Weiss 1979). This framework focuses on building networks to facilitate KT. The framework describes steps of establishing goodwill, achieving reciprocity, knowledge utilization and long-term alliances in a fairly linear way.
Roy 2003 (including Parent and Beliveau 2003) (Canada)	"Knowledge networking" approach to developing knowledge on workplace health and safety. Proposed by the authors to replace traditional linear approaches to KTE. The proposed model is based primarily on knowledge management (Seufert et al., 1999) and organizational learning (eg. Argote 1999, Hargadon 1998, Hutchison and Huberman 1993).
Schulte 2003 (USA)	"Production, Dissemination, Utilization of Information framework". The framework is proposed by the authors for OHS dissemination and use based on the work of Shannon and Weaver 1949, Robert 1983, Takala 1993, Lagerlof 2000). The framework allows for various stages to be done in parallel or iteratively.
Schulte 2002 (USA)	No KTE theory, model or framework described or referenced
Mayhew 1997 (Australia)	No KTE theory, model or framework described or referenced
Hudson 2013 + Schill 2013 (USA)	No KTE theory, model or framework described or referenced
Sublet 2011 (USA)	Social exchange theory (Homans 1958) noted as a theoretical basis for blogs. The link to KTE is the idea that social behaviour is a result of an exchange process.
Schneider 2010 (USA)	No KTE theory, model or framework described or referenced

2.7 BEYOND THE TRANSFER OF RESEARCH EVIDENCE TO WORKPLACES

I chose to focus on KTE approaches that disseminated research evidence to workplaces (or OHS systems which include workplaces). However there is a literature describing a broad range of KTE activities and information sharing that could have positive impacts on work-related injuries and diseases.

2.7.1 CLINICAL

There were KTE approaches for clinicians involved in treating workers with injuries and illnesses (e.g. Gross et al., 2009; Hugenholtz et al., 2009, 2008; Lyons et al., 2014; Rebergen et al., 2009; Schaafsma et al., 2007). These approaches focused on clinicians (for example: occupational physicians, physiotherapist, and occupational therapists) as the target audience. The knowledge transfer was based on syntheses of research often in the form of practice guidelines. The KTE approach was based using education and training often by opinion leaders and researchers. The impact of the KTE approach was most often related to practice change leading to improve patient outcomes. The primary conceptual foundation for these types of KTE approaches was evidence-based medicine. There are a number of articles in the peer-reviewed literature supporting the idea that occupational medicine should be evidence-based (e.g. van Dijk 2010; Schaafsma et al., 2005; Verbeek 2002; Franco 2005, 2003, 2001; Vineis 2000; Larson 2002).

2.7.2 INFORMATION SHARING/SEEKING

There are a number of articles describing information sharing approaches related to work and health (Chinien and Cheyne, 2006; Creely et al., 2003; Sinclair et al., 2007; Morken et al., 2009; Broberg 2007; Selby and Moran, 2004; Shaw et al., 2010; Vecchio-Sadus and Griffiths, 2004; Rhebergen et al., 2011; Rhebergen et al., 2012a; Rhebergen 2012b; Porter 2004). I refer to these approaches as information sharing only because there is no explicit mention that the information

shared included research evidence as per the definition of KTE used here. I will summarize the information sharing approaches here comparing them to the KTE approaches described above.

The information sharing approaches appear to be very similar to the KTE approaches differing in the knowledge transferred by definition. The information transferred was more often described as expert opinion and also often included regulations which were not described in the KTE approaches. The target audience (to whom) for the information sharing approaches are essentially the same as those described in the KTE approaches. Those transferring knowledge (by whom) are often described as experts and include government agencies and professional associations. There are far fewer researchers described as transferring the knowledge. The information sharing approaches tend to focus on using printed materials or electronic communication (websites and email). However there are a number of information approaches that describe employing intermediaries (and knowledge brokers) which is similar to KTE. The effects or impact of the information sharing approaches are also quite similar to those of the KTE approaches. The outcomes mentioned were diverse and were based on the different target audiences, approaches and context. There appears to be more emphasis on awareness as an outcome for the information sharing as compared to KTE approaches.

The information sharing approaches are complemented by some more recent articles that describe workers seeking OHS information (e.g. Dragano et al., 2015; Rhebergen et al., 2012). Surveys of workers show that they do look for health and safety information. Workers reported searching the internet, consulting with people in their networks, consulting OHS experts, as well as health experts (Rhebergen et al., 2012). However not all workers felt well informed about occupational health and safety (Dragno et al., 2015).

2.8 CONCLUSION

A narrative review of the literature shows there are a variety of KTE approaches to transfer work and health research knowledge to workplaces. The KTE approaches address various target audiences and workplace contexts related to health and safety. A majority of the articles reporting on KTE for workplaces provide information about the conceptual foundations of the approaches employed. Indeed, many approaches were based on newly developed conceptual framework drawing on and adapting existing KTE frameworks and models.

It appears the state of KTE targeting workplaces is well positioned to continue to transfer research knowledge to workplace parties with the aim of reducing occupational injury and illness. However there are a number of challenges that must be taken into account for successful KTE activities. *First* is the growth of work and health research production globally with rapid increases in the volume of work and health literature (Ferris et al., 2015; Li et al., 2015; Sweileh et al., 2014; Rollin et al., 2009). The sheer volume of research makes it challenging to transfer the relevant findings or evidence to the audiences that can best use them to inform practice or policy. Furthermore there is the question of whether all research should be transferred and if not how to best choose what gets transferred and what does not. Evidence synthesis approaches such as systematic reviews can help to reduce the burden of finding and transferring individual studies (Irvin et al., 2010). However with an ever increasing volume of literature there are major challenges in conducting and updating these syntheses.

A *second* challenge, related to the volume of information, is how to best transfer the knowledge to target audiences. Many of the KTE approaches used networking, relationship building and face-to-face meetings however some recent approaches were moving towards web-based

dissemination using blogs (Sublet et al., 2011), social media (Hudson and Hall, 2013; Schill and Chosewood, 2012), and portals (Hugenholtz et al., 2008; Rhebergen et al., 2010, 2011).

Thirdly there remains a challenge of how to best evaluate the KTE approaches. There were many different outcomes and endpoints described in the various KTE approaches. With the variety of KTE approaches, target audiences and workplace contexts it is necessary to select the appropriate outcomes. However it is challenging to compare the various approaches when there are different outcomes used. Improved evaluation can only help improve the effectiveness of the KTE approaches related to the health and safety of workers.

KTE in work and health is a work in progress which must keep up with increasing research, increasing access to information, and highly dynamic and ever changing work environments.

CHAPTER 3: DISSEMINATION AND USE OF A PARTICIPATORY ERGONOMICS GUIDE FOR WORKPLACES

3.1 OVERVIEW

Musculoskeletal disorders (MSDs) result in lost-time injury claims and lost productivity worldwide, placing a substantial burden on workers and workplaces. Participatory ergonomics (PE) is a popular approach to reducing MSDs; however, there are challenges to implementing PE programs. Using evidence to overcome challenges may be helpful but the impacts of doing so are unknown. We sought to disseminate an evidence-based PE tool and to describe its use. An easy to use, evidence-based PE guide was disseminated to workplace parties, who were surveyed about using the tool. The greatest barrier to using the tool was a lack of time. Reported tool use included for training purposes, sharing, and integrating the tool into existing programs. New actions related to tool use included training, defining team responsibilities and suggesting program implementation steps. Evidence-based tools could help ergonomists overcome some challenges involved in implementing injury reduction programs such as PE.

3.1.1 PRACTITIONER SUMMARY:

Practitioners experience challenges implementing programs to reduce the burden of MSDs in workplaces. Implementing participatory interventions requires multiple workplace parties to be 'on-board'. Disseminating and using evidence-based guides may help to overcome these challenges. Using evidence-based tools may help ergonomics practitioners implement PE programs.

3.2 INTRODUCTION

Musculoskeletal disorders (MSDs) are a leading cause of lost-time injury claims and lost productivity in many workplaces worldwide (Schneider and Irastorza, 2010; Silverstein and Evanoff, 2011). Overall, work-related MSDs account for approximately 39% of occupational diseases in Europe (Schneider and Irastorza, 2010) and 29% of all US workplace injuries (Silverstein and Evanoff, 2011). In Canada, MSDs contribute to between 40 to 67% of lost-time claims (WSIB 2013; SafeWork Manitoba 2013; WCB Nova Scotia 2013; WorkSafeBC 2013). MSDs place a substantial burden on the health of workers and, in turn, on healthcare and compensation systems.

MSDs can be reduced via ergonomics initiatives. One approach to ergonomics interventions is to engage workers in the process of identifying hazards and determining solutions – called participatory ergonomics (PE) (Kuorinka, 1997; Wilson and Haines, 1997). There is evidence from the scientific literature that PE interventions are effective in reducing MSDs outcomes (Rivilis et al., 2008; Hignett et al., 2005). Participatory change processes increase the acceptance and uptake of the changes implemented (Wilson and Haines, 1997). However, there are challenges to initiating and implementing a PE program or intervention (Van Eerd et al., 2010; Driessen et al., 2010).

In a comprehensive literature review, Van Eerd and colleagues (2010) examined the process and implementation of PE. The review identified five key elements for effective PE implementation: 1) defining team members and their roles, 2) involving additional key actors beyond the team, 3) using group consultation for decisions, 4) providing adequate training, and 5) addressing barriers to implementation. An evidence-based, easy to use tool, the *PE Guide*,

(http://www.iwh.on.ca/pe-guide) was designed using evidence from the review to support initiating and implementing a PE program.

Busy ergonomists encounter a number of challenges incorporating research evidence into practice (Buckle 2011; Caple 2010; Whysall, Haslam and Haslam 2004). The *PE Guide* is an attempt to bridge a research-practice gap in ergonomics (Chung and Shorrock 2011; Chung, Williamson, and Shorrock 2014) by incorporating the available evidence into an easy to use guide for the workplace. Recent reports advocate the development of guidelines by ergonomists (Straker et al., 2014; Tran and Subrahmanyama 2013). However, there is little research about how best to disseminate research evidence to workplace-based occupational health and safety (OHS) practitioners. Kramer and colleagues have explored dissemination using various knowledge transfer and exchange (KTE) approaches in occupational contexts (Kramer and Cole 2003; Kramer, Cole and Leithwood 2004; Kramer and Wells 2005). Findings from the individual case studies suggest that intensive engagement approaches can lead to uptake and use of tailored messages. Kramer et al. (2009) found opinion leaders were important in passing on knowledge about innovative practices but workplace parties also participated in knowledge transfer. Recent research has shown that workplace-based audiences with a variety of jobs from different sectors do search for OHS information (Rhebergen et al., 2011; Hudson and Hall, 2013) with the intent to share the information and initiate changes.

Lavis et al. (2003) describe a framework for knowledge transfer for research organizations, which can be used to evaluate knowledge transfer among workplace-based audiences.

The framework is based on an assessment of the literature on knowledge transfer. It provides a practical approach to designing knowledge transfer activities and also provides opportunities to

evaluate specific elements and the overall approach. The framework has been used to develop a KTE training workshop and guideline related to OHS (Reardon, Lavis, and Gibson 2006). More recently Grimshaw et al. (2012) have used this framework to summarize current concepts and evidence for effective knowledge translation in clinical and health research settings.

3.2.1 OBJECTIVES

Our overall objective was to evaluate a knowledge transfer approach of disseminating an evidence-based guide and its use. Our specific study objectives were: 1) to disseminate and document the uptake of the *PE Guide*; 2) to describe the audience; and 3) to examine the use of the *PE Guide* for initiation of PE programs in workplaces.

3.3 METHODS

3.3.1 DISSEMINATION

Our target audience was workplace-based OHS stakeholders in British Columbia (BC), Canada. We started with a previously established stakeholder network (n=24) (Van Eerd et al., 2010). An advisory group comprised of ergonomics consultants, knowledge transfer personnel, and industrial relations personnel from BC helped to identify an additional 51 OHS stakeholders. These two groups created our convenience sample of 75 stakeholders. In addition, the Western Chapter of the Association of Canadian Ergonomists, the BC Association of Kinesiologists, BC Human Resources Management Association, BC Municipal Safety Association, and the Canadian Society of Safety Engineering – BC Lower Mainland Chapter were contacted and asked to inform their membership about the PE Guide. Our audience also included visitors to the

WorkSafeBC website (main page) and recipients of industry specific e-newsletters from WorkSafeBC.

We disseminated the *PE Guide* via: email, website posting and e-newsletter. A link to a download site was sent by email to the convenience sample of 75 stakeholders from British Columbia. Each individual who received the download link via email was asked to forward the link for download to other persons they felt would be interested in the guide. In our requests to pass on the link for download, we emphasized the desire to reach workers. We posted the download link on the WorkSafeBC website and included it in industry specific e-newsletters distributed through regular communication channels of WorkSafeBC. The BC Municipal Safety Association also posted a link to the WorkSafeBC download page on their website.

3.3.2 DATA COLLECTION

We tracked the uptake and use of the *PE Guide* through an online survey. Survey participants were recruited through email (n=75), website, e-newsletters and word of mouth (n=unknown). The link to the online survey remained active for 15 months. When interested individuals downloaded the *PE Guide*, they could volunteer to participate in the survey study. The website contained a participation agreement form which, if completed, allowed us to contact these stakeholders to request completion of follow up surveys. Approval for this study was obtained from the Office of Research Ethics of the University of Waterloo, Canada.

Those who volunteered were invited to participate in online surveys at baseline and at one, three, six and nine months. The baseline survey was administered when the PE guide was downloaded, collecting demographics and intention/plans to implement PE programs. Participants were sent a reminder one week after each survey if they had not already completed the survey (Dillman 2009).

The follow-up surveys contained items about how the *PE Guide* was used, barriers to using the guide, the use of evidence-based tools, and new actions taking place after using the *PE Guide* (survey items are available from the corresponding author upon request). The KTE framework from Lavis et al. (2003) was used to guide the study. The framework is based on five key principles which are in the form of questions:

1) What (is the message)?

2) To whom (audience)?

3) By whom (messenger)?

4) How (transfer method)?

5) With what expected impact (evaluation)?

When developing the online survey we adapted questions 2 (To whom) and 5 (With what impact) into a series of short questions that allowed participants to provide answers with a minimum amount of effort and time.

Questions 1, 3, and 4 of the framework were held constant throughout the study. The message (Q1- What): evidence-based information about initiating a PE intervention from a systematic review (Van Eerd et al. 2010) in the form of an easy-to-use guide was common for the entire study. The messengers (Q3 – By Whom): the Institute for Work & Health (IWH) a not-for-profit research organization with a focus on worker health (http://iwh.on.ca). WorkSafeBC was a partner in the dissemination, both as a funding agent and providing use of their website and newsletter to include links to the guide. The transfer methods (Q4 - How) included: email directly to a group of stakeholders, posting a link to the download site on the WorkSafeBC

website and in WorkSafeBC e-newsletters. In our email communications with stakeholders we encouraged a broad dissemination of the download link. Our request was to share the guide via the link so that we could monitor downloads but we expected that some electronic and print copies of the guide would also be shared.

3.3.3 *ANALYSIS*
A descriptive approach was taken to explore audience demographics, uptake (number of downloads), and *PE guide* use. The analysis considers the surveys as a series of cross-sectional panels because subjects could enter the study at any time over the 15 month data collection period. Therefore subjects may not have been able to contribute data to all surveys. We explored change over time with respect to guide use, awareness, and new actions in the subset of respondents (n=34) that completed all surveys. These analyses did not show change over time in this small subset and therefore are not reported here.

Questions 2 and 5 of the KTE framework from Lavis et al. (2003) were used to guide the descriptive analysis. The audience (Q2 – To Whom): workplace-based OHS stakeholders. The dissemination and sampling method targeting those involved in workplace OHS. Additional information about the audience was obtained from the survey. Categories for sector were created, combining variations in responses when they clearly described a single sector. We categorized the job titles into five groups (manager/Human Resources, worker/student, consultant/trainer, health/safety, other) to protect anonymity.

With what expected impact (Q5 - Impact): how the *PE Guide* was used, collected from the survey. We, a priori, defined use as employing concepts from the guide in training, sharing it, reading to keep up to date, initiating PE, integrating guide elements into existing PE programs, or integrating guide elements into existing OHS programs. We also asked respondents to report on

any other use of the guide. For the question about why the guide was not used, there were five response categories (1. have not had the opportunity, 2. did not find the guide useful, 3. have not had time, 4. not interested in PE, and 5. other) plus the opportunity to add comments. From the comments it appeared that the respondents did not differentiate between 'time' and 'opportunity', often using the terms together or as synonyms so we collapsed them together under the label time which was the predominant issue. Descriptions of guide use are presented according to the percentage of respondents for each item. Responses to open ended questions were read to see if they fit within existing categories (response options in the existing questionnaire) or if they represented new concepts.

3.4 RESULTS

3.4.1 UPTAKE
During the 15 month study period (January 13, 2011 to April 15, 2012), 916 individuals visited the download site of the *PE Guide*, and 763 (83%) downloaded the *PE Guide*.

3.4.2 SURVEY PARTICIPATION RATES

3.4.2.1 Baseline survey
542 (71% of those downloading guide) consented to participate. Of those who consented, we have data for 529 (98%). The missing data at baseline (13/542) were primarily due to duplicate downloads (same individual at different times) which we identified and removed from analysis.

3.4.2.2 Follow-up surveys
At one month 208 (39% of 529 invited) responded to the survey. At three months 146 (28% of the 517 invited) responded to the survey. For the six-month survey, there were 112 (23% of the 493 invited) respondents and at nine months there were 95 (20% of the 470 invited) respondents.

The smaller number of possible respondents at each survey was due to study withdrawal (7

participants requested to leave the study) and the number of respondents who entered the study

with sufficient time to complete the subsequent follow-up surveys.

3.4.3 TO WHOM – AUDIENCE DEMOGRAPHICS

The *PE Guide* was downloaded by individuals from a variety of industrial sectors within British

Columbia (Table 3-1) with manufacturing (20%), healthcare (15%), and government (15%)

sectors well represented among survey participants. A wide variety of job titles were listed by

participants with only 10% of respondents not completing this item of the survey. Most of the

respondents indicated they had OHS duties. In addition, 57% reported that they were members of

a joint health and safety committee. Many respondents indicated there were plans to implement a

PE program (Table 3-1).

Table 3-1: Survey respondent demographics (n=529).

Demographic	Category	Percentage*
Sector	Manufacturing	20
	Healthcare	15
	Government	12
	Transportation	6
	Construction	6
	Others	41
Job title category	Health & Safety	47
	Manager / HR	16
	Worker/ student	15
	Consultant	9
Occupational Health and Safety role	Yes	84
	No	7
Plans to implement PE program	Yes	42
	Unsure	47
	No	3

*Totals may not add up to 100% due to missing responses for the individual items.

Those who downloaded the *PE Guide* most often found out about the guide from WorkSafeBC (44%), while 14% said they found the guide through an online search. Additionally, 4% responded they found the guide through supervisors or co-workers. Ten percent of respondents noted they received the link directly from IWH (this represents primarily the convenience sample from IWH and the advisory group). There were few differences across sectors regarding how they found out about the guide. Responses from manufacturing showed 46% found the guide from WorkSafeBC and 15% from an online search. In the government sector, 45% found the guide from WorkSafeBC and 12% from online searches. However, in healthcare a more even balance between WorkSafeBC (21%) and online search (27%) was reported. In all sectors WorkSafeBC and online searches were the largest proportions.

At one month, participants were asked (n=208) to let us know if they felt evidence-based tools/guides were helpful in their work. The majority of respondents (56%) said yes, while some (29%) said they did not know, and only four percent said no. We also asked how they would like to receive evidence-based tools/guides. Most respondents (78%) said they would like to receive guides/tools like the *PE Guide* electronically (via email or download). In addition, respondents also suggested they would like to receive guides/tools in print versions (27%), or via workshop or training presentations, both in person (28%) or via webinar (24%).

3.4.4 IMPACT - BARRIERS TO PE GUIDE USE

At one month, 126 respondents (61%) said they had not used the PE guide (Table 3-2). The main

reason given for not using the guide was lack of time. Nine percent felt the guide was not useful.

Other reasons given for not using the PE guide included: having a PE program already in place,

losing the guide due to computer or download difficulties, or lack of interest. However, about

one in five respondents noted they were planning to start a PE program.

The reasons given for not using the guide at three, six and nine months were predominantly due

to lack of time. Yet, at the six and nine month surveys a greater proportion of respondents

reported the PE guide was not useful (from below 10% at 1 and 3 months to 19% at 9 months).

At each survey a majority of respondents (50 to 60%) reported not using the PE guide. Open-

ended responses did not reveal additional reasons for non-use.

Table 3-2: Survey respondents reporting not using the guide and why not used*

	Survey time			
Survey item	**1 month**	**3 months**	**6 months**	**9 months**
Did not use guide	61% (127/208)	56% (82/146)	54% (61/112)	50% (48/95)
Why not used (%)				
- No opportunity	29	67	58	49
- No time	37	20	18	23
- Not helpful	9	7	15	19
- Other	17	5	7	6

*Totals may not add up to 100% due to missing responses for the individual items.

3.4.5 IMPACT - PE GUIDE USE

The proportion of respondents reporting they used the PE guide did not change greatly over time, from 37% at one month to 42% at each subsequent survey (Table 3-3). How the guide was used varied somewhat but most often it was shared with others. When the guide was shared it was most often given to colleagues, employees or employers. The proportion sharing the guide did not change over the study surveys.

The PE guide was also often used for training purposes and staying up to date. The proportion using the guide for training changed from a third of the respondents at one and three months to almost half at six and nine months. The numbers using it to stay up to date differed from over 50% at one month to almost 25% at nine months. The proportion reporting initiating a PE program remained relatively low, varying from 5 to 18%. Similarly the proportion integrating the guide information into an existing PE program varied between 8 and 20%. However the proportion who integrated the PE guide into an existing OHS program remained somewhat consistent from 22 to 28%.

Table 3-3: Survey respondents reporting guide use, how it was used and new actions taken.

Survey item	Survey time			
	1 month	3 months	6 months	9 months
Used guide	37% (77/208)	42% (61/146)	43% (48/112)	42% (40/95)
How used* (%)				
- Training	36	38	48	50
- Share with others^	64	64	52	58
- Keep up to date	52	36	44	28
- Initiate PE	16	8	20	8
- Integrate into PE	12	21	8	18
- Integrate into OHS	23	28	27	28
- other	14	5	10	5
^Shared with* (%)				
- colleague	86	90	80	35
- employee	41	44	28	30
- employer	31	31	48	20
- client	10	10	16	10
- union rep	18	15	20	13
- other	16	8	12	0
New actions* (%)				
- Teams	5	7	4	10
- Champion	9	18	13	15
- Training	36	48	31	50
- Involve people	21	31	19	28
- Responsibilities	12	30	21	13
- Making decisions	17	13	15	23
No new actions (%)	30	23	33	18

*adds up to greater than 100% as respondents could select multiple response items.

3.4.6 NEW ACTIONS

New actions reported by respondents varied over the study (Table 3-3). The new action taken as a result of using the guide most often was training (32 to 50%). Additional new actions most often reported at each survey concerned involving people in the PE process and defining responsibilities. New actions related to team creation, selecting a champion, and making decisions were less often reported, though making decisions did reach 23% at nine months (from

13% at three months). Overall those who reported taking no new actions often reported already being engaged in many of the elements of PE noted in the guide.

3.4.7 *AWARENESS OF PE ELEMENTS AND BARRIERS TO PE IMPLEMENTATION*

Among those reporting use of the guide, many reported an increased awareness of the six PE elements described in the guide. The number of respondents reporting increased awareness varied according to element and survey time. The element with the greatest numbers reporting increased awareness was training (34% to 59% depending on survey). However, many respondents reported increased awareness for: team creation (21% to 36%), PE champions (25% to 33%), involving people in PE process (23% to 41%), defining responsibilities (23% to 34%), and decision making process (19% to 30%). Overall 13% to 18% (depending on the survey) of respondents reported already being aware of the six elements (Table 3-4).

Many respondents who indicated that they had used the *PE Guide* reported they were aware of the barriers to PE implementation listed in the guide. This was the case in all surveys: one month (61%), three months (43%), six months (51%), and nine months (40%). Nevertheless, some respondents reported increased awareness of the barriers described in the guide from six to nine months: lack of support (13% to 30%), lack of communication (12% to 30%) and lack of resources (16% to 30%). In general the percentage of respondents reporting that the guide had increased their awareness of three barriers to PE implementation differed over time (Table 3-4).

Table 3-4: Survey respondents reporting raised awareness of PE elements and barriers to PE implementation with guide use.

	Survey time			
Survey item	1 month	3 months	6 months	9 months
Used guide	37% (77/208)	42% (61/146)	43% (48/112)	42% (40/95)
*Raised awareness of elements (%):				
- Teams	23	21	35	25
- Champion	25	33	31	30
- Training	34	59	40	40
- Involve people	35	41	23	33
- Responsibilities	26	34	25	23
- Making decisions	30	20	19	28
- Already aware	18	12	15	15
*Raised awareness of barriers (%):				
- Support	13	25	19	30
- Resources	16	26	21	30
- Communication	12	23	17	30
- Already aware	61	43	52	40

*adds up to greater than 100% as respondents could select multiple response items.

3.5 DISCUSSION

We disseminated an evidence-based *PE Guide* and surveyed those who downloaded the tool over

fifteen months and surveyed participants over a nine month period after download to see how it

was used. We considered a KTE framework by Lavis and colleagues (2003) and focused on

describing characteristics of the target audience and how the tool was used (KT impact).

3.5.1 TO WHOM (TARGET AUDIENCE)

We reached a variety of individuals connected to workplaces from a variety of industrial sectors

and with various job types. More specifically our audience included health and safety personnel,

managers, and workers representing individual workplaces or organizations. The majority of

respondents indicated health and safety responsibilities. We focused on a workplace-based audience because the PE Guide was designed to help overcome barriers related to PE initiation and implementation and therefore targets workplace decision makers. Schulte et al. (2003) suggest that workplace audiences are important audiences for OHS information. How best to reach these audiences is still a challenge, although information campaigns using the internet and social media seem to reach workplace-based audiences (Hudson and Hall, 2013; Sublet, Spring and Howard, 2011).

3.5.2 IMPACT (PE GUIDE USE)

Many respondents who downloaded the guide did not use it. The most common reason given for not using the guide was a lack of time. This is consistent with the literature on guideline use in healthcare contexts revealing lack of time as the most prevalent barrier (Grimshaw et al. 2004; Grol and Jones 2000). Downloading the guide suggests respondents had an interest in implementing a prevention program. It is possible that nine months was too short to examine guide use by workplace-based personnel (Whysall, Haslam and Haslam 2004). Respondents may be waiting until they have time to act on the information in the guide.

However, our dissemination approach was low cost and reached specific workplace parties and therefore successful. Increased reports of use are desirable but overcoming perceived time barriers continue to be challenging. The guide was short, six pages, with practical evidence-based information for initiating PE. Further work to reduce the perceived time of guide use may be required.

The 40 to 50% of respondents who did use the tool reported using it in a variety of ways, most often sharing it with others (mostly colleagues) and using it for training purposes. Respondents often reported using the guide to stay up to date and integrating the information into existing occupational health practices. In general, the guide raised awareness of six elements of PE described in the guide. Many reported that they were already aware of the barriers to successful PE implementation described in the guide. This suggests that they have some experience in implementing OHS programs. Rhebergen et al. (2011) explored the impact of OHS information available from an online network of OHS experts targeting workplace-based decision makers and noted 74% of survey respondents indicated increased knowledge and understanding. Furthermore 25% felt that the information would have an impact on their work or work functioning and 16% reported changes made as a result of the information from the portal.

New actions arising from use of the guide were most often related to training or the involvement of people (including defining their responsibilities) in a PE process. The new actions suggest that there are aspects of implementation taking place in these workplaces. The new actions reported here compare favourably to the clinical guideline implementation literature. Pilling (2006) reports implementation rates (citing studies from a review by Gimshaw et al. 2004) are typically quite low (6-14%). However, they do note that there are exceptions where the implementation rates are as high as 30 to 60% (Grol and Jones 2000). Higher implementation rates are attributed to active, integrated implementation approaches, which include a training component (Hugenholtz et al 2008; Schaafsma et al 2007). However, active approaches are not a guarantee that practice change will be implemented (Gross and Lowe 2009).

Our study showed that new actions were reported by between four and 50% of respondents. The creation of PE teams varied between 4 and 10%, which is low but still comparable to the

guideline literature. However, new training activities were reported by 32 to 50% of respondents. Given that training is a usual first step of a PE program this is suggestive of program initiation (Van Eerd et al 2010; Wells et al 2004). The stability in the types of use over nine months suggests that there is sustained use of the knowledge over time that may lead to further implementation steps (Kramer et al 2010; Weinstein et al 2007).

Kramer and colleagues (Kramer and Cole 2003; Kramer, Cole, and Leithwood 2004; Kramer and Wells 2005) describe minimal sustained knowledge use with a knowledge broker approach. Our study explored a more passive approach of getting an electronic copy of a guide to key workplace stakeholders. Despite the more passive approach, there was some indication of use and potential implementation steps. Future studies could explore additional strategies to improve implementation using evidence-based tools.

3.5.3 STUDY LIMITATIONS AND STRENGTHS
One study limitation is the number of participants lost to follow-up over nine months. It is possible that the loss to follow-up was in part due to using an online survey method, which typically has lower response rates than mail (Jones and Pitt 1999; Nulty 2008). However the online tool dissemination method was most easily linked to online surveys. This reduced cost and allowed immediate contact with potential participants. To increase response rates we also sent reminders at regular intervals to non-respondents (Dillman 2009). Linked to the response rate is the possibility of response bias where those who used the guide maybe more likely to respond. However participants were informed that we would follow up with multiple surveys which would allow them to report use as it occurred. We conducted a number of follow-up surveys in a nine-month period in an attempt to capture tool use when it occurred and perhaps changing use over time. We note that the pattern of missing responses was not predictable, in

that there were many cases where a survey was missed but a later survey was completed. This suggests that respondents didn't drop out of the study but had other reasons for missing surveys. A more likely explanation is that the survey participants were busy, which is supported by the reported barriers for tool use. However, with low response rates at each survey, we must remain cautious about our interpretation of use over time.

We do not have a denominator for our sample of stakeholders from BC limiting the generalizability of our results. Potential participants were invited to download a guide about PE and were also asked to pass on the link to the guide to others. Anyone that found the download page was invited to participate. The sampling technique is not specific but is in keeping with an online tool dissemination plan (Sublet, Spring and Howard, 2011) and was targeted to workplace stakeholders potentially interested in PE. In addition we were not able to collect more than minimal demographic information. Our focus was to minimize respondent burden; therefore, we restricted the number of demographic questions. Given that non-response was an issue, it is likely that a more burdensome survey would have resulted in more missing surveys/responses.

A strength was that we reached a broad representation of individuals with some OHS responsibilities. Results from Kramer et al. (2009) suggest that reaching a broader audience is a good approach as they found that knowledge about a workplace innovation was spread by a variety of workplace personnel, not just identified opinion leaders.

3.6 CONCLUSION

The study findings suggest that the *PE Guide*, when used, was helpful in raising awareness about PE process and the initiation of some new actions related to PE that could help to reduce MSD

burden among workplaces. Evidence-based tool use by workplace decision-makers can help overcome challenges related to implementation of hazard and injury reduction programs such as PE. OHS practitioners and consultants (such as Ergonomists) may benefit from tools that target workplace audiences when implementing injury prevention and hazard reduction programs. Future research examining how OHS decisions are made in workplaces as well as the determinants of the decision-making process is needed. Overcoming the ubiquitous challenge related to lack of time in busy workplaces remains.

The results provide us with an understanding about the dissemination and use of an evidence-based guide related to OHS. Developing and disseminating more evidence-based tools related to OHS may help in program implementation and ultimately the reduction of MSD burden.

CHAPTER 4: KNOWLEDGE TRANSFER AND EXCHANGE BY WORK AND HEALTH RESEARCHERS

4.1 OVERVIEW

Background: Getting research evidence into practice is important to improve practice and reduce the burden of workplace injury and illness. Knowledge transfer and exchange (KTE) is the practice of preparing and disseminating research to those who can use it. The objectives of this study were to 1) document and describe the dissemination activities and the KTE experiences of research staff within work and health research organizations; and 2) identify opportunities for improving KTE in work and health research.

Methods: An online survey was developed to enable the self-assessment of KTE activities of work and health researchers. The survey was administered to 79 work and health research staff from three research institutes in North America.

Results: Fifty-two complete responses (66%) were received from researchers (36.5%), research assistants (52%), and KTE specialists (including communications) (11.5%). The average tenure in their respective roles was 7.6 years. Work and health research staff respondents considered dissemination and KTE to be important. A wide variety of dissemination activities were reported. Overall respondents felt they were confident in their abilities to perform KTE activities. However they reported that processes supporting KTE as well as the promotion and evaluation of research use could be improved.

Conclusions: Work and health researchers reported engaging in various KTE activities that extend beyond the typical academic approaches of 'publish and present'. However, although aware of KTE, it was not clear that activities beyond peer-review publication and conference presentation were consistently integrated into their day-to-day research activities of work and health research staff. Barriers related to time demands and organizational support were noted for KTE and dissemination activities.

4.2 INTRODUCTION

The concept of research to practice is growing in importance in research communities globally (CIHR 2012, WHO 2012; Levin 2008; Gillen 2010; Holmes et al., 2014; Jones et al., 2015; Scott et al., 2012). Closing the gap between research and practice is known as knowledge translation or knowledge transfer and exchange (KTE) in Canada and the UK or dissemination and implementation (D&I) science in the USA (Tabak et al., 2012; Eccles and Mittman, 2006).

KTE is described in various ways and often using different terms (Grimshaw et al., 2006 McKibbon et al., 2010; Greenhalgh and Wieringa, 2012). An often used definition comes from the Canadian Institutes of Health Research (CIHR): "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge" (CIHR). The definition focuses on Canadian healthcare but can be adapted to other jurisdictions and research/practice settings. Importantly the definition extends beyond the traditional "end-of-grant" KTE activities of publication in peer-reviewed journals and presentation at scientific conferences.

Researchers are faced with the challenge of how to best disseminate the findings of their research to appropriate audiences who may be able to apply the findings in their practice. Recent research in healthcare and public health explored dissemination and KTE activities (Wilson et al., 2010b; Brownson et al., 2012; Gholami et al. 2013; Maleki et al., 2014; Goldner et al., 2014; Scott et al., 2012). Findings suggest that, although researchers feel that dissemination and KTE is important they may not engage consistently in activities that successfully close the research – practice gap. Wilson (2010b) noted that while a variety of dissemination activities were undertaken by UK public health researchers, they are done so in an ad-hoc fashion. In addition Lavis and colleagues

recently explored how researchers describe their KTE activities to policy makers in low and

middle income countries (Lavis et al., 2010; Guindon et al., 2010; Cameron et al., 2010; El

Jardali et al., 2011). The findings indicate that less than half of the researchers surveyed

indicated engaging in KTE activities. Importantly the low engagement could not be explained by

level of economic development. Factors such as low support for KTE, lack of incentives, and

direction from research organizations were the main barriers to engaging in KTE activities.

It is unclear whether the KTE findings from clinical healthcare, policy and public health settings

are transferable to work and health research. Work-related (or work relevant) injuries and disease

remain a great burden on workers, workplaces, as well as healthcare and insurance systems

(Murray et al., 2012; Vos et al., 2012; Woolf et al., 2004; Schneider and Irastorza 2010;

Silverstein and Evanoff 2011). Therefore work and health researchers and practitioners are faced

with the challenge of better understanding and reducing the high prevalence of work related

injuries and diseases. Knowledge transfer and exchange (KTE) is a burgeoning practice at

research institutions focusing on work and health (Sinclair et al., 2013; MOL, 2015;

WorkSafeBC 2012). KTE is encouraged, and at times required, by various research funding

agencies including those that fund research in work and health (MOL, 2015; WorkSafeBC

2012). Hence a variety of KTE approaches in work and health have been developed (see Chapter

2 above).

Occupational health and safety (OHS) is an area where research to practice is increasingly

popular (Schulte 2002; Van Eerd et al., 2015; Gillen 2010; Sinclair et al., 2013; Zardo et al.,

2014). In a survey of OHS researchers in Canada, Laroche and Amara (2011), found active

engagement in KTE activities was reported. Further, it was noted that researchers who reported

positive impacts on research transfer engaged in the following activities: i) adapted knowledge,

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ii) focused on knowledge users' needs, iii) interacted with knowledge users, and iv) had resources for dissemination activities. However, the authors point out that more research is needed. The current study adds to the description of KTE activities of OHS researchers and details their perspectives of organizational support and resources. As the concept of knowledge-to-action moves to the forefront in the OHS research community, there is a need to consistently evaluate the effectiveness and impact of dissemination and KTE activities (Schulte 2006; Zardo et al., 2014).

The objectives of this study were to 1) document and describe the dissemination activities and the KTE experiences of research staff within work and health research organizations; and 2) identify opportunities for improving KTE in work and health research.

4.3 METHODS

4.3.1 SAMPLE

The focus was on work and health research staff from established research organizations in North America:

1) Institute for Work & Health in Ontario Canada. The Institute for Work & Health (IWH) is an independent, not-for-profit research organization established in 1990, see www.iwh.on.ca for more details.

2) Safety & Health Assessment & Research for Prevention (SHARP) in Washington State USA, SHARP coordinates with the Washington Industrial Safety and Health Act (WISHA) Advisory Committee and the National Occupational Research Agenda (NORA) to develop research priorities, see www.lni.wa.gov/safety/research/about/ for more information.

3) Liberty Mutual Research Institute for Safety (LMRIS) in Massachusetts USA. LMIRS is owned and operated by Liberty Mutual Insurance, Boston, MA. See www.libertymutualgroup.com/omapps/ContentServer?pagename=LMGroup/Views/LMG&ft=2&fid=1138356633468&ln=en for additional details.

The three research organizations constitute a convenience sample of research institute with similar missions. The research/scientific director of each organization was approached to ask for permission to contact research staff within each organization. Once permission was granted emails were sent directly to staff to request participation in a survey. Ethics approval was obtained for this project from the University of Waterloo, Office of Research Ethics.

All of the research organizations have a mandate to conduct research to help in the prevention of workplace injuries and disability. Each of these organizations also makes an explicit mention of transferring or disseminating scientific knowledge to various stakeholders. IWH and LMRIS have dedicated staff for knowledge transfer while SHARP does not.

4.3.2 INSTRUMENTS AND ADAPTATION

Two previously developed instruments were adapted and used to ask work and health research staff to describe dissemination activities and self-assess KTE experiences within their organizations.

Wilson (2010b) developed a survey instrument to assess dissemination/KTE activities of public health researchers. One section of this instrument (19 questions) covered general questions about dissemination activities which were used to ask research staff about dissemination of research. Respondents were asked to indicate their agreement with items (Yes/No/not sure) or provide indicate importance on a Likert scale (1 to 5; with the anchors of very important to not important). In addition they were asked to indicate the types of activities they engaged in (from a list) and indicate the amount of time spent engaging in the activities (again from a list). The items were adapted by replacing terms specific to public health with terms related to work and health research (see Appendix B).

The Self-Assessment Tool for Research Institutes (SATORI) developed by Gholami et al. (2011) was used to examine aspects of KTE at an individual and organizational level. The SATORI instrument has a healthcare focus as it was originally designed to capture KTE in a teaching hospital setting. Therefore the SATORI instrument was adapted to replace terminology specific to a teaching hospital setting with more generic terms to fit with work and health research. In addition some minor English translation concerns (original developed in Farsi) were addressed

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including rephrasing the items so respondents could indicate their level of agreement.

Respondents were asked to indicate their agreement with each item on a Likert scale (1 to 5)

with the anchors of strongly disagree (1) to strongly agree (5). In addition, each item had an

option to include open-ended responses to add details or comments if desired by the respondents.

The instrument developers were contacted to clarify terminology and translation changes to

ensure that the intent of the items remained unaltered (see Appendix B).

4.3.3 SURVEY
A web-based version of the adapted instruments was created using Qualtrics™. The survey was

distributed via email link to research staff at the three organizations and a modified Dillman

approach (Dillman, 2009) used with email reminders at one, three, and six weeks after the initial

email. Potential participants were asked to read a consent statement and indicate their agreement

before completing the survey.

4.3.4 ANALYSIS
The data were analyzed descriptively by calculation of frequency counts or examination of

distributions for normality, and if adequate, then calculation of means and standard deviations.

The focus of the descriptive analysis was to examine the views of work and health research staff

about dissemination activities they conduct as well as the KTE approaches and supports within

their organization.

The responses from the SATORI questionnaires were aggregated across organizations based on

categories created by the tool developers in order to better describe strengths and weaknesses of

KTE in research institutes (Gholami et al., 2013). The seven categories are: "priority setting,

research quality and timeliness, resources for knowledge transfer, support for knowledge

transfer, KTE capacities, interaction with research users, and promoting and evaluating the use of

evidence". The mean response scores and percent agreement for each item from the SATORI instrument were used to describe how well the seven categories were addressed across organizations. I considered good agreement with the item statements if there was a mean score above 3 and the percent agreement (percent of respondents selecting 4 or 5 on the 5-point scale) was above 50%. Though somewhat arbitrary, this allowed for comparison among the various aspects of KTE represented by the SATORI items. Open-ended sections of the survey questions were read and classified by a single person (DVE) into four possible categories: clarification, barriers, facilitators, and resource needs. The open-ended responses were then reported in the description of the seven categories of KTE.

4.4 RESULTS

We approached 79 work and health research staff (from three organizations in North America) and received 56 survey responses. Four (7%) of the surveys were not completed by the end of the study period (only demographics questions completed) and were not included in the analysis leaving a final sample of 52 (66%). The data from all three organizations will be presented together to protect the anonymity and confidentiality of participants. Note that response proportions varied across questions, so N's are included in all tables.

4.4.1 SAMPLE CHARACTERISTICS

Over one third of the sample was comprised of those who identified as researchers (36.5%), with most of the sample identifying as Research Assistants/Associates (52%), and the remainder considered themselves KTE specialists (including communications) (11.5%). The average tenure in their respective roles was 7.6 years (SD 6.6), however those identifying as researchers had a longer average tenure (13 years) than those who were not researchers (5.4 years).

The remainder of the survey results are presented in two sections. The first section describes the dissemination activities that respondents used and considered important (from Wilson et al., 2010b). The second section covers the respondent-assessment of KTE in their organizations (Gholami et al., 2011).

4.4.2 DISSEMINATION ACTIVITIES

<u>Importance of dissemination</u>: A large majority of respondents (92%) reported that dissemination was important or very important to them, with the remainder reporting it as somewhat important. Almost all (98%) felt dissemination was important or very important to the organization. Respondents endorsed a variety of reasons for dissemination with raising awareness of findings receiving the greatest endorsement (92%). Influencing practice, transferring research to practice, promoting understanding of OHS, and influencing policy also got high endorsement (67%). When asked to rank reasons for dissemination, raising awareness (29%) and influencing practice (27%) were ranked as most important. Influencing policy, transferring research to practice, and promoting public understanding of occupational health and safety were also ranked as important reasons for dissemination.

<u>Dissemination role and methods</u>: Overall 65% of the respondents reported having dissemination formally part of their role with 79% suggesting that dissemination should be formally part of their role. The reported time spent for dissemination activities varied with the largest proportion (23%) spending between 10 and 20% of their time on these activities.

Respondents endorsed a wide variety of dissemination methods (see Table 4-1). The most endorsed methods were: academic journals, academic conferences and reports to funders.

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Table 4-1: Dissemination methods employed by work and health researchers

Method	% of respondents (n=52)
Academic journals	87
Academic conferences	81
Report to funders	69
Full report (paper)	56
Summary report (web access)	56
Summary report (paper)	54
Newsletters	52
Face to face meetings	52
Professional journals	50
Other conferences	50
Full report (web access)	42
Press releases	42
Workshops	42
Email alerts	38
Media interviews	38
Seminars/Plenaries	35
Networking	35
Targeted mailings	21
Policy briefing paper	19
RSS feeds	13
Other	15

Open-ended comments listed academic journals and face to face most often but conferences and workshops were also mentioned often as the methods having the most impact. However many respondents noted that the best method was contingent on the target audience and therefore often put forward multiple methods as "best", depending on the audience.

Overall, respondents suggested they were pleased with their own dissemination activities with 50% of respondents rating their dissemination as good or excellent, and a further 30% rating it as adequate. However, 34% of respondents did report they have not had opportunity to use certain

dissemination methods, mostly related to social media and web-based approaches (including video).

Dissemination strategies: Most respondents (77%) reported their organization had a formal communications strategy. Many respondents also noted that they used guidance or a framework for their dissemination activities at least sometimes (69%). Dissemination planning occurred at different times in a project cycle with many respondents (45%) indicating they planned dissemination activities at the proposal stage of research and 16% reported they planned dissemination activities at all stages of research, whereas 18% reported they planned dissemination activities at the final report stage of research.

When planning dissemination activities a majority of respondents (87%) said they usually or always considered who the audience should be as well as how the audience would like to receive the information (82%).

 When asked if they produced research summaries for specific audiences 74% of respondents indicated they did so sometimes or usually, only 10% saying always or never.

However evaluation of dissemination impact was not routinely reported. Forty-eight percent of respondents reported rarely or never evaluating impact while 44% said they sometimes evaluated impact.

4.4.3 SELF-ASSESSMENT OF KTE
Item scores and agreement are presented in Table 4-2 and described by category below (Gholami et al., 2013).

Priority setting: Respondents agreed that regular meetings occur with knowledge users and that the organizations research priorities are determined through such meetings. There was also agreement that the research organization had an up-to-date list of research priorities available to the research staff. However there was less agreement about whether there was a list of research priorities of other research organizations available to staff. The uncertainty about a list of research priorities was also reflected in open-ended comments.

Research quality and timeliness: Respondents clearly agreed that knowledge users trust the quality of the research produced by their organizations. There was also general agreement about quality control and internal review mechanisms being in place. Respondents indicated they were aware that projects should be completed in a timely manner and that the time to begin projects and present results once completed was reasonable. There was much less agreement that the time between article submission and publication is reasonable.

Facilities and resources for knowledge transfer and exchange: Respondents reported they could use the services of those familiar with KTE within their organizations. Furthermore they agreed that they have research manager support for KTE activities. There was agreement that there were organizational supports (structure and personnel) for KTE and that researchers have appropriate skills, personnel and financial resources to prepare content for KTE. Electronic avenues such as web and databases were considered available for dissemination.

Respondents clearly indicated they were encouraged to seek external funding for research and that research proposal budgets included dissemination activities other than publication and conferences. However there was less agreement that research staff had adequate time to prepare content for dissemination.

Processes supporting knowledge transfer: There was agreement that the research organizations had regular communication with the media and knowledge users for dissemination of research evidence. Agreement was noted regarding the prioritization of research with 'actionable messages' and that the organization had a process to determine which research results can be transferred to audiences. However there was less agreement that research results were peer-reviewed (internally) before KTE activities.

There was relatively good agreement that research staff were encouraged to use external funding and that they had incentives to secure the funding for research and dissemination. However there was much less agreement that research could access funding easily and in a timely manner.

There was less agreement that the format of final reports allowed knowledge users to easily determine actionable messages. As well, respondents tended to disagree that the format of peer-review journals was such that knowledge users could extract actionable messages. There was also low agreement that intellectual property rights existed to support research in disseminating message prior to publication in journals.

Respondents tended not to agree that researchers have incentives for performing KTE nor that there were criteria for evaluating KTE activities.

Knowledge transfer and exchange capacities: Respondents agreed that research staff convert research results into messages appropriate for target audience. There was also agreement that research staff had communication skills and were familiar with KTE. Agreement that lists of potential stakeholders are prepared for each research project was noted as well. However there was less agreement that KTE and research utilization were part of the organizations program of research training.

Interaction with knowledge users: There was high agreement that research topics and projects were made available via the web or electronic databases. As well, respondents agreed that knowledge users know the fields of research that the organizations cover.

There was good agreement that there was a comprehensive list of knowledge users that can use the organizations research results. Furthermore there was agreement that meetings were held with knowledge users to present research results as well as to consider cooperation opportunities such as knowledge networks. Respondents also agreed that knowledge users regularly participated in the design and conduct of research projects.

Promoting and evaluating the use of evidence: The respondents agreed that their organizations produced systematic review or guidelines that strengthen evidence-based decision making. They also agreed that evidence-based decision making was an area of research within their organizations. Respondents likewise agreed that research staff played an active role in technical committees that help in decision making.

There was less agreement that knowledge users are sent reminders to consider research previously sent. There was also less agreement about identifying barriers to research use, or studying how knowledge users utilize their research. Nor did respondents agree that their organizations provide education sessions for knowledge users.

Table 4-2: The SATORI tool mean scores and agreement per item in seven domains by all participating organizations (based on Gholami 2013; Maleki 2014)

Domain / **Item**	**Mean**	**SD**	**% agree**	**N**
Priority setting				

Regular meetings are held with knowledge users for the exchange and identification of research priorities. (1.3)	3.98	0.89	78	50
A website and/or data base is available in our organization for identifying the research priorities of other organizations. (1.6)	2.84	1.06	22	50
Our organizations' research priorities are determined through meetings with knowledge users. (1.7)	3.68	0.82	70	50
Our organizations' research priorities are compiled and an up-to-date list is available to our researchers. (1.8)	3.58	0.95	56	50

Research Quality and Timeliness

Our impression is that knowledge users trust the quality of the research done in our organization. (2.3)	4.35	0.66	90	49
There is an internal review mechanism (quality assurance) to ensure the quality of the research process. (2.4)	3.78	0.96	65	49
Quality control is carried out while research is being conducted (internally or externally). (2.5)	3.58	0.78	56	50
The time between 'presentation of the research proposal' and 'beginning of the research' is reasonable (the process of reviewing the research proposal). (2.6)	3.40	0.82	54	48
While designing the research proposal and conducting the projects, researchers are aware that applied projects should be completed in a timely manner. (2.7)	3.92	0.60	82	50
The time between 'end of research' and 'finalization of results in the form of a report' is reasonable (the process of presentation of research results). (2.8)	3.47	0.74	57	49
The time between article submission and its publication in journals is such that the interventions that results from research can be implemented in reasonable time by knowledge users. (3.16)	2.83	0.82	17	47

Facilities and resources for knowledge transfer and exchange

Relative to our organization's internal budget for research, the amount of external funding is such that researchers are encouraged to use external funding. (1.9)	4.06	0.89	76	50

In research proposals (with knowledge users involvement) the budget includes funds for disseminating the results (other than being published in peer-review journals and/or attending conferences). (2.9)	3.55	1.12	61	49
Our researchers can use the services of those familiar with knowledge transfer (internally or externally). (3.6)	4.16	0.74	90	50
Our researchers have the necessary personnel and financial resources for preparing content appropriate to the target audience. (3.7)	3.44	1.09	56	50
Our researchers have the necessary tools (technology or skills) for preparing content appropriate to the target audience. (3.8)	3.54	0.76	58	50
Our researchers have adequate time for preparing content appropriate to the target audience. (3.9)	3.30	0.84	48	50
The necessary structure (e.g. a department) and/or personnel is available for strengthening knowledge transfer in our organization. (3.13)	4.02	1.06	80	50
Our organizations' research managers are aware of the researchers KTE needs, and provide support or direction in this area. (3.14)	3.78	0.95	72	50
Researchers can provide the results of their research through the web and/or electronic databases. (3.18)	4.14	0.61	88	49

Processes supporting knowledge transfer

Compared to the internal process, the external grant securing process is such that researchers are encouraged to use external funding. (1.10)	3.74	1.08	52	50
Our researchers can access external funding easily and in a timely manner for research projects. (1.11)	2.98	1.10	34	50
Our researchers have incentives for securing external funding. (1.12)	3.51	1.08	55	49
Research projects that result in production of 'actionable messages' with a high level of evidence (such as systematic reviews and/or guideline or tool development activities) are considered priorities for funding and completion. (2.1)	3.59	0.96	61	49

Our organization has a process to determine which research results can be transferred (keeping in mind that not every research result is transferable) to the target audiences (apart from transferring to other researchers and funders). (3.1)	3.49	0.96	53	49
In our organization, all research results are peer reviewed prior to knowledge transfer activities. (3.2)	3.27	1.04	35	49
Our researchers have the necessary incentives for performing knowledge transfer (rewards, appropriate promotion rules). (3.10)	2.88	0.96	28	50
The format of peer review journals is such that the knowledge users can easily determine the actionable messages when applicable. (3.15)	2.56	0.87	13	48
The format of research projects' final reports are such that decision makers can easily determine the actionable message when applicable. (3.17)	3.31	0.76	46	48
Intellectual property rights exist which support researchers who help disseminate research results prior to their publication in journals. (3.21)	3.13	0.76	27	48
There are criteria for evaluation of researchers' knowledge transfer activities in our organization. (3.25)	2.67	0.88	15	48
Our organization has regular communications with the media and knowledge users for transfer of research-based evidence. (3.20)	3.86	0.84	65	48
In our research organization knowledge transfer is integrated throughout the research process to increase the likelihood of utilization of research results [Footnote]	3.73	1.01	65	48
Knowledge Transfer and Exchange capacities				
Researchers are familiar with knowledge transfer and how to perform it. (3.3)	3.44	0.86	56	50
Our researchers convert their research results into actionable messages appropriate to the target audience. (3.4)	3.63	0.70	63	49
Our researchers have communication skills for knowledge transfer. (3.5)	3.45	0.79	55	49
Knowledge transfer and utilization of research results exist in our organizations' general program of research methodology training. (3.11)	3.12	0.99	37	49

A list of all potential stakeholders or research users is prepared for each research project. (3.12)	3.48	1.03	60	50

Interaction with knowledge users

In our organization there is a comprehensive list of knowledge users or organizations that can use our research results. (1.1)	3.76	1.12	74	50
Information about our researchers' projects and topic areas is made available to other organizations through the web or electronic databases. (1.2)	4.50	0.68	92	50
Knowledge users know which fields our organizations' research covers. (1.4)	3.62	0.83	62	50
When preparing for utilization, our organization holds regular and purposeful meetings with knowledge users for cooperation opportunities (establish a knowledge network). (1.5)	3.64	1.03	64	50
Knowledge users regularly participate in the design and/or conduct of research projects. (2.2)	3.49	1.04	61	49
Meetings are held for presentation of research results to knowledge users. (3.19)	4.04	0.76	82	49

Promoting and evaluating the use of evidence

Evidence-based decision making is among the research areas in our organization. (3.22)	3.57	1.06	68	47
Our researchers study the extent to which knowledge users utilize our organizations' research results. (3.23)	2.98	1.05	34	47
Our researchers identify the potential barriers for utilization of research results by our knowledge users. (3.24)	3.23	0.83	42	48
We conduct education sessions (such as 'evidence-based decision making') for knowledge users. (4.1)	3.10	0.93	33	48
Systematic reviews and guidelines…etc that strengthen evidence-based decision making are produced in our organization. (4.2)	4.04	1.03	79	48
Our researchers play an active role in technical committees that help in decision making. (4.3)	3.77	0.63	71	48
We routinely send knowledge users reminders to consider research results that we've previously sent them. (4.4)	3.19	0.89	31	48

Footnote – this question was added to the SATORI survey

4.5 DISCUSSION

The objective of this study was to explore and describe dissemination and KTE experiences among work and health research staff from organizations in North America. The study builds on research that has explored dissemination and KTE in public health and healthcare (Wilson et al., 2010b; Maleki et al., 2014; Gholami et al., 2011; Brownson et al., 2013) as well as OHS (Larroche and Amara, 2011). This study is unique in that it not only examines dissemination activities and KTE experiences of individuals but includes their perspectives about organizational support for KTE.

The study findings suggest that work and health research staff engage in a variety of dissemination activities to raise awareness of research findings, influence practice and policy, and promote public understanding of OHS. The respondents were almost unanimous in reporting that dissemination was important to them and their organizations. However only about two-thirds felt dissemination was formally part of their role. This is lower than the 93% of public health researchers reporting dissemination as part of their role (Wilson et al., 2010b).

Traditional academic dissemination avenues (peer-reviewed publication, conferences and reports to funders) dominated the activities reported, similar to Wilson 2010 and Brownson 2013. The predominant dissemination activities may reflect the academic demands of work and health researchers or potentially the organizational desire to publish in peer-reviewed journals and present at conferences as relevant outcomes of research funding. However respondents did note that the impact of a particular dissemination method was dependent on the target audience. Since researchers are a valid target audience it is not surprizing that dissemination avenues to reach research audiences are used.

Considering the target audience is important for dissemination (Lavis et al., 2003; Kitson et al., 2008). The current results revealed that respondents thought about audiences and how they would prefer to access and use research findings. Wilson et al. (2010) also found that public health researcher reported thinking about target audiences. What remains uncertain is which audiences are considered or prioritized. It is possible that while the work and health researchers thought about target audiences early in the research process they may have only considered few specific audiences (such as other researchers).

Brownson et al. (2013) found it disconcerting that only 17% of US public health researchers in their study reported using a framework or theory to guide dissemination activities. Similarly Wilson et al. (2010) also noted that very few (9%) UK public health researchers used guidance. Just over a third (36%) of respondents in the current study reported they referred to guidance or a framework to plan their dissemination activities at least sometimes. It is not clear why there would be a difference between work and health and public health researchers in this regard. It is possible that funding agencies for work and health research demand greater attention to dissemination approaches. Perhaps most likely, the research organizations may provide guiding frameworks to allow for consistency in dissemination across the organization. This is similar to previous findings from a Canadian setting, where different organizational structure and support appeared to impact on dissemination activities (Newton 2007).

Overall most aspects of KTE were reported as favourable within the respective organizations. When barriers were noted they were often related to a lack of time, for example the time to get actionable messages out or time to prepare content for transfer. Lack of time is not surprising in busy research organizations however it may be indicative of a lack of prioritization on KTE. This is supported by the finding that respondents tended not to agree that they had support for KTE

despite having the facilities and resources for KTE in their organizations. Overall there was a sense that incentives for KTE and access to funding for KTE were less than optimal. Despite the lack of support, respondents felt that their own KTE capacities were reasonable.

Two recent studies using the same self-evaluation instrument reported lower agreement for almost all items (Gholami et al., 2013; Maleki et al., 2014). However, it is not possible to determine if the differences are due to jurisdiction and/or related to research area as the studies are from Eastern Mediterranean countries and focused on medical schools and universities. Newton (2007) reported that research area had an impact on dissemination activities.

The current findings are more consistent with those of Laroche and Amara (2011) who noted that Canadian OHS researchers reported engaging with knowledge users, spending time adapting knowledge for transfer, and thinking about the audience when conducting research (Laroche and Amara 2011). The concept of interacting with and communicating effectively with knowledge users was also noted as important in the Australian context of work and health (Zardo et al., 2014).

4.5.1 *AREAS FOR IMPROVEMENT*
Overall there were three broad areas of KTE where survey results suggest there is room for improvement. Aspects related to *processes supporting KTE* such as the format of reports and peer-reviewed journals (to determine actionable messages) and intellectual rights for dissemination could be improved. It appears that a consistent process for peer-reviewing findings prior to KTE activities and improved criteria to evaluate KTE would be useful to work and health researchers. Perhaps not surprisingly, improved access to research funding as well as more

incentives for KTE was also desired. The suggested improvements around process suggest that respondents are looking for guidance and incentives to performing KTE activities. Gholami et al., (2013) and Maleki et al., (2014) also noted that improvements to processes supporting KTE were necessary in Iranian research institutions.

Respondents also appeared to be looking for guidance and improvement in aspects of *priority setting* (identifying priorities), *research timelines* (article submission time), *facilities and resources* (adequate time to prepare content), and *KTE capacities* (KTE training). Barriers related to time demands related to KTE are common (Mitton 2007; Rycroft-Malone et al., 2004; Francke et al., 2008)

In addition, aspects of *promoting and evaluating the use of evidence* such as the evaluation of knowledge utilization as well as better understanding the barriers of utilization could be improved. Conducting education sessions for knowledge users and sending more reminders about research results could also be improved. It is, perhaps, also not surprising that researchers would desire better evaluation and training approaches. Gholami et al., (2013) and Maleki et al., (2014) also noted that improvements to KTE evaluation were necessary in Iranian research institutions. The training component was not a concern in the Iranian setting perhaps because they were university settings as opposed to the work and health research organizations in the present study.

4.5.2 STRENGTHS AND LIMITATIONS

The main limitation of the study is the small sample size. However the sample was a result of focusing on a specific area of research and therefore targeted three organizations that specialize in work and health research. I chose to recruit from research organizations so that I could better understand organizational level support and processes for KTE. The small sample size required

that I combine responses from researchers, research associates and KTE personnel. There may be differences in activities and experiences based on role however the collective perspective is valid and allows me to comment on the organizations that focus on work and health in North America. The small sample also prevented me from comparing responses from different research organizations. While each organization publically reports some focus on KTE, I was not able to compare across organizations and therefore cannot comment on how organizational KTE policies and practices may have affected individual KTE approaches.

The survey employed self-report instruments of dissemination and KTE activities that were adapted from previous studies (Wilson 2010b; Gholami et al., 2011). While the measurement properties of the self-assessment instruments have not been rigorously evaluated, they were used as intended with minimal adaptation. However this means that there is no direct measure of dissemination or KTE. An understanding of self-reported activities will be useful to devise better studies to measure dissemination and KTE directly.

It should be noted that there is a possibility of social desirability having an impact on the responses. The responses for many items was much higher than responses from previous studies but I cannot rule out that the differences are not due to context as there were great differences in research area, jurisdiction, and potential funding. While I cannot rule out social desirability we note that responses were similar across different roles within organizations suggesting that they were based on experiences.

4.6 CONCLUSIONS

Work and health research organization staff considered dissemination and KTE to be important. The research staff at three work and health research organizations reported a variety of dissemination activities extending somewhat beyond the typical academic approaches of 'publish and present'. However it is not clear how well work and health research staff plan their dissemination activities given that use of models or frameworks to guide dissemination was only reported by a third of the research staff surveyed. In addition, only about two thirds of respondents considered KTE to be formally part of their role. The survey findings suggest a level of confidence in KTE activities related to priority setting and interaction with knowledge users yet there was little agreement that evaluation of research use was well done. Overall respondents reported that there was limited organizational support and incentives for KTE activities.

The picture that emerges is that work and health research staff are aware of KTE and engage in KTE activities but that activities beyond peer-review publication and conference presentation may not be fully or consistently integrated into their day-to-day research activities.

Future research should approach a larger sample of work and health researchers from more jurisdictions. A larger study should go beyond KTE practice descriptions and barriers/facilitators, focusing on the impacts of KTE. Morton (2015) recently described a Research Contribution Framework (RCF) which may provide a starting point for such research.

CHAPTER 5: CONCEPTUAL FOUNDATIONS OF KNOWLEDGE TRANSFER AND EXCHANGE IN WORK AND HEALTH RESEARCH

5.1 OVERVIEW

Background: Knowledge transfer and exchange (KTE) is the practice of generating, disseminating and implementing the best available research evidence. There is a call for KTE activities to be guided by clearly stated theory or conceptual framework. The aim of this article was to i) determine and describe the KTE activities of work & health researchers according to two common KTE frameworks (Graham et al., 2006; Lavis et al., 2003), ii) examine how comprehensively the self-reported KTE activities represent the categories of the two frameworks, and iii) discuss which framework shows promise for work and health research and why.

Methods: An online survey was developed to enable the self-assessment of KTE activities of 79 work and health research staff from three research institutes in North America. The responses from the survey were matched to two popular KTE frameworks (Graham 2006; Lavis 2003). Scores from the survey items were averaged across framework elements to estimate how well they were addressed by work and health researchers.

Results: Fifty-two completed responses (66%) were received from researchers (36.5%), research assistants (52%), and KTE specialists (including communications) (11.5%). The average tenure in their respective roles was 7.6 years (SD 6.6). Almost all of the survey items could be mapped to each of the KTE frameworks and each element of the KTE frameworks was represented by at least one survey item. The KTA categories related to tool creation and monitoring/evaluating outcomes were not as well represented as were the remaining categories. Similarly, the "effect" category of the Lavis framework was not as well represented at the other categories in that framework.

Conclusions: The self-reported KTE activities of work and health research staff represent all categories of two popular KTE conceptual frameworks. Despite the good fit, only one-third of

work and health research staff KTE activities report they are guided by conceptual frameworks. The Lavis framework (2003) appears to be a good starting point to guide work and health KTE activities.

5.2 INTRODUCTION

Knowledge transfer and exchange (KTE) is concerned with generating, disseminating and implementing the best available research evidence. There are a number of different terms used to describe KTE including knowledge translation, knowledge transfer, and knowledge exchange (Graham et al., 2006). Despite the different terminology the common goal of KTE is to bring research to practice. Failing to transfer research to practice may result in use of ineffective practice or programs as well as wasting costly research (Pierson and Rosella 2015; Colquhoun et al., 2014; Graham et al., 2006; Ward et al., 2009; Grimshaw et al., 2012; Wilson et al., 2010a; Verbeek et al., 2002; Hudon et al., 2014). While KTE is a burgeoning practice, it is not consistently guided by theory or conceptual frameworks (Wilson et al., 2010a; Tabak et al., 2012; Visram et al., 2013; Nilsen, 2015; Colquhoun et al. 2014; Field et al., 2014; Mitton et al. 2007). Estabrooks and colleagues (2006) noted that there was no one predominant theoretical or conceptual framework for KTE in healthcare, organizational innovation, and social sciences literatures. There is an increased call for KTE activities to be guided by clearly stated theory or conceptual underpinning (Colquhoun et al., 2014; Nilsen 2015; Field et al., 2014; Visram 2013; Ward et al., 2012; Holmes et al., 2014; Wilson et al., 2010a; Newman et al., 2015). The terms conceptual frameworks, theories and models are often used interchangeably, however conceptual frameworks tend to be broad and descriptive, while theories and models are more specific and better suited for testing and comparison (Rycroft-Malone 2010; Graham et al., 2007). Conceptual

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frameworks are for guiding practice and organizing approaches (Rycroft-Malone 2010; Graham et al., 2007).

In a systematic review of the literature Wilson et al. (2010a) explored whether there were conceptual frameworks that could guide researcher dissemination activities. The authors found 33 frameworks that could be helpful to researchers in guiding dissemination activities. One of the frameworks described in the Wilson et al. review (2010a) was by Lavis and colleagues (2003). The framework was developed to help research organizations evaluate their knowledge transfer strategies. The framework is based on an evaluation of the literature on knowledge transfer from many disciplines including healthcare (evidence-based medicine), policy, management, and education. The framework consists of five key questions which provides a strategy for knowledge transfer: What should be transferred (the message)?, To whom should the knowledge be transferred (the target audience)?, By whom should the knowledge be transferred (the messenger)?, How should knowledge be transferred (the knowledge transfer process)?, With what effect should the knowledge be transferred (evaluation)?. This framework provides a practical approach to the evaluation of knowledge transfer activities for a variety of research organizations.

Another framework often cited and used to guide KTE practice is the Knowledge to Action Framework (K to A) (Graham et al., 2006; Graham et al., 2007; Field et al., 2014; Goldner et al., 2014). Field and colleagues (2014) completed a citation analysis and systematic review of K to A use. The K to A was cited almost 1800 times and used in some way in 146 studies. The framework was developed to provide conceptual clarity in the healthcare KTE field (Graham et al., 2006). The basis for the framework was from planned action theories and the framework has two components: knowledge creation and action cycle. There are a number of phases within

each component however the phases can occur in parallel and iteratively. The framework considers context as well as the characteristics of target audiences. The K to A has been used in various research areas (Field et al., 2014; Sinden et al., 2014; Curran et al., 2011).

Work and health research contributes to evidence to reduce the burden of workplace injury and illness. Therefore KTE activities are required to get the research into practice as with other disciplines. Many work and health KTE approaches described in the literature report an underlying conceptual framework that guides the various KTE activities (see Chapter 2 above). However, only approximately one-third of work and health researchers report regularly using conceptual frameworks to guide their KTE activities (see Chapter 4 above).

The aim of this article was to i) determine and describe the KTE activities of work & health researchers according to two common KTE frameworks (Graham et al., 2006; Lavis et al., 2003), ii) examine how comprehensively the self-reported KTE activities represent the categories of the two frameworks, and iii) discuss which framework shows promise for work and health research and why.

5.3 METHODS

5.3.1 SAMPLE:

Work and Health research staff from a convenience sample of three established research organizations in North America were approached via email to participate in the survey study: Institute for Work & Health (IWH) in Ontario Canada, Safety & Health Assessment & Research for Prevention (SHARP) in Washington State USA, Liberty Mutual Research Institute for Safety

(LMRIS) in Massachusetts USA. Please see Van Eerd 2016 Chapter 4 for more details about the sampling approach. Ethics approval was obtained for this project from the University of Waterloo, Office of Research Ethics.

5.3.2 DATA COLLECTION:

Instrument adaptation: Two previously developed instruments were adapted and used to ask work and health researchers to describe their KTE activities. Wilson et al. (2010b) developed an instrument (19 items) to inquire about researchers' KTE activities and get their views about dissemination of research. The items were adapted simply by replacing terms specific to public health with terms related to work and health research. A KTE self-evaluation tool (SATORI) developed by Gholami et al. (2011) was adapted to replace terminology specific to a teaching hospital setting with more generic terms to fit with work and health research. In addition, the items were rephrased so respondents could indicate their level of agreement. Respondents were asked to indicate their agreement with each item on a Likert scale (1 to 5) with the anchors of strongly disagree (1) to strongly agree (5). The instrument developers were contacted to clarify terminology and translation issues (original developed in Farsi) to ensure that the intent of the items remained unaltered.

Survey: A web-based survey was created using Qualtrics™ using items from the adapted instruments. The survey was distributed via email link to researchers from three North American research organizations that focus on work and health research: IWH, LMRIS, and SHARP.

The research director (or scientific director or president) was approached to ask for permission to approach research staff within each organization. Once permission was granted, research staff were sent an email containing a unique link to the web-based survey inviting them to participate. A modified Dillman approach (Dillman, 2009) with email reminders at one, three, and six weeks

after the initial email. Potential participants were asked to read a consent statement and indicate their agreement before completing the survey.

Framework selection: The Lavis (2003) and K to A (Graham et al., 2006) frameworks were chosen because they have been much cited as guiding KTE approaches in healthcare (Lavis et al., 2010; Guindon et al., 2010; Field et al., 2014), public health (Wilson et al., 2010a; El Jardali 2012) and work and health (Sinden and MacDermid, 2014; Reardon 2006). They are popular and considered to be useful to guide KTE approaches (Wilson et al., 2010a; Grimshaw et al., 2012).

Analysis: First the relevant items from the questionnaire were mapped to each of the frameworks. This was done (by DVE) using the descriptions from the original articles (Lavis et al., 2003; Graham et al., 2006; Wilson et al., 2010b; Gholami et al., 2011). The responses from the questionnaires were aggregated across all respondents and compared to the KTA framework based on the main categories and phases of the framework: 1) knowledge creation: inquiry, synthesis, tools/products, tailoring knowledge, and 2) Action cycle: Identify problem, review/select knowledge, adapt knowledge to context, assess barriers to knowledge use, select/tailor/implement interventions, monitor, evaluate and sustain knowledge use.

In addition the items from the questionnaires were mapped to the framework by Lavis et al. (2003). The mapping was done according to the five key questions which provide a strategy for knowledge transfer: What should be transferred to decision makers (the message)?, To whom should the knowledge be transferred (the target audience)?, By whom should the knowledge be transferred (the messenger)?, How should knowledge be transferred (the knowledge transfer process and supporting communications infrastructure)?, With what effect should the knowledge be transferred (evaluation)?.

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Secondly the data from work and health researchers were analyzed using the descriptive statistics of each item of the questionnaire. As distributions were adequately normal, a mean score for the SATORI instrument was calculated for each section of the respective frameworks. A mean score of three or greater (out of five) was considered to represent some agreement (or least not disagreement) with the items that make up a particular section of the conceptual framework.

5.4 RESULTS

Seventy-nine work and health research staff were approached and 56 survey responses (71%) were received. Four (7%) of the surveys were not completed by the end of the study period (completing only demographics questions) and were not included in the analysis leaving a final sample of 52 (66%).

Sample characteristics: The respondents identified as researchers (36.5%), research assistants/associates (52%), or KTE specialists (including communications) (11.5%). The average tenure in their respective roles was 7.6 years (SD 6.6), however those identifying as researchers had a longer average tenure (13 years) than those who were not researchers (5.4 years).

The complete detailed survey findings are presented in Van Eerd (2016, Chapter 4). Briefly, all respondents felt that dissemination was at least somewhat important to them, with a majority (92%) reporting it was important or very important. Almost all (98%) felt dissemination was important or very important to their organization. Overall 65% of the respondents reported formally having dissemination as part of their work role and 79% suggested that dissemination should be formally part of their role. Many respondents also noted that they used guidance or a

framework for their dissemination activities sometimes (37%) or usually (29%). Only 4%

indicated that used guidance always. Overall, respondents suggested they were pleased with their

own dissemination activities with 50% of respondents rating their dissemination as good or

excellent, and a further 30% rating it as adequate.

5.4.1 MATCH TO CONCEPTUAL FRAMEWORKS

Table 5-1 shows the mapping of KTE activities items to the KTA framework. All but eleven

survey items related to KTE activities could be mapped to the KTA framework. The eleven items

asked about very general aspects of KTE or the importance of dissemination that did not fit

specifically within the KTA framework. The self-report KTE activities considered by the survey

items could be fit into all of the categories of the KTA framework.

Using the self-report questions from SATORI (Gholami et al.,2011) the only categories that did

not achieve a mean score of at least three (out of five) were: 'action cycle: monitor knowledge

use' and 'action cycle: evaluate outcomes'. In both cases there was only a single item from the

SATORI instrument to score in these categories. In addition, the Wilson et al. (2010b) items in

the 'action cycle: select, tailor, implement interventions' section represented positive KTE

activities. However in 'action cycle: evaluate outcomes' the Wilson et al. (2010b) item about

evaluating dissemination was not well endorsed whereas the item about self-rating dissemination

activities was positive.

There was at least one survey item in every category described in the KTA framework. However

not all categories were represented equally well. The categories of 'knowledge creation: tools

and products', 'action cycle: monitor knowledge use' and 'action cycle: evaluate outcomes' only

had a single item representing each. For these categories there was also relatively low agreement

with the items as well. One other category also not as well represented was 'action cycle: sustain

knowledge use' with low agreement on two of three items.

Table 5-1: Questionnaire items (including mean scores and agreement per item) according to the KTA model. SATORI (Gholami 2011) items are shaded grey; Wilson (2010b) items are shaded green. (see Appendix C for detailed tables showing individual survey items and scores)

Domain / Item	Mean	SD	% agree range
KNOWLEDGE CREATION			
Inquiry	3.60	0.89	34-82
Synthesis	3.63	1.10	27-79
Tools and products	3.13	0.76	27
Tailoring knowledge	3.74	0.88	55-88
ACTION CYCLE			
Identify problem	3.67	0.91	56-78
Identify problem/ Review/ Select knowledge	3.70	0.82	13-92
Adapt knowledge to context	3.48	0.85	48-63
Assess barriers to knowledge use	3.31	0.96	37-68
Select, tailor, implement interventions	3.48	0.89	17-76
Is there a dedicated person or team responsible for dissemination related activities within your organization? (1.7) (Yes, No, Unsure) **Most endorsed = Yes**			85
Does your organization have a formal communication/dissemination strategy? (1.11) (Yes, No, Not Sure) **Most endorsed = Yes**			77
Can you estimate the proportion of your own time that is dedicated to dissemination related activities? (1.8) (None, Less than 5% (i.e., less than two hours a week), Between 5 and 10%, Between 10 and 20%, Between 20 and 30%, Between 30 and 40%, Between 40 and 50%, More than 50%) **Most endorsed = Between 5 and 10%**			23
Why do you disseminate the findings of your research? (1.9) [top 3, most endorsed] **To raise awareness of the findings** **To influence practice** **To influence policy**			92 79 65
Do you ever refer to guidance or use a framework to plan dissemination-related activities? (1.12) (Always, Usually, Sometimes, Rarely, Never, Not sure) **Most endorsed = Sometimes**			37

At what stage in the research process do you usually plan dissemination-related activities? (1.13) (When the research is being formulated, At the proposal stage, During the research process, At the draft report stage, At the final report stage, At all stages of the process) **Most endorsed = At the proposal stage**			45
As part of your research dissemination, do you ever think about who needs to know about the findings and/or who is most likely to be influenced or will influence others? (1.14) (Always, Usually, Sometimes, Rarely, Never) **Most endorsed = Always**			48
As part of your research dissemination, do you ever consider how audiences or groups you would like to reach access, read, and use research findings? (1.15) (Always, Usually, Sometimes, Rarely, Never) **Most endorsed = Usually**			44
What methods do you usually use to disseminate research findings? (1.16) (top 3 most endorsed) **Academic journals** **Academic conferences** **Report to funders**			87 81 69
Do you ever produce research summaries or key messages that are written for specific audiences or groups (such as policy makers, or health and safety practitioners)? (1.18) (Always, Usually, Sometimes, Rarely, Never) **Most endorsed = Sometimes**			41
Monitor knowledge use	2.67	0.88	15
Evaluate outcomes	2.98	1.05	34
Do you ever evaluate the impact of your research? (1.19) (Always, Sometimes, Usually, Rarely, Never, Not Sure) **Most endorsed = Sometimes**			44
Overall, how do you rate your current research dissemination activities? (Excellent, Good, Adequate , Poor, Not sure) **Most endorsed = Good**			42
Sustain knowledge use	3.34	0.94	31-65

Table 5-2: Questionnaire items (including mean scores and agreement per item) according to the Lavis framework. SATORI (Gholami 2011) items are shaded grey; Wilson (2010b) Items are shaded green. (see Appendix C for detailed tables showing individual survey items and scores)

Domain / Item	Mean	SD	% agree
What			
What should be transferred	3.73	0.85	35-92
To whom			
To whom	3.58	1.04	53-74
As part of your research dissemination, do you ever think about who needs to know about the findings and/or who is most likely to be influenced or will influence others? (1.14) (Always, Usually, Sometimes, Rarely, Never) **Most endorsed = Always**			48
By Whom			
By Whom	3.51	1.00	28-90
Is the dissemination of research findings formally part of your role? (1.3) (yes, no) **Most endorsed =Yes**			65
Do you think the dissemination of research findings should be formally part of your role? (1.4) (yes, no) **Most endorsed =Yes**			79
Is there a dedicated person or team responsible for dissemination related activities within your organization? (1.7) (yes, no, unsure) **Most endorsed =Yes**			85
How			
How	3.51	0.86	13-88
Does your organization have a formal communication/dissemination strategy? (1.11) (yes, no, not sure) **Most endorsed =Yes**			77
Can you estimate the proportion of your own time that is dedicated to dissemination related activities? (1.8) (None, Less than 5% (i.e., less than two hours a week), Between 5 and 10%, Between 10 and 20%, Between 20 and 30%, Between 30 and 40%, Between 40 and 50%, More than 50%) **Most endorsed = Between 5 and 10%**			23
Do you ever refer to guidance or use a framework to plan dissemination-related activities? (1.12) (Always, Usually, Sometimes, Rarely, Never, Not sure) **Most endorsed = Sometimes**			37

At what stage in the research process do you usually plan dissemination-related activities? (1.13) (When the research is being formulated, At the proposal stage, During the research process, At the draft report stage, At the final report stage, At all stages of the process) **Most endorsed = At the proposal stage**			45
As part of your research dissemination, do you ever consider how audiences or groups you would like to reach access, read, and use research findings? (1.15) (Always, Usually, Sometimes, Rarely, Never) **Most endorsed = Usually**			44
What methods do you usually use to disseminate research findings? (1.16) (top 3 most endorsed) **Academic journals** **Academic conferences** **Report to funders**			87 81 69

With what Effect (3.11= mean SATORI score) 0.96 15-68

With what Effect	3.11	0.96	15-68
Why do you disseminate the findings of your research? (1.9) (top 3 most endorsed) **To raise awareness of the findings** **To influence practice** **To influence policy**			92 79 65
Do you ever evaluate the impact of your research? (1.19) (Always, Sometimes, Usually, Rarely, Never, Not Sure) **Most endorsed = Sometimes**			44
Overall, how do you rate your current research dissemination activities? (Excellent, Good, Adequate , Poor, Not sure) **Most endorsed = Good**			42

Table 5-2 shows the mapping of KTE activities items to the Lavis framework. All but eight survey items related to KTE activities could be mapped to the Lavis framework. The eight items asked about the importance of dissemination or about aspects of funding that did not fit within the Lavis framework. The self-report KTE activities considered by the survey items could be fit into all of the five elements of the KTA framework. In addition, the Wilson et al. (2010b) items in all sections of the Lavis framework reflected positive responses except the item about evaluating dissemination which was not well endorsed.

There were at least four items in every category described in the Lavis framework. All elements scored a mean score of the SATORI questions over three (of five). However the overall agreement or endorsement for items related to 'with what effect' was relatively low as compared with the other categories of the framework.

5.5 DISCUSSION

This paper explored how well KTE activities reported by work and health research staff fit two existing conceptual frameworks. Two KTE frameworks which have been much cited in the KTE literature were used in this study. The frameworks have both been used to guide KTE approaches. Using the self-report questions (from Wilson et al., 2010b and Gholami et al., 2011) it appears that most aspects of the KTA and Lavis frameworks are addressed reasonably well by work and health researchers. The only categories that did not achieve a mean SATORI score of at least three (out of five) were: action cycle monitor knowledge use and action cycle: evaluate outcomes. In both cases there was only a single item from the SATORI instrument to score in these categories. However it seems that these KTE activities are not well done by the work and health researchers in this sample.

5.5.1 SHOULD WORK AND HEALTH RESEARCHERS USE THE K TO A OR LAVIS FRAMEWORKS AND WHY?

The debate over use of conceptual frameworks for KTE is not limited to work and health research. There has been much attention directed to the conceptual underpinning of KTE strategies and approaches in a variety of research areas (Wilson et al., 2010a; Tabak et al., 2012; Visram et al., 2013; Nilsen, 2015; Colquhoun et al., 2014; Field et al., 2014; Hudon et al., 2014; Curran et al., 2011). While there is agreement that conceptual guidance is important there is debate about whether new frameworks or models should be created for each context (Colquhoun et al., 2014; Wilson et al., 2010a; Tabak et al., 2012).

As is the case for many research areas, work and health KTE activities should be guided by conceptual frameworks because they can help to organize and guide the development of KTE activities, map or link activities with desired outcomes, guide observation or evaluation of desired outcomes and guide the implementation of the KTE approach (Graham et al., 2007; Estabrooks et al., 2006; Maxwell 2013; Tabak et al., 2012 ICEBeRG, 2006). While there is no evidence that KTE approaches guided by theory are more effective than those not (Scott et al., 2012; Bhattacharyya et al., 2006) it is logical to consider that conceptual frameworks can help guide KTE approaches (Bhattacharyya et al., 2006; Tabak et al., 2012).

The third aim of this paper was to discuss which framework shows promise for work and health research and why. The two frameworks chosen for this exercise are much cited (Field et al., 2014; Graham et al., 2012; Cameron et al., 2010; El Jardali et al., 2011). This is not to suggest that these are the only frameworks to consider but rather to determine which of the two would be most suitable to work and health KTE activities.

The Lavis framework can be used by researchers (Wilson et al., 2010a) and was designed to provide an organizing framework for KTE strategies (Lavis et al., 2003). It has been used to guide KTE approaches for work and health (Reardon et al., 2006). It is also been used to summarise concepts and evidence related to KTE activities (Grimshaw et al., 2012). I found Lavis framework to be useful in guiding a dissemination plan and study targeting various workplace audiences (see Chapter 3 above).

The K to A framework is popular and has been used in many research areas (Field et al., 2014; Sinden and MacDermid 2014). However Wilson and colleagues (2010a) did not consider it designed for use by researchers. The review by Field et al (2014) reports, that while it is often referenced, it is far less often used completely. A recent study by Sinden and MacDermid (2014) used the K to A model to direct the development of a policy-based return to work tool in a workplace. They found that the K to A was useful for knowledge synthesis but not so for tool development. The authors report that the K to A lacked specific guidance in the action cycle related to 'adapting knowledge to local context'. The findings of the current study suggest it matches the KTE activities of work and health research staff slightly better than the K to A framework. This, taken together with reports from the literature, leads me to conclude that that the Lavis et al framework is more useful for work and health research.

A strength of the study is that the research staff respondents cover a broad range of work and health research and are located across three research institutes in North America. However there are some limitations to consider. The biggest limitation of the approach described here is the description of the research KTE activities. The items selected for the survey (Van Eerd 2016, Chapter 4) were chosen from existing questionnaires used to self-evaluate KTE activities. The survey items have been used in previous studies to describe and compare the KTE activities of

researchers (Wilson et al., 2010b; Gholami et al., 2013; Maleki et al., 2014). However it is possible that there are additional questions to consider which could help to capture all possible KTE activities.

We are also limited in the scoring of the items in that only one of the questionnaires had a scoring system that allowed combination. However the SATORI instrument has been used to compare KTE strategies between universities (Maleki et al., 2014). If the method of "applying" KTE activities to frameworks is considered useful then a consistent way of scoring all items should be considered in future research.

5.6 CONCLUSIONS

The self-reported KTE activities of work and health research staff represent all categories of two popular KTE conceptual frameworks. While not all elements are addressed equally well, it is positive that many elements are well addressed. However this does not mean that work and health research staff KTE activities are guided by conceptual frameworks, in fact, only one-third said they were.

Given the stated importance of the conceptual basis of KTE activities (Wilson et al., 2010a; Tabak et al., 2012; Visram et al., 2013; Nilsen, 2015; Colquhoun et al., 2014), it is likely good that work and health researchers are guided by conceptual frameworks. The Lavis framework (2003) is a good starting point to guide work and health KTE activities. Future research should examine whether KTE activities guided by conceptual frameworks have greater impact than those that are not so guided.

CHAPTER 6: GENERAL DISCUSSION

6.1 OVERALL FINDINGS

The three studies described in this thesis examined KTE in the area of work and health research. Simply put, KTE consists of preparing and disseminating research to those who can use it in practice or policy making. The notion of research to practice is important in work and health research (Laroche and Amara 2011; Schulte et al., 2003; Schulte 2006; Rondinone et al., 2010; Gillen 2010).

A review of the literature found a variety of KTE approaches that were used in work and health. The descriptions from the literature highlight that KTE is context dependent and that approaches should take into account audience, message and desired outcome/impact characteristics. The variety of target audiences and workplace contexts requires different outcomes, making it challenging to directly compare the various approaches. Despite the variety of approaches there were common elements related to audience, KTE activities and outcomes that can help to guide future KTE approaches. The various approaches were guided by conceptual frameworks many of which were newly created for the particular approach and context.

A dissemination study explored uptake and use of an evidence-based guide about initiating Participatory Ergonomics (PE) interventions. The study describes the dissemination of an evidence-based guide that workplace parties could use to initiate programs to reduce MSD injuries. PE is a popular approach to reducing MSDs; however, there are challenges to implementing PE programs. The study results show that various workplace-based OHS personnel and ergonomists downloaded the evidence-based tool, however many report they do not use them due to time constraints. Those that do use the tool report using for training, sharing with colleagues, and integrating into existing programs. Study participants reported that new

actions related to training, defining team responsibilities and suggesting program implementation steps were initiated.

In the study examining work and health KTE activities respondents reported engaging in various KTE activities that extended beyond the typical academic approaches of 'publish and present'. Work and health research staff felt confident about the level of interaction with knowledge users. However they reported that processes supporting KTE as well as the promotion and evaluation of research use could be improved.

In addition the KTE activities of work and health research staff appear to address all categories of two popular KTE conceptual frameworks (Graham et al., 2006; Lavis et al., 2003). However only one-third of work and health research staff KTE activities report they are guided by conceptual frameworks. In comparing the two conceptual frameworks, it appeared that the Lavis framework (2003) would be the better to guide work and health KTE activities.

There is support for using conceptual frameworks (models, theories) to direct KTE strategies and approaches (Wilson et al., 2010a; Tabak et al., 2012; Hudon et al., 2014; Curran et al., 2011). This support persists despite some reports that KTE approaches that are guided by conceptual frameworks are no more effective than those that are not Scott et al., 2012; Bhattacharyya et al., 2006). Conceptual guidance for KTE approaches is logical and likely to improve practice and evaluation (Tabak et al., 2012; Graham et al., 2006). There is no single KTE theory or framework (Estabrooks et al., 2006) that is universally agreed upon making it challenging to empirically test whether guided approaches are superior to those that are not guided. In fact Bhattacharyya et al., (2006) points out that the arbitrary choice of framework is part of the concern regarding whether conceptual guidance is desired. Colquhoun and colleagues (2014)

suggest that creating a simplified framework may be a necessary step to improve the use of conceptual guidance, however more work is needed to reach consensus. There is much support suggesting that conceptual guidance for KTE approaches is logical and likely to improve practice and evaluation (Tabak et al., 2012; Graham et al., 2006; Colquhoun et al, 2014; Hudon et al., 2014; Curran et al., 2011; Brownson et al., 2013).

The Lavis framework was used in all of the studies presented in this thesis. It provided a basis for comparing KTE approaches from the literature as well the KTE activities of work and health research staff. The Lavis framework also guided the dissemination approach for an evidence-based tool as well as the evaluation of tool use. It also provided the comparison to another popular conceptual framework, the KTA (Graham et al., 2006).

The Lavis framework is well suited to bring together the study findings of this thesis as it has been used to summarize the state of KTE by Grimshaw and colleagues (2012). Therefore to provide a summary and tie together the findings from the three studies I will use the Lavis (2003) conceptual framework: (1) What (information disseminated), (2) To Whom (target audience, and context), (3) By Whom (messengers), (4) How (KTE approach), (5) What effect (outcomes, impact) as it is used in each project.

6.2 METHODOLOGICAL DIRECTIONS

There are methodological limitations to consider in the studies that make up this thesis. This section will briefly describe the limitations of the studies and provide some directions for future research.

Narrative reviews are considered to have limitations when compared to systematic reviews. The limitations revolve around the systematic search of the literature and the approach to reducing bias in the synthesis of literature. The review of KTE approaches (Chapter 2) did not employ literature searches that strived to be comprehensive, therefore it is possible that there are some approaches that were not included in the review. However the searches were guided by systematic search methods available in the literature (McKibbon et al., 2010). The searches were also conducted in an iterative nature to build upon previous search results and capture as many approaches as possible. The reference lists of relevant documents were used to find new documents and guide the searches. The review also included grey literature. Systematic searches are more important when conducting reviews of intervention effectiveness or prognostic factors. The current review was focussed on describing KTE approaches in work and health, therefore missing documents will not likely lead to a biased representation of KTE.

The issue of bias is also a common concern raised about narrative reviews (Klassen et al., 1998). This concern is also more of an issue in reviews of effectiveness. The purpose of the review was not to suggest what the best KTE approaches are but rather to find and describe approaches and synthesize the common elements. It is important to point out that the documents reviewed were not all evaluation studies. Therefore this review was not limited by only examining evaluation studies. Given the nature of KTE this is most appropriate, I believe.

There is likely some bias in the synthesis based on the author's understanding of KTE, however the synthesis was guided by a popular definition and the use of the Lavis (2003) framework to provide a transparent synthesis much as a systematic review might. I strived to provide a great deal of detail for each approach – some will no doubt criticize the volume of information and

some will lament the lack of specific detail for each approach listed. I have tried to find a middle ground.

The key limitation of the dissemination study (Chapter 3) revolves around the fact that there is no denominator for our sample of stakeholders which limits the generalizability of the results. There is no evaluation of responder bias possible with this approach. However the sampling approach was tied to the dissemination method for an evidence-based guide. One purpose of the study was to determine if we could reach workplace-based audiences, and this was considered successful. It is important to note that it is only useful to enroll study participants that downloaded the guide and other sampling approaches may have been restrictive or lack the immediacy of capturing potential participants when they downloaded the guide.

A second limitation was the attrition over time for the survey responses. This prohibits a clear interpretation of guide use over time. A modified Dillman (2009) was used to reduce the attrition. The study respondents consistently pointed out that time was the main barrier to using the guide and that may well have been the reason they did not participate in later survey points.

In the research study of work and health research staff KTE activities the limitations also revolved around the sample and the cross-sectional survey approach used. The sample was a convenience sample of three research institutes that were known. The selection of research institutes that were similar was purposeful to allow for comparison while keeping the variability in setting to a minimum. This could potentially avoid simply concluding that the differences were due to the differences in organizational/institutional contexts (as did Laroche & Amara 2011; Tabak et al., 2012; Brownson et al., 2013).

A more unfortunate limitation was the low response rate for one organization which made it impossible to make direct comparisons between the organizations. It was necessary to combine all responses across organizations to maintain confidentiality/anonymity.

There is also a limitation related to the survey instruments used in the survey of work and health researchers. The instruments were adapted from previous studies that targeted public health and healthcare research. The instruments do not have well defined measurement properties, were based on self-assessment, and were chosen based on their ability to describe KTE approaches rather than contribute to evaluation. Description was a key objective of the thesis to provide a better baseline to design an evaluation of KTE in work and health.

Lastly some will consider the exploratory nature of the each of the studies of the thesis to be limitation. However the overall objective of the thesis was to be exploratory and provide a starting point for future research. The desire here was to better describe the activities and organizational environment for work and health research staff. This description will allow for future studies to better design studies to evaluate KTE. Better evaluation will be possible because we can target the types of KTE activities staff actually do, as well as the organizational supports and resources that staff report as important. The current studies will also allow for more parsimonious survey instruments with a focus on the issues that are important to researchers and knowledge users in work and health research.

In future research, it will be important to address the limitations noted above and build on the findings of the thesis studies. Future studies should consider the sampling frame and provide a clear denominator to allow for estimations of response bias and a better understanding of the sample characteristics. Considerable effort should be devoted to reducing attrition, study

instruments should be short to reduce the time burden for respondents as time is a key barrier to researcher and knowledge user audiences (Chapter 3 and 4). It may be necessary to conduct interviews rather than surveys to collect the data however this presents time burdens as well. In addition, the measurement properties of the data collection instruments should be established in research that goes beyond description. Qualitative approaches to data collection and analysis would be useful to provide deeper understanding of KTE approaches as well as the facilitators and barriers to KTE.

The following section (6.3) describes a number of research ideas. A specific study design idea is presented in section 6.3.4. I will not describe the design here other than to say that it is based on the Lavis (2003) framework and suggests that it would be important to control all aspects of KTE other than that under study. The idea is attractive but the cost of conducting such a study would likely be great.

6.3 FUTURE RESEARCH IDEAS

More research is necessary to better understand KTE for work and health. The studies presented in this thesis reveal a variety of KTE approaches that are applicable to work and health. The following section presents some research ideas and potential directions, they are not meant to be complete research proposals.

There has been little in the way of evaluating the effectiveness of the various KTE approaches used in work and health. Determining the effectiveness of KTE/dissemination approaches can be positioned in the Lavis (2003) framework: *how* to effectively disseminate research knowledge will be dependent on *what* the message is, *who* the audience is, *who* is disseminating, with what desired *effects*. A well designed study will have to take all of the Lavis framework elements into

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account. It may be possible to design and conduct a research project to determine the effectiveness of a KTE approach taking into account each framework element; however this would likely be a major undertaking requiring substantial resources and time. I suggest that there are also a number of smaller research studies which could be important prerequisites for larger effectiveness studies. The smaller, focussed studies can also be organized according to the Lavis framework.

6.3.1 STUDY IDEAS RELATED TO WHAT:
Should all work and health research findings be transferred and if not what are the criteria required to choose what gets transferred and what does not? A starting point for gathering criteria for choosing evidence for dissemination could be a focus group study. For example Gholami et al. (2011) suggests that "actionable messages" should be available in research studies for transfer. It would be interesting to conduct focus groups with work and health researchers to determine the criteria for "actionable messages" from research studies. In addition, it would also be useful to conduct focus groups with knowledge users to see if their view of actionable messages is similar to that of researchers.

Another question related to *what* is whether findings from single studies or only evidence from syntheses should be transferred? This is also a question that could be answered focus groups or interviews with work and health researchers. Grimshaw et al (2012) suggests that only healthcare/health services evidence from syntheses should be transferred. In work and health the available research is typically not from highly controlled studies as might be the case in healthcare. However there are synthesis methods that can be employed in work and health

research (Irvin et al. 2009). A consensus view about what constitutes research with "actionable messages" from a broad selection of work and health researchers would be valuable.

6.3.2 STUDY IDEAS RELATED TO TO WHOM:

While the findings from the literature review in Chapter 2 and the survey in Chapter 4 have suggested a variety of target audiences, it is not clear that all potential important audiences for work and health research have been identified. Therefore it would be useful to survey or interview a broader selection of work and health researchers as well as work and health practitioners, knowledge transfer personnel and knowledge users asking about key audiences for work and health research findings. A key aspect of such a study would be to determine who the decision makers are that can make changes related to work and health. A recent study found that occupational health and safety knowledge users (KU) reported that they use research in their decision making (Van Eerd et al., 2016). Future research should consider a broader audience and seek to determine who the key decision makers are.

6.3.3 STUDY IDEAS RELATED TO BY WHOM:

One key question arising from the thesis studies is whether researchers should be responsible for transferring research knowledge to target audiences? The findings from Chapter 2 and 4 suggest that researchers were consistently involved in the dissemination of research findings. It would be useful to conduct a study to determine if researchers are in fact the best transfer agents. This type of study might be possible in work and health institutes that have knowledge transfer staff. A study could be designed where the same research findings (*what*) could be disseminated to similar audiences (*to whom*) using two different transfer agents (*by whom*: researchers and KTE staff) examining the same outcomes (*effects*).

6.3.4 STUDY IDEAS RELATED TO HOW:

There are many questions to consider for future study related to how to transfer knowledge. Rather than provide a potentially long list of questions here I will focus on suggesting a study design. One could choose a single approach from Chapters 2, 3, 4 or develop a new approach and design an effectiveness study. The design should allow the message (W*hat*), audience (*To whom*), transfer agent (*By whom*), and outcomes (E*ffects*) were kept constant so that there was some confidence that the approach could be evaluated. This could be done using a randomized controlled trial design if the requisite funding and willing study participants were available. In this study KTE would be considered as an intervention to be evaluated. One area, which arises from Chapter 5, where such a study design could be utilized, is to explore whether KTE activities guided by conceptual frameworks have greater impact than those that are not so guided.

6.3.5 STUDY IDEAS RELATED TO WITH WHAT EFFECT:

Another important element to determine in future research is what *effects* to consider as outcomes or impacts of KTE approaches. The impacts of KTE approaches can be challenging to determine because they can vary according to the message and the audience. Part of the challenge in determining the effects of KTE approaches may also be related to the fact that KTE is often not considered a research project i.e., it is not the intervention under study. One research idea to address impact would be to conduct a survey study (similar to Chapter 4) with a larger sample of work and health researchers from more jurisdictions focusing on the impacts of KTE. Morton (2015) recently described a Research Contribution Framework (RCF) which may provide a starting point for such research. The framework describes three main concepts:

research uptake (users engage with research), research use (users act upon research) and research impact (changes are made based on research). I think it would be useful to engage with work and health researchers to determine their awareness of these concepts and move towards consensus on how these concepts could be used to determine appropriate impacts of KTE approaches.

6.4 A PRACTITIONER'S GUIDE TO KTE IN WORK AND HEALTH

6.4.1 WHAT SHOULD BE TRANSFERRED?

The studies in this thesis focused on the dissemination of research evidence which is consistent with common definitions of KTE (Graham et al., 2006; Strauss et al., 2009; Strauss et al., 2011; Thompson et al., 2006). The literature review (Chapter 2) revealed that the research evidence often came from single studies, translated findings (lay language - from multiple studies or syntheses), and evidence-based innovations. The dissemination study (Chapter 3) used translated knowledge in the form of an evidence-based guide. Single studies and translated knowledge were described by work and health research staff in the KTE evaluation study (Chapters 4 and 5).

The knowledge transferred is variable as it should be tailored to the primary target audience(s). Grimshaw et al. (2012) argue that results from single studies should not be transferred unless the target audience is researchers or research funders. They argue that in healthcare findings from a single study do not provide sufficient evidence for action. In the current thesis studies, translated findings appeared to be the predominant form of knowledge for transfer.

6.4.2 TO WHOM SHOULD RESEARCH KNOWLEDGE BE TRANSFERRED?

The target audiences for work and health research knowledge appear to be quite varied. The KTE approaches described in the literature (Chapter 2) reported a number of target audiences

depending on knowledge to be transferred and the expected impacts. Most of the approaches included workers as one of the target audiences. The dissemination study (Chapter 3) also targeted workplace-based audiences including workers and OHS practitioners. The target audiences were not explicitly described by work and health research staff (Chapters 4 and 5) but each of the research organizations considered a variety of stakeholders as knowledge users.

Grimshaw and colleagues (2012) provide a categorization of target audiences that can be applied to work and health with minimal modification (see Table 6-1). Having various target audiences is a common challenge of KTE approaches. KTE approaches are context dependent with messages tailored for specific audiences. If there are multiple audiences it may be necessary to create multiple versions of the message for dissemination.

Table 6-1: Potential target audiences modified from healthcare (Grimshaw, 2012) and targeted in thesis studies.

Potential target audiences for Healthcare (Grimshaw, 2012)	Work and Health audiences	Targeted in thesis studies
Consumers	Workers	YES (Chapters 2, 3, 4, 5)
Professionals	OHS professionals/practitioners	YES (Chapters 2, 3, 4, 5)
Local administrators	Worker managers or supervisors	YES (Chapters 2, 3, 4, 5)
National policy makers	National policy makers	YES (Chapters 2, 4, 5)
Regulatory bodies	Regulatory bodies	YES (Chapters 2, 4, 5)
Industry	Workplaces and industry associations	YES (Chapter 2)
Research funder	Research funders	YES (Chapters 2, 4, 5)
Researchers	Researchers	YES (Chapters 2, 4, 5)

6.4.3 BY WHOM SHOULD RESEARCH KNOWLEDGE BE TRANSFERRED?

A variety of individuals were identified as the messenger in the thesis studies. The KTE approaches described in the literature (Chapter 2) most often involved researchers in transferring knowledge but only rarely were they the sole messenger. Other identified messengers included knowledge brokers, OHS practitioners, workplace personnel, and KTE/communications specialists (usually with research organization involvement). The dissemination study (Chapter 3) employed researcher, knowledge broker and OHS practitioners as messengers. The focus of the KTE evaluation study (Chapters 4 and 5) was on research organizations and the role of researchers, research assistants and KTE/communications staff as messengers.

The preponderance of researcher involvement may, in part, be a result of the focus of the three thesis studies. The peer-reviewed literature was a major source of documents describing KTE approaches in work and health. Given that a one of the main activities of researcher is to publish it may be that the studies that make it into the peer-reviewed literature over represent the role of the research in KTE. The dissemination study was such a research study targeted for peer-review publication. The focus on research organizations in the KTE evaluation study meant that the research staff role in KTE was emphasized. Though interestingly, 79% of the research staff reported that dissemination should be formally part of their job role. A similarly high proportion of researchers also reported they felt that they have a formal role in dissemination in other studies (Wilson et al., 2010b; Laroche and Amara 2011). While these findings do not mean that researchers are necessarily the best messengers, it does suggest that they are willing and should be involved in KTE approaches.

6.4.4 HOW SHOULD RESEARCH KNOWLEDGE BE TRANSFERRED?

There are multiple ways that research knowledge can be transferred. Since KTE approaches are context dependent the transfer activities should be tailored to the message, the audience(s), and

the desired outcomes or impacts. The findings of the literature review (Chapter 2) supports that this is the case, with multiple KTE activities described. Most often multiple activities were used in any given approach. There did appear to be an emphasis on activities that allowed direct contact between the messenger and the audience such as face-to-face meetings, workshops, and presentations.

The dissemination study (Chapter 3) used more passive KTE activities with dissemination via website, email, and through stakeholder contacts as part of a research study. Research staff (Chapters 4 and 5) also reported that they used multiple dissemination methods highly endorsing their use of academic journals and conference presentations, reports to funders and other audiences, as well as face-to-face meetings and newsletters. Media/press releases, workshops, networking and email alerts were also mentioned but not as well endorsed. The variety of dissemination activities reported by work and health research staff is driven, in part, by the variety of audiences that they try to reach.

Findings from recent studies in healthcare and public health suggest that, although researchers feel that dissemination and KTE is important they may not engage consistently in KTE activities (Wilson et al., 2010b; Brownson et al., 2012; Gholami et al., 2013; Maleki et al., 2014). However Laroche and Amara (2011) noted that Canadian OHS researchers reported engaging with knowledge users, spending time adapting knowledge for transfer, and thinking about the audience when conducting research (Laroche and Amara 2011).

6.4.5 WITH WHAT EFFECT SHOULD RESEARCH KNOWLEDGE BE TRANSFERRED?
There are a multitude of possible effects, outcomes or impacts possible in KTE approaches related to work and health research. The literature review (Chapter 2) revealed many different

outcomes/impacts described in the various KTE approaches. The variety of target audiences and

workplace contexts requires different outcomes. The most often mentioned effects/impacts

proposed or evaluated related to knowledge uptake (including access to knowledge), knowledge

use (conceptual, instrumental, strategic), or practice change (innovation adoption).

The dissemination study (Chapter 3) focussed on the use of an evidence-based tool and

operationalized use as training, sharing, keeping up to date, initiating or integrating practices, or

new actions. This allowed me to comment on the direct influence of the evidence-based tool.

The research staff in the KTE evaluation study (Chapters 4 and 5) reported that they considered

raising awareness of findings, influencing practice and policy and promoting public

understanding of OHS as most important impacts of research dissemination. Overall the

respondents reported that knowledge use and the barriers to knowledge use were important to

understand in their roles.

6.5 CRITICAL REFLECTIONS ON A THESIS ABOUT KTE – FROM A WORK AND HEALTH RESEARCHER

This section is a critical reflection on the thesis experience/learnings which provides an

integration of the individual chapters. There are varying definitions of critical reflection (Fook et

al., 2006; Lucas, 2012). Here the critical reflection is about discovering, examining and

challenging assumptions – which is consistent with many definitions. My reflection is also in-

line with an approach called "critical incident analysis" where one can reflect on past experience

to change future action (Fook, 2015). I will reflect on the entire experience of my PhD thesis

research projects (about KTE in work and health) and what I learned with a focus on integration across the chapters.

6.5.1 My background and perspective

My area of research interest is work and health broadly. More specifically I am interested in exploring and evaluating the prevention of workplace injuries and disability especially those related to musculoskeletal disorders (MSD). I strongly believe that using the best available evidence is an important part of designing and implementing workplace-based prevention programs/interventions. Research evidence is one type of evidence that I feel should be considered but I also believe that practice evidence and the values of end users should be incorporated.

I have been working in the area of work and health research for almost 20 years. I consider myself as a post-positivist researcher. However I can say that I am not a purist (if that is even possible as a post-positivist) and that my views are inclusive of the concept that the world contains unequal power balances, and the possibility that people may not consider that an objective truth exists. I remain open to non-fundamentalist views from various epistemological perspectives. Perhaps these views place me more as a pragmatist, however I am not convinced of that, as I have some difficulty with the concept of "truth is what works" (Tashakkori and Teddlie, 1998). I am however a practical person and tend to look for find what works – often without considering how I might find or evaluate it (epistemologically speaking).

In my work as a researcher in work and health I came to appreciate the importance of KTE to get research into practice. I was introduced to a framework by Lavis (2003) that helped to guide KTE through five questions related to what is to be transferred, to whom, by whom, how and with what effect (see Chapter 1, p 6-7 for details). I was encouraged to participate in KTE and

use the Lavis framework to guide my efforts. My early experiences with KTE work set up a desire to better understand the practice of KTE.

I assumed that an evidence-based approach to KTE was the best way to guide KTE activities. In this I considered that KTE should be planned according to the best available evidence and by theory or conceptual frameworks (such as Lavis (2003)). An important aspect of planning KTE was determining the outcomes (effects – according to Lavis (2003)) of interest for researchers and knowledge users. In my opinion the evidence to guide KTE activities could come from research, KTE practitioners, or knowledge users. It was often challenging to determine useful and measureable KTE outcomes from the available research. However, long standing relationships with knowledge users often provided me with indications of outcomes.

6.5.2 MY EXPERIENCE
The literature review (Chapter 2) was a research project that I began early in the thesis process but took the much energy and time to complete. I was engrossed and happily looking for and finding a variety of literature that, while challenging to find (relative to my experience with systematic reviews) was extremely rewarding to me when I found it. Many documents described

unique KTE approaches and often led me to more documents to consider. This was not particularly surprising but it was time consuming. I suspected that the literature would reflect variety but I assumed that I could find some common ground – some key elements or aspects underlying each approach that were consistent and could be described.

In the end I felt there were some commonalities but not as much as I had hoped. In particular there was great variability in how the literature reported on the "effects or outcomes" of KTE (the "with what effect" category of the Lavis framework). From my own KTE experience I could

appreciate that it is difficult to define specific outcomes from KTE activities, however I assumed that each approach would have a reasonably well defined outcome related to effect. This was not the case.

My feeling about the need for a reasonably specific outcome/effect was related to the fact that I had also started the dissemination project (Chapter 3) rather early on in the thesis process. In that project, one aim was to better understand what effects (from a KTE approach) we should be looking for in workplaces. To that end, workplace-based respondents were asked what they did (how they used) with an evidence-based guide they downloaded. The respondents reported a variety of ways they used the guide which were considered the outcomes of the KTE approach – the effect of KTE (in Lavis terminology). This was exciting, the project showed that an evidence-based guide could be disseminated to workplace-based audiences and that about 40% of survey respondents used the guide in some way. There were barriers to use of the guide, mostly well-known ones like time and resources, but there was a description of use that we could build upon in future KTE projects. Issues related to responder bias and attrition were present and would have to be overcome in future research but a feasible dissemination strategy was described.

The final research project of my thesis, examining the KTE approaches of work and health research staff (Chapters 4 and 5) was started well after the review and dissemination projects. It was challenging to get funded and once funded there were numerous challenges to get access to the work and health research community. While the challenges were not particularly unusual nor were they insurmountable, they were time consuming. However, I was excited to survey a subset of work and health research staff coming from similar research organizations to find out what dissemination and KTE activities they engage in. When planning this study I was also quite

excited to find two survey instruments previously created (Wilson et al., 2010; Gholami et al., 2011), that I felt could be used to find out about dissemination and KTE. The instruments were relatively simple and straightforward and I considered them useful for an exploration of KTE approaches in work and health research. In this study I was gratified to find that respondents felt that KTE was important and that two thirds of them considered KTE to part of their job. However it was not so clear how 'planful' respondents were about their KTE activities. The respondents reported thinking about their audience(s) but little else seemed consistently planned – even the planning was not always done at early stages leaving one to wonder if KTE was added on later. Many respondents also reported they did not use frameworks or theory to guide their KTE activities, perhaps another indicator of a lack of planfulness.

6.5.3 INTEGRATION – WHAT I LEARNED

My assumptions about planning KTE activities with specific outcomes were challenged in the overall experience of my thesis projects. Work and health research staff were not as planful about KTE as I had assumed – even those from similar research institutes all with some emphasis on KTE. Furthermore a review of the literature revealed great variability in the category outcome (effect) category of KTE. As well, as I reflect, the dissemination project provides a different view about outcome or effect. Workplace-based knowledge users reported on use that extended beyond the dissemination outcomes that research staff and the literature often consider. The research staff described dissemination and ways to get the research findings to their audience(s) but did not concern themselves as much with how research was used.

We can classify types of knowledge use but perhaps this is still too high a level and more emphasis should be placed on the subcategories under conceptual, instrumental and strategic use (Weiss 1979). Weiss (1981) alluded to this by pointing out that some of the differences between

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these types of knowledge use are somewhat arbitrary. She suggests that in the real world of implementation there may be a continuum across these types of use as it may be difficult to isolate any single type of use. She further explains that to better understand the concept of use there is a need to better define what is used, how direct is the derivation (i.e. does it come directly from the original study or report), by whom is it used, how immediate is the use, and how much effect is required.

While I was aware of this view from Weiss (1979, 1981), as I consider it now I realize that my assumption of planning with meaningful outcomes probably needs to change. In that we need a better understanding of the types of use that end users consider important. This fits with my desire to plan and rigorously evaluate KTE approaches. This is also consistent with my post-positivist stance – in that using theoretical guidance (to develop and evaluate KTE) is strongly linked to post-positivist perspectives (Ryan 2006). The thesis project experience has strengthened my desire to use the Lavis framework but I will continue to explore other frameworks and the practicalities of KTE.

My assumptions about KTE outcomes have been challenged; from my thesis experience it appears that research staff focused heavily on dissemination with less understanding about knowledge users' needs regarding knowledge use. The focus on dissemination could be related to the reasons the research staff reported for engaging in dissemination and knowledge transfer. The reasons most often reported were: raising awareness, influencing practice and policy, and promoting understanding. If the purpose of dissemination centers around awareness, influence, and understanding rather than implementation of changes then it makes sense that dissemination would be the focus of research staff. My opportunities to engage directly with knowledge users have reinforced the assumptions I had about important KTE outcomes. However the thesis

projects taken as a whole suggest to me that there is possibly more of a gap in the understanding of relevant outcomes from KTE activities between researchers and knowledge users than I had considered. It is also possible that the focus on dissemination is guided by research funding agencies as they request, suggest or require KTE activities from successful research grants. It is unclear whether the activities from funding agencies consider a balanced view of researcher and knowledge user KTE outcomes. Future research (as noted above, see section 6.3.5) should focus on KTE outcomes that are important to both researchers and knowledge users.

6.6 CONTRIBUTIONS TO THE LITERATURE ABOUT KTE IN WORK AND HEALTH

The findings of the thesis studies will be useful to scientific/researcher audiences as well as health and safety practitioners, and workplace parties. The results advance our understanding of KTE in work and health. A comprehensive literature review (Chapter 2) presents and summarizes a broad selection of KTE approaches germane to work and health research. The description of the various approaches using a common framework allows both researchers and KTE practitioners to select or adapt approaches for their own purposes. A further contribution arises from the extraction of common elements from the various approaches which would allow practitioners and researchers to more easily develop KTE approaches. The review also highlights the various conceptual frameworks that have been used to guide KTE approaches in work and health. This knowledge is valuable to both practitioners and researchers when considering their own KTE. The intent is to publish the chapter in a peer-reviewed journal.

A study examining the dissemination of an evidence-based guide has been published in the peer-reviewed journal Ergonomics (Chapter 3). This contribution to the literature can help to guide future dissemination approaches for practitioners and researchers. The dissemination approach

described in the study shows that it is possible to reach workplace-based audiences. The findings highlighted important and challenging barriers mostly related to lack of time that prevented the use of research evidence. However the study showed that an evidence-based tool was used by workplace audiences to integrate into existing practice and guide training.

The survey study assessing the KTE activities of work and health research staff (Chapter 4) provides a contribution to the knowledge of KTE practices. The study findings reveal practical information about what research staff report they do well as well as what they do not do. In addition the study explored barriers to KTE activities from individual as well as organizational perspectives. These findings are valuable to practitioners and researchers in considering and guiding their own KTE activities. In addition, a close look at how well the self-reported KTE activities match with two common conceptual frameworks (Chapter 5) helped to show that KTE activities could be guided by frameworks. A comparison of the frameworks with respect to self-report KTE activities and the literature suggests one framework that can be used by work and health researchers. This will be of great use to practitioners and researchers to guide KTE practice and also potentially aid in the evaluation of KTE approaches.

6.7 CONCLUSIONS
It is abundantly clear that there is no "one" KTE approach for work and health research. There are a number of KTE approaches for transferring work and health research knowledge, often targeting workers and OHS practitioners that can have impacts on knowledge use and practice change. These approaches can be used along-side or in addition to the traditional publish and present approaches that target researcher audiences. The ultimate goal of work and health research is to reduce the number and burden of workplace injury and disability. This is where the

idea of research to practice applies. Perhaps the key message from the thesis is that work and

health research should employ multiple KTE approaches that are tailored to the target

audience(s), the message, and the desired outcome/impact. Following a conceptual framework

such as one developed by Lavis and colleagues (2003) can help to develop the KTE approaches

to meet the needs of work and health audiences.

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APPENDICES

APPENDIX A: SEARCH TERMS AND STRATEGY FOR REVIEW OF KTE STUDIES IN WORK AND HEALTH (CHAPTER 2)

The search strategy focused on keywords for workplaces (worker, workplace, occupational etc) combined with knowledge transfer (knowledge trans*, knowledge exchange etc). The search strategies were guided by McKibbon (2010) and combined KTE terms using the OR Boolean operator and then combining these with terms related to work and health with the AND Boolean operator. In addition, reference lists from relevant articles were searched for relevant articles. The literature search strategies were guided by the CIHR definition: "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians …" (CIHR, 2015).

The development of the searches was guided by terms recommended in the following sources on KT:

- Graham ID. Knowledge translation at CIHR. Part 1: What is Knowledge Translation? 2007 [cited 2009 Aug 4] Available from http://www.cihr-irsc.gc.ca/e/33747.html

- Estabrooks CA, Derksen L, Winther C, Lavis JN, Scott SD, Wallin L, Profetto-McGrath J. The intellectual structure and substance of the knowledge utilization field: a longitudinal author co-citation analysis, 1945 to 2004. Implementation Science. 2008 Nov 13;3:49. [Additional file 1: Search strategy. Available from http://www.implementationscience.com/content/3/1/49/additional]

- WhatisKT. KT terms [wiki]. [cited 2009 July 20] Available from http://whatiskt.wikispaces.com/KT+Terms

- McKibbon KA, Lokker C, Wilczynski NL, Ciliska D, Dobbins M, Davis DA, Haynes RB, Straus SE. A cross-sectional study of the number and frequency of terms used to refer to knowledge translation in a body of health literature in 2006: a Tower of Babel? Implementation Science. 2010 Feb 12;5:16.

A number of focussed literature searches were done in a variety of electronic databases (Medline, Embase, ERIC, Social Sciences, Web of Science, and Business Source Premier) as well as hand-searching a database maintained at the Institute for Work & Health (IWH) for KTE research (including results from a search on KTE evaluation Van Eerd et al, 2011). The literature search covered a variety of electronic databases in an attempt to search the literature broadly. The search was not limited to English language but only English language articles and reports were reviewed.

The review focus was on KTE approaches that disseminated or exchanged research evidence (or information) that could be used at the workplace to improve the health of workers regardless of jurisdiction. The definition focuses on the transfer or dissemination of research evidence therefore not on knowledge management or organizational knowledge use (Walshe & Rundell, 2001; Nonaka et al., 2006).

APPENDIX B: RESEARCHER SURVEY QUESTIONS FOR CHAPTERS 4 AND 5

Part 1: Your KT Activities

1.1 Please select a title/role that best fits your work within your research organization:

○ Independent researcher (1)

○ Research assistant/associate (2)

○ Knowledge transfer specialist (3)

○ Other (Specify): (4) _____

1.2 How many years have you been in this role?

1.3 Is the dissemination of research findings formally part of your role?

○ Yes (1)

○ No (2)

1.4 Do you think the dissemination of research findings should be formally part of your role?

○ Yes (1)

○ No (2)

1.5 How important to your own research is the process of dissemination?

○ Very important (1)

○ Important (2)

○ Somewhat important (3)

○ Not important (4)

○ Not sure (5)

1.6 How important is the process of research dissemination to the work of your organization?

○ Very important (1)

○ Important (2)

○ Somewhat important (3)

○ Not important (4)

○ Not sure (5)

1.7 Is there a dedicated person or team responsible for dissemination related activities within your organization?

○ No (1)

○ Not sure (2)

○ Yes. If yes please give details in the box below: (3) _____

1.8 Can you estimate the proportion of your own time that is dedicated to dissemination related activities?

○ None (1)

○ Less than 5% (i.e., less than two hours a week) (2)

○ Between 5 and 10% (3)

○ Between 10 and 20% (4)

○ Between 20 and 30% (5)

○ Between 30 and 40% (6)

○ Between 40 and 50% (7)

○ More than 50% (8)

1.9 Why do you disseminate the findings of your research? Please select all that apply.

❑ To raise awareness of the findings (1)

❑ To stimulate discussion/ debate (2)

❑ To influence policy (3)

❑ To influence practice (4)

❑ To transfer research to practice (5)

❑ To justify public funding (6)

❑ To attract future funding (7)

❑ To raise the organisational profile (8)

❑ To improve your own communication (9)

❑ To promote public understanding of occupational health and safety (10)

❑ To satisfy contractual obligations (11)

❑ Other (please give details in the box below) (12) _____

1.10 Which of the reasons given for disseminating the findings of your research are the most important?

❑ Most important (1) _____

❑ Second most important (2) _____

❑ Third most important (3) _____

1.11 Does your organization have a formal communication/dissemination strategy?

○ Yes (1)

○ No (2)

○ Not sure (3)

1.12 Do you ever refer to guidance or use a framework to plan dissemination-related activities?

○ Always (1)

○ Usually (2)

○ Sometimes (3)

○ Rarely (4)

○ Never (5)

○ Not sure (6)

1.13 At what stage in the research process do you usually plan dissemination-related activities?

○ When the research is being formulated (1)

○ At the proposal stage (2)

○ During the research process (3)

○ At the draft report stage (4)

○ At the final report stage (5)

○ At all stages of the process (6)

1.14 As part of your research dissemination, do you ever think about who needs to know about the findings and/or who is most likely to be influenced or will influence others?

○ Always (1)

○ Usually (2)

○ Sometimes (3)

○ Rarely (4)

○ Never (5)

1.15 As part of your research dissemination, do you ever consider how audiences or groups you would like to reach access, read, and use research findings?

○ Always (1)

○ Usually (2)

○ Sometimes (3)

❍ Rarely (4)

❍ Never (5)

1.16 What methods do you usually use to disseminate research findings? Please select all that apply.

❑ Academic journals (e.g., Scandinavian Journal of Work an Environmental Health) (1)

❑ Professional journals (e.g., Professional Safety) (2)

❑ Report to funders (3)

❑ Full report (paper) (4)

❑ Full report (web access) (5)

❑ Summary report (paper) (6)

❑ Summary report (web access) (7)

❑ Press releases (8)

❑ Newsletters (9)

❑ Policy briefing paper (10)

❑ Email alerts (11)

❑ RSS feeds (12)

❑ Targeted mailings (13)

❑ Academic conferences (14)

❑ Other conferences (15)

❑ Seminars (16)

❑ Workshops (17)

❑ Face to face meetings (18)

❑ Networking (19)

❑ Media interviews (20)

❑ Research registers (21)

❑ CD-ROMs (22)

❑ Other (please give details in the box below) (23) _____

1.17 Of the methods you use to publish and disseminate the research findings, which do you think generally have the most impact?

1.18 Do you ever produce research summaries or key messages that are written for specific audiences or groups (such as policy makers, or health and safety practitioners)?

○ Always (1)

○ Usually (2)

○ Sometimes (3)

○ Rarely (4)

○ Never (5)

1.19 Do you ever evaluate the impact of your research?

○ Always (1)

○ Usually (2)

○ Sometimes (4)

○ Rarely (5)

○ Never (6)

1.20 Overall, how do you rate your current research dissemination activities?

○ Excellent (1)

○ Good (2)

○ Adequate (3)

○ Poor (4)

○ Not sure (5)

1.21 Are there any methods of disseminating research findings that you would like to use but have been unable to do so?

○ No (1)

○ Not sure (2)

○ Yes. If yes, please give details in the box below: (3) _____

Part 2: Knowledge Translation Self Assessment Tool for Research Institutes (SATORI)

SECTION ONE: SETTING THE RESEARCH QUESTIONS Do we identify decision makers' research needs and convert them into research questions?

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.1.1 In our organization there is a comprehensive list of knowledge users or organizations that can use our research results. Comments: (1)	○	○	○	○	○
2.1.2 Information about our researchers' projects and topic areas is made available to other organizations through the web or electronic databases. Comments: (2)	○	○	○	○	○
2.1.3 Regular meetings are held with knowledge users for the exchange and identification of research priorities Comments: (3)	○	○	○	○	○
2.1.4 Knowledge users know which fields our organizations' research covers. Comments: (4)	○	○	○	○	○
2.1.5 When preparing for utilization, our organization holds regular and purposeful meetings with knowledge users for cooperation opportunities(establishment of a knowledge network). Comments: (5)	○	○	○	○	○

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.1.6 A website and/or data base is available in our organization for identifying the research priorities of other organizations. Comments: (1)	❍	❍	❍	❍	❍
2.1.7 Our organizations' research priorities are determined through meetings with knowledge users. Comments: (2)	❍	❍	❍	❍	❍
2.1.8 Our organizations' research priorities are compiled and an up-to-date list is available to our researchers. Comments: (3)	❍	❍	❍	❍	❍
2.1.9 Relative to our organization's internal budget for research, the amount of external funding is such that researchers are encouraged to use external funding. Comments: (4)	❍	❍	❍	❍	❍
2.1.10 Compared to the internal process, the external grant securing process is such that researchers are encouraged to use external funding. Comments: (5)	❍	❍	❍	❍	❍
2.1.11 Our researchers can access external funding easily and in a timely manner for research projects Comments: (6)	❍	❍	❍	❍	❍
2.1.12 Our researchers have incentives for securing external funding. Comments: (7)	❍	❍	❍	❍	❍

SECTION TWO: KNOWLEDGE PRODUCTION Do we produce useful evidence for decision making?

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.2.1 Research projects that result in production of 'actionable messages' with a high level of evidence (such as systematic reviews and/or guideline or tool development activities) are considered priorities for funding and completion. Comments: (1)	❍	❍	❍	❍	❍
2.2.2 Knowledge users regularly participate in the design and/or conduct of research projects. Comments: (2)	❍	❍	❍	❍	❍
2.2.3 Our impression is that knowledge users trust the quality of the research done in our organization. Comments: (3)	❍	❍	❍	❍	❍
2.2.4 There is an internal review mechanism (quality assurance) to ensure the quality of the research process. Comments: (4)	❍	❍	❍	❍	❍
2.2.5 Quality control is carried out while research is being conducted (internally or externally). Comments: (5)	❍	❍	❍	❍	❍

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.2.6 The time between 'presentation of the research proposal' and 'beginning of the research' is reasonable (the process of reviewing the research proposal). Comments: (1)	❍	❍	❍	❍	❍
2.2.7 While designing the research proposal and conducting the projects, researchers are aware that applied projects should be completed in a timely manner. Comments: (2)	❍	❍	❍	❍	❍
2.2.8 The time between 'end of research' and 'finalization of results in the form of a report' is reasonable (the process of presentation of research results). Comments: (3)	❍	❍	❍	❍	❍
2.2.9 In research proposals (with knowledge users involvement) the budget includes funds for disseminating the results (other than being published in peer-review journals and/or attending conferences). Comments: (4)	❍	❍	❍	❍	❍
2.2.10 A dissemination plan is developed at the research proposal stage. Comments: (5)	❍	❍	❍	❍	❍

SECTION THREE: KNOWLEDGE TRANSFER Do we have appropriate means for disseminating the organizations' research results to their target audiences?

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.3.1 Our organization has a process to determine which research results can be transferred (keeping in mind that not every research result is transferable) to the target audiences (apart from transferring to other researchers and funders). Comments: (1)	❍	❍	❍	❍	❍
2.3.2 In our organization, all research results are peer reviewed prior to knowledge transfer activities. Comments: (2)	❍	❍	❍	❍	❍
2.3.3 Researchers are familiar with knowledge transfer and how to perform it. Comments: (3)	❍	❍	❍	❍	❍
2.3.4 Our researchers convert their research results into actionable messages appropriate to the target audience. Comments: (4)	❍	❍	❍	❍	❍
2.3.5 Our researchers have communication skills for knowledge transfer. Comments: (5)	❍	❍	❍	❍	❍
2.3.6 Our researchers can use the services of those familiar with knowledge transfer (internally or externally). Comments: (6)	❍	❍	❍	❍	❍
2.3.7 Our researchers have the necessary personnel and financial resources for preparing content appropriate to the target audience. Comments: (7)	❍	❍	❍	❍	❍

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.3.8 Our researchers have the necessary tools (technology or skills) for preparing content appropriate to the target audience. Comments: (1)	❍	❍	❍	❍	❍
2.3.9 Our researchers have adequate time for preparing content appropriate to the target audience. Comments: (2)	❍	❍	❍	❍	❍
2.3.10 Our researchers have the necessary incentives for performing knowledge transfer (rewards, appropriate promotion rules). Comments: (3)	❍	❍	❍	❍	❍
2.3.11 Knowledge transfer and utilization of research results exist in our organizations' general program of research methodology training. Comments: (4)	❍	❍	❍	❍	❍
2.3.12 A list of all potential stakeholders or research users is prepared for each research project. Comments: (5)	❍	❍	❍	❍	❍
2.3.13 The necessary structure (e.g. a department) and/or personnel is available for strengthening knowledge transfer in our organization. Comments: (6)	❍	❍	❍	❍	❍
2.3.14 Our organizations' research managers are aware of the researchers KT needs , and provide support or direction in this area. Comments: (7)	❍	❍	❍	❍	❍

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.3.15 The format of peer review journals is such that the knowledge users can easily determine the actionable messages when applicable. Comments: (1)	❍	❍	❍	❍	❍
2.3.16 The time between article submission and its publication in journals is such that the interventions that results from research can be implemented in reasonable time by knowledge users. FOOTNOTE: The authors are aware that the journals that usually publish articles may be outside the organization, but it may be possible to introduce appropriate interventions in this field; for example the decision to publish a journal, or to encourage and support publication in electronic journals. Comments: (2)	❍	❍	❍	❍	❍
2.3.17 The format of research projects' final reports are such that decision makers can easily determine the actionable message when applicable. Comments: (3)	❍	❍	❍	❍	❍
2.3.18 Researchers can provide the results of their research through the web and/or electronic databases. Comments: (4)	❍	❍	❍	❍	❍
2.3.19 Meetings are held for presentation of research results to knowledge users. Comments: (5)	❍	❍	❍	❍	❍
2.3.20 Our organization has regular communications with the media and knowledge users for transfer of research-based evidence. Comments: (6)	❍	❍	❍	❍	❍

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.3.21 Intellectual property rights exist which support researchers who help disseminate research results prior to their publication in journals. Comments: (1)	❍	❍	❍	❍	❍
2.3.22 Evidence-based decision making is among the research areas in our organization. Comments: (2)	❍	❍	❍	❍	❍
2.3.23 Our researchers study the extent to which knowledge users utilize our organizations' research results. Comments: (3)	❍	❍	❍	❍	❍
2.3.24 Our researchers identify the potential barriers for utilization of research results by our knowledge users. Comments: (4)	❍	❍	❍	❍	❍
2.3.25 There are criteria for evaluation of researchers' knowledge transfer activities in our organization. Comments: (5)	❍	❍	❍	❍	❍

SECTION FOUR: PROMOTING THE USE OF EVIDENCE Do we help decision makers utilize research results better?

	Strongly Disagree (1)	Disagree (2)	Neither agree or disagree (3)	Agree (4)	Strongly Agree (5)
2.4.1 We conduct education sessions (such as 'evidence-based decision making') for knowledge users. Comments: (1)	❍	❍	❍	❍	❍
2.4.2 Systematic reviews and guidelines…etc that strengthen evidence-based decision making are produced in our organization. Comments: (2)	❍	❍	❍	❍	❍
2.4.3 Our researchers play an active role in technical committees that help in decision making. Comments: (3)	❍	❍	❍	❍	❍
2.4.4 We routinely send knowledge users reminders to consider research results that we've previously sent them. Comments: (4)	❍	❍	❍	❍	❍
2.4.5 In our research organization knowledge transfer is integrated throughout the research process to increase the likelihood of utilization of research results. Comments: (5)	❍	❍	❍	❍	❍

Table A5-1: Questionnaire items (including mean scores and agreement per item) according to the KTA model. SATORI (Gholami 2011) items are shaded grey; Wilson (2010b) items are shaded green.

Domain / Item	Mean	SD	% agree
KNOWLEDGE CREATION			
Knowledge creation: Inquiry (3.60= mean SATORI score)			
Relative to our organization's internal budget for research, the amount of external funding is such that researchers are encouraged to use external funding. (1.9)	4.06	0.89	76
Compared to the internal process, the external grant securing process is such that researchers are encouraged to use external funding. (1.10)	3.74	1.08	52
Our researchers can access external funding easily and in a timely manner for research projects. (1.11)	2.98	1.10	34
Our researchers have incentives for securing external funding. (1.12)	3.51	1.08	55
There is an internal review mechanism (quality assurance) to ensure the quality of the research process. (2.4)	3.78	0.96	65
Quality control is carried out while research is being conducted (internally or externally). (2.5)	3.58	0.78	56
The time between 'presentation of the research proposal' and 'beginning of the research' is reasonable (the process of reviewing the research proposal). (2.6)	3.40	0.82	54
While designing the research proposal and conducting the projects, researchers are aware that applied projects should be completed in a timely manner. (2.7)	3.92	0.60	82
The time between 'end of research' and 'finalization of results in the form of a report' is reasonable (the process of presentation of research results). (2.8)	3.47	0.74	57
Knowledge creation: Synthesis (3.63= mean SATORI score)			
Research projects that result in production of 'actionable messages' with a high level of evidence (such as systematic reviews and/or guideline or tool development activities) are considered priorities for funding and completion. (2.1)	3.59	0.96	61
In our organization, all research results are peer reviewed prior to knowledge transfer activities. (3.2)	3.27	1.04	35
Systematic reviews and guidelines…etc that strengthen evidence-based decision making are produced in our organization. (4.2)	4.04	1.03	79
Knowledge creation: Tools and products (3.13= mean SATORI score)			

Intellectual property rights exist which support researchers who help disseminate research results prior to their publication in journals. (3.21)	3.13	0.76	27

Knowledge creation: Tailoring knowledge (3.74= mean SATORI score)			
In our organization there is a comprehensive list of knowledge users or organizations that can use our research results. (1.1)	3.76	1.12	74
Our researchers have communication skills for knowledge transfer. (3.5)	3.45	0.79	55
A list of all potential stakeholders or research users is prepared for each research project. (3.12)	3.48	1.03	60
Researchers can provide the results of their research through the web and/or electronic databases. (3.18)	4.14	0.61	88
Our organization has regular communications with the media and knowledge users for transfer of research-based evidence. (3.20)	3.86	0.84	65

ACTION CYCLE			

Action cycle: Identify problem (3.67= mean SATORI score)			
Regular meetings are held with knowledge users for the exchange and identification of research priorities. (1.3)	3.98	0.89	78
Knowledge users know which fields our organizations' research covers. (1.4)	3.62	0.83	62
Our organizations' research priorities are determined through meetings with knowledge users. (1.7)	3.68	0.82	70
Our organizations' research priorities are compiled and an up-to-date list is available to our researchers. (1.8)	3.58	0.95	56
Knowledge users regularly participate in the design and/or conduct of research projects. (2.2)	3.49	1.04	61

Action cycle: Identify problem/ Review/ Select knowledge (3.70= mean SATORI score)			
Information about our researchers' projects and topic areas is made available to other organizations through the web or electronic databases. (1.2)	4.50	0.68	92
When preparing for utilization, our organization holds regular and purposeful meetings with knowledge users for cooperation opportunities (establish a knowledge network). (1.5)	3.64	1.03	64
Our impression is that knowledge users trust the quality of the research done in our organization. (2.3)	4.35	0.66	90
Our organization has a process to determine which research results can be transferred (keeping in mind that not every research result is transferable) to the target audiences (apart from transferring to other researchers and funders). (3.1)	3.49	0.96	53
The format of peer review journals is such that the knowledge users can easily determine the actionable messages when applicable. (3.15)	2.56	0.87	13
The format of research projects' final reports are such that decision makers can easily determine the actionable message when applicable. (3.17)	3.31	0.76	46

Meetings are held for presentation of research results to knowledge users. (3.19)	4.04	0.76	82
Action cycle: Adapt knowledge to context (3.48= mean SATORI score)			
Our researchers convert their research results into actionable messages appropriate to the target audience. (3.4)	3.63	0.70	63
Our researchers have the necessary personnel and financial resources for preparing content appropriate to the target audience. (3.7)	3.44	1.09	56
Our researchers have the necessary tools (technology or skills) for preparing content appropriate to the target audience. (3.8)	3.54	0.76	58
Our researchers have adequate time for preparing content appropriate to the target audience. (3.9)	3.30	0.84	48
Action cycle: Assess barriers to KU (3.31= mean SATORI score)			
Knowledge transfer and utilization of research results exist in our organizations' general program of research methodology training. (3.11)	3.12	0.99	37
Evidence-based decision making is among the research areas in our organization. (3.22)	3.57	1.06	68
Our researchers identify the potential barriers for utilization of research results by our knowledge users. (3.24)	3.23	0.83	42
Action cycle: Select, tailor, implement interventions (3.48= mean SATORI score)			
In research proposals (with knowledge users involvement) the budget includes funds for disseminating the results (other than being published in peer-review journals and/or attending conferences). (2.9)	3.55	1.12	61
A dissemination plan is developed at the research proposal stage. (2.10)	3.78	0.98	76
The time between article submission and its publication in journals is such that the interventions that results from research can be implemented in reasonable time by knowledge users. (3.16)	2.83	0.82	17
Our researchers play an active role in technical committees that help in decision making. (4.3)	3.77	0.63	71
Is there a dedicated person or team responsible for dissemination related activities within your organization? (1.7) Yes No Unsure			84.62 9.62 5.77
Does your organization have a formal communication/dissemination strategy? (1.11) Yes No Not sure			76.92 15.38 7.69

Can you estimate the proportion of your own time that is dedicated to dissemination related activities? (1.8)			
None (1)			11.5
Less than 5% (i.e., less than two hours a week) (2)			21.2
Between 5 and 10% (3)			23.1
Between 10 and 20% (4)			19.2
Between 20 and 30% (5)			13.5
Between 30 and 40% (6)			5.8
Between 40 and 50% (7)			0.0
More than 50% (8)			5.8
Why do you disseminate the findings of your research? (1.9) [top 3]			
To raise awareness of the findings (1)			92
To influence practice (4)			79
To influence policy (3)			65
Do you ever refer to guidance or use a framework to plan dissemination-related activities? (1.12)			
Always (1)			3.9
Usually (2)			28.9
Sometimes (3)			36.5
Rarely (4)			9.6
Never (5)			15.4
Not sure (6)			5.8
At what stage in the research process do you usually plan dissemination-related activities? (1.13)			
When the research is being formulated (1)			11.8
At the proposal stage (2)			45.1
During the research process (3)			5.9
At the draft report stage (4)			3.9
At the final report stage (5)			17.7
At all stages of the process (6)			15.7

As part of your research dissemination, do you ever think about who needs to know about the findings and/or who is most likely to be influenced or will influence others? (1.14)		
Always (1)		48.1
Usually (2)		38.5
Sometimes (3)		9.6
Rarely (4)		1.9
Never (5)		1.9
As part of your research dissemination, do you ever consider how audiences or groups you would like to reach access, read, and use research findings? (1.15)		
Always (1)		36.5
Usually (2)		44.2
Sometimes (3)		13.5
Rarely (4)		3.9
Never (5)		1.9
What methods do you usually use to disseminate research findings? (1.16)		
Academic journals		87
Academic conferences		81
Report to funders		69
Full report (paper)		56
Summary report (web access)		56
Summary report (paper)		54
Newsletters		52
Face to face meetings		52
Professional journals		50
Other conferences		50
Do you ever produce research summaries or key messages that are written for specific audiences or groups (such as policy makers, or health and safety practitioners)? (1.18)		
Always		9.8
Usually		33.33
Sometime		41.18
Rarely		5.88
Never		9.8

Action cycle: Monitor knowledge use (2.67= mean SATORI score)

There are criteria for evaluation of researchers' knowledge transfer activities in our organization. (3.25)	2.67	0.88	15

Action cycle: Evaluate outcomes (2.98= mean SATORI score)			
Our researchers study the extent to which knowledge users utilize our organizations' research results. (3.23)	2.98	1.05	34
Do you ever evaluate the impact of your research? (1.19) Always (1) Usually (2) Sometimes (4) Rarely (5) Never (6)			4.0 4.0 44.0 34.0 14.0
Overall, how do you rate your current research dissemination activities? Excellent Good Adequate Poor Not sure			8.0 42.0 30.0 16.0 4.0
Action cycle: Sustain knowledge use (3.34= mean SATORI score)			
We conduct education sessions (such as 'evidence-based decision making') for knowledge users. (4.1)	3.10	0.93	33
We routinely send knowledge users reminders to consider research results that we've previously sent them. (4.4)	3.19	0.89	31
In our research organization knowledge transfer is integrated throughout the research process to increase the likelihood of utilization of research results [Footnote]	3.73	1.01	65

Table A5-2: Questionnaire items (including mean scores and agreement per item) according to the Lavis framework. SATORI (Gholami 2011) items are shaded grey; Wilson (2010b) Items are shaded green.

Domain / Item	Mean	SD	% agree
What (3.73= mean SATORI score)			
Information about our researchers' projects and topic areas is made available to other organizations through the web or electronic databases. (1.2)	4.50	0.68	92
Our impression is that knowledge users trust the quality of the research done in our organization. (2.3)	4.35	0.66	90
Systematic reviews and guidelines…etc that strengthen evidence-based decision making are produced in our organization. (4.2)	4.04	1.03	79
While designing the research proposal and conducting the projects, researchers are aware that applied projects should be completed in a timely manner. (2.7)	3.92	0.60	82
There is an internal review mechanism (quality assurance) to ensure the quality of the research process. (2.4)	3.78	0.96	65
Our organizations' research priorities are determined through meetings with knowledge users. (1.7)	3.68	0.82	70
Knowledge users know which fields our organizations' research covers. (1.4)	3.62	0.83	62
Research projects that result in production of 'actionable messages' with a high level of evidence (such as systematic reviews and/or guideline or tool development activities) are considered priorities for funding and completion. (2.1)	3.59	0.96	61
Our organizations' research priorities are compiled and an up-to-date list is available to our researchers. (1.8)	3.58	0.95	56
Quality control is carried out while research is being conducted (internally or externally). (2.5)	3.58	0.78	56
Our organization has a **process to determine which research results can be transferred** (keeping in mind that not every research result is transferable) to the target audiences (apart from transferring to other researchers and funders). (3.1)	3.49	0.96	53
The time between 'end of research' and 'finalization of results in the form of a report' is reasonable (the process of presentation of research results). (2.8)	3.47	0.74	57
The time between 'presentation of the research proposal' and 'beginning of the research' is reasonable (the process of reviewing the research proposal). (2.6)	3.40	0.82	54
In our organization, all research results are peer reviewed prior to knowledge transfer activities. (3.2)	3.27	1.04	35
To whom (3.58= mean SATORI score)			

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In our organization there is a comprehensive list of knowledge users or organizations that can use our research results. (1.1)	3.76	1.12	74
Our organization has a process to determine which research results can be transferred (keeping in mind that not every research result is transferable) to the **target audiences (apart from transferring to other researchers and funders)**. (3.1)	3.49	0.96	53
A list of all potential stakeholders or research users is prepared for each research project. (3.12)	3.48	1.03	60
As part of your research dissemination, do you ever think about who needs to know about the findings and/or who is most likely to be influenced or will influence others? (1.14)			
Always (1)			48.1
Usually (2)			38.5
Sometimes (3)			9.6
Rarely (4)			1.9
Never (5)			1.9

By Whom (3.51= mean SATORI score)

Our researchers can use the services of those familiar with knowledge transfer (internally or externally). (3.6)	4.16	0.74	90
The necessary structure (e.g. a department) and/or personnel is available for strengthening knowledge transfer in our organization. (3.13)	4.02	1.06	80
Our organizations' research managers are aware of the researchers KTE needs , and provide support or direction in this area. (3.14)	3.78	0.95	72
Our researchers have the necessary tools (technology or skills) for preparing content appropriate to the target audience. (3.8)	3.54	0.76	58
Our researchers have communication skills for knowledge transfer. (3.5)	3.45	0.79	55
Researchers are familiar with knowledge transfer and how to perform it. (3.3)	3.44	0.86	56
Our researchers have the necessary personnel and financial resources for preparing content appropriate to the target audience. (3.7)	3.44	1.09	56
Our researchers have adequate time for preparing content appropriate to the target audience. (3.9)	3.30	0.84	48
Knowledge transfer and utilization of research results exist in our organizations' general program of research methodology training. (3.11)	3.12	0.99	37
Our researchers have the necessary incentives for performing knowledge transfer (rewards, appropriate promotion rules). (3.10)	2.88	0.96	28

Is the dissemination of research findings formally part of your role? (1.3)			
Yes			65.38
No			43.62
Do you think the dissemination of research findings should be formally part of your role? (1.4)			
Yes			78.85
No			21.15
Is there a dedicated person or team responsible for dissemination related activities within your organization? (1.7)			
Yes			84.62
No			9.62
Unsure			5.77

How (3.51= mean SATORI score)

Researchers can provide the results of their research through the web and/or electronic databases. (3.18)	4.14	0.61	88
Meetings are held for presentation of research results to knowledge users. (3.19)	4.04	0.76	82
Regular meetings are held with knowledge users for the exchange and identification of research priorities. (1.3)	3.98	0.89	78
Our organization has regular communications with the media and knowledge users for transfer of research-based evidence. (3.20)	3.86	0.84	65
A dissemination plan is developed at the research proposal stage. (2.10)	3.78	0.98	76
Our researchers play an active role in technical committees that help in decision making. (4.3)	3.77	0.63	71
In our research organization knowledge transfer is integrated throughout the research process to increase the likelihood of utilization of research results [Footnote]	3.73	1.01	65
When preparing for utilization, our organization holds regular and purposeful meetings with knowledge users for cooperation opportunities (establish a knowledge network). (1.5)	3.64	1.03	64
Our researchers convert their research results into actionable messages appropriate to the target audience. (3.4)	3.63	0.70	63
In research proposals (with knowledge users involvement) the budget includes funds for disseminating the results (other than being published in peer-review journals and/or attending conferences). (2.9)	3.55	1.12	61
Knowledge users regularly participate in the design and/or conduct of research projects. (2.2)	3.49	1.04	61
The format of research projects' final reports are such that decision makers can easily determine the actionable message when applicable. (3.17)	3.31	0.76	46
We routinely send knowledge users reminders to consider research results that we've previously sent them. (4.4)	3.19	0.89	31

Intellectual property rights exist which support researchers who help disseminate research results prior to their publication in journals. (3.21)	3.13	0.76	27
We conduct education sessions (such as 'evidence-based decision making') for knowledge users. (4.1)	3.10	0.93	33
The time between article submission and its publication in journals is such that the interventions that results from research can be implemented in reasonable time by knowledge users. (3.16)	2.83	0.82	17
The format of peer review journals is such that the knowledge users can easily determine the actionable messages when applicable. (3.15)	2.56	0.87	13
Does your organization have a formal communication/dissemination strategy? (1.11) Yes No Not sure			76.92 15.38 7.69
Can you estimate the proportion of your own time that is dedicated to dissemination related activities? (1.8) None (1) Less than 5% (i.e., less than two hours a week) (2) Between 5 and 10% (3) Between 10 and 20% (4) Between 20 and 30% (5) Between 30 and 40% (6) Between 40 and 50% (7) More than 50% (8)			11.5 21.2 23.1 19.2 13.5 5.8 0.0 5.8
Do you ever refer to guidance or use a framework to plan dissemination-related activities? (1.12) Always (1) Usually (2) Sometimes (3) Rarely (4) Never (5) Not sure (6)			3.9 28.9 36.5 9.6 15.4 5.8

At what stage in the research process do you usually plan dissemination-related activities? (1.13)			
When the research is being formulated (1)			11.8
At the proposal stage (2)			45.1
During the research process (3)			5.9
At the draft report stage (4)			3.9
At the final report stage (5)			17.7
At all stages of the process (6)			15.7
As part of your research dissemination, do you ever consider how audiences or groups you would like to reach access, read, and use research findings? (1.15)			
Always (1)			36.5
Usually (2)			44.2
Sometimes (3)			13.5
Rarely (4)			3.9
Never (5)			1.9
What methods do you usually use to disseminate research findings? (1.16)			
Academic journals			87
Academic conferences			81
Report to funders			69
Full report (paper)			56
Summary report (web access)			56
Summary report (paper)			54
Newsletters			52
Face to face meetings			52
Professional journals			50
Other conferences			50

With what Effect (3.11= mean SATORI score)

Evidence-based decision making is among the research areas in our organization. (3.22)	3.57	1.06	68
Our researchers identify the potential barriers for utilization of research results by our knowledge users. (3.24)	3.23	0.83	42
Our researchers study the extent to which knowledge users utilize our organizations' research results. (3.23)	2.98	1.05	34
There are criteria for evaluation of researchers' knowledge transfer activities in our organization. (3.25)	2.67	0.88	15

Why do you disseminate the findings of your research? (1 9)		
To raise awareness of the findings (1)		92%
To influence practice (4)		79%
To influence policy (3)		65%
Do you ever evaluate the impact of your research? (1.19)		
Always (1)		4.0
Usually (2)		4.0
Sometimes (4)		44.0
Rarely (5)		34.0
Never (6)		14.0
Overall, how do you rate your current research dissemination activities?		
Excellent		8.0
good		42.0
adequate		30.0
poor		16.0
Not sure		4.0