

Identification, Evaluation and Bibliometric Analyses of Conceptual Models, Frameworks, and Theories of Knowledge Translation Relevant To Health Care Organization and Professional Behaviour

Background: This proposal has been prepared to enhance understanding of conceptual models, conceptual frameworks and grand theories of knowledge translation. Conceptual models, frameworks, and grand theories are overarching views that generally are at the system level, rather than the individual behaviour level. Examples of such theories include: Lomas' Coordinated Implementation model, Kitson's Research into Practice framework, Bartholomew's Intervention Mapping model, Green's Precede-Proceed model, the CIHR's Knowledge Translation framework and the Alberta Heritage Foundation for Medical Research's Research in Practice framework.

Objectives: 1) To conduct a focused search for conceptual models, frameworks, or grand theories of knowledge translation, 2) To undertake a theory analysis of the identified models to determine their strengths and limitations and to determine similarities and differences among them, and 3) To determine the extent to which each model has been used and/or tested, 4) to develop a KT Theories User's Guide.

Methods: *Objective 1:* We will conduct a focused literature search of the social science, education, management, and health literature and search the internet to identify KT models/theories. *Objective 2:* This will involve conducting a theory analysis of the identified theories. We will identify the major concepts/elements of each theory, the definition of KT related to each, and the nature and scope of the theory. We will compare the models/theories and their components for similarities, differences, and inclusiveness. *Objective 3:* We will perform a bibliometric analysis using the science and social science citation journals to identify additional literature which might report on the use and/or testing of the models/theories. This analysis will be used to identify who is citing/using the various models/theories, the extent to which the models/theories are being used, and the areas of research to which the models/theories have been applied.

Significance of Results: The results of this work will inform health researchers and others about conceptual models, frameworks and grand theories in the field of knowledge translation. Health researchers often tend to be unaware of these broad conceptual frameworks, perhaps because many have originated in disciplines other than medicine. The result of the proposed work will provide a valuable resource in terms of cataloguing knowledge translation models/theories as well as furthering our understanding of the critical elements of such frameworks. The proposed synthesis of models/theories of knowledge translation will have the potential to increase understanding of research utilization and may be useful to guide implementation studies and knowledge translation endeavours. The study will also provide foundational information upon which new theories or frameworks of knowledge translation may be derived.

IDENTIFICATION, EVALUATION AND BIBLIOMETRIC ANALYSES OF CONCEPTUAL MODELS, FRAMEWORKS, AND THEORIES OF KNOWLEDGE TRANSLATION RELEVANT TO HEALTH CARE ORGANIZATION AND PROFESSIONAL BEHAVIOR

AIMS AND OBJECTIVES

The aim of the project is to identify and critically review conceptual models of knowledge translation that might apply to health care professional behaviour.

The specific objectives of the project are to:

1. conduct a focused search for planned change conceptual models, frameworks, or grand theories of knowledge translation.
2. undertake a theory analysis of the identified models to determine their strengths and limitations and to determine similarities and differences among them.
3. determine the extent to which each model has been used and/or tested.
4. develop a KT Theories User's Guide

RELEVANCE OF THE PROPOSED RESEARCH

KT is an important and increasingly recognized area of health research. Although it has been ongoing in medicine since the early quality assurance work of Donabedian in the 1960s¹, the growing awareness that research findings are not making their way into practice in a timely fashion coupled with the current emphasis on evidence based, cost effective and accountable health care have stimulated increased interest in knowledge translation research. Unfortunately, much of the KT research in health care to date has been empirical and largely lacking any theoretical underpinning^{2,3}, despite other disciplines such as management, administration and the social sciences having conducted research on diffusion of innovations for over 50 years⁴. Many existing KT theories are either not known or poorly understood by health services researchers and policy makers. This can, in part, be attributed to disciplinary divides (the tendency of disciplines to only be familiar with their own literature) and to the tendency for health services researchers to be largely atheoretical in their approach to research. As is the case with all developing sciences, the success of the field is related to its theoretical foundation. Work is needed to identify KT theories that have been developed in various disciplines and to critically review them to determine their similarities, differences, strengths and limitations. By doing this, the proposed project will help to identify significant gaps in the theoretical basis of KT research and practice. Increased awareness of the range of existing KT theories will advance of the science of KT in health care by enabling ongoing refinement and empirical testing of these theories.

The proposed research will also be of considerable value to policy makers, researchers, educators, and others interested in bringing about greater use of research in practice (e.g. implementers, knowledge brokers, research facilitators). Getting research into practice requires a systematic effort on the part of organizational policy makers, practitioners, consumers and others to effect a practice change. The process is complex and occurs in the face of competing organizational and practice priorities. Therefore, researchers have an obligation to create, analyze and synthesize the theoretical and empirical underpinnings of practice change. Policy makers will be able to achieve increased knowledge translation with clear and useful theories to guide their efforts. Armed with an understanding of what theories are available, their strengths and limitations, as well as an understanding of the key elements to consider, they will be better equipped to select and apply an appropriate range of strategies when planning to implement change.

BACKGROUND

What is Knowledge Translation and Why Is It Important?

As there can be confusion about terminology, especially in the area of KT, we wish to define our terms. The CIHR has adopted the following KT definition: *the exchange, synthesis and ethically-sound application of knowledge within a complex system of relationships among researchers and users*. The concept or process of the application or uptake of research findings into practice has also been referred to as *knowledge transfer, knowledge mobilization, knowledge exchange, knowledge utilization, diffusion, and implementation*. The term ‘*implementation research*’ has been defined as the scientific study of methods to promote the uptake of research findings⁵. It includes the study of influences on healthcare professionals’ and organizations’ behaviour and of interventions to enable them to use research findings more effectively. The proposed study falls within the general heading of implementation research. It should be emphasized that even though the target of KT may be an individual, group of individuals, or organization, a defining characteristic of knowledge translation is that it occurs within a social system and that the social system influences the process and must therefore be considered. For simplicity, we will use the terms, knowledge translation and implementation interchangeably throughout the proposal to mean the process of getting research in practice.

Considerable resources are devoted to clinical and health services research and the production of new knowledge that could contribute to effective and efficient patient care. However, new research evidence will not change population outcomes unless health care systems, health care organizations and health care professionals apply it in practice⁶. Unfortunately, one of the most consistent findings in health services research is that the transfer of research findings into practice is unpredictable and can be a slow and haphazard process⁷. Whenever the transfer of knowledge to practice is inappropriately long, patients are denied treatments of proven benefit and policy makers are left uninformed about results that could impact their decision-making. In some cases, transfer of knowledge to practice can be premature, before the effectiveness of treatments has been established, leading to patients’ exposure to potentially ineffective and even harmful treatments. In addition, many decisions at the organizational or health care system level do not explicitly consider the available evidence base, again leading to potentially ineffective or harmful policies. This evidence-to-practice or knowledge translation gap has significant adverse effects on the health and social welfare of Canadians and the economic productivity of the country. Given the limited nature of resources available to fund the health care system, knowledge translation can be used as a tool to maximise research transfer and optimise care while making the most efficient use of available resources.

The Structural Hierarchy of Knowledge

For this project, we have opted to use the hierarchy of knowledge and the definitions proposed by

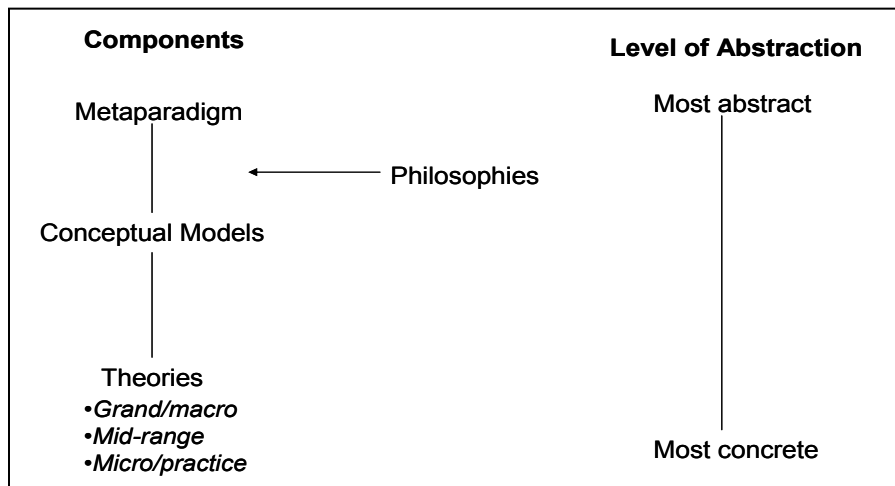


Figure 1
Structural Hierarchy of
Knowledge

Fawcett⁸. Figure 1 represents this hierarchy graphically. *Metaparadigm* is the most abstract component in the structural hierarchy of knowledge. It is made up of highly abstract concepts that identify the phenomena of interest to a discipline and general propositions that may describe the relationships among the phenomena. The concepts and propositions of a metaparadigm are extremely global and provide no definitive direction for such activities as research or practice⁸. This is because a metaparadigm is the broadest consensus of a discipline. It provides general parameters of the field and gives scientists a broad orientation from which to work⁹. The function of a metaparadigm is to summarize the intellectual and social missions of a discipline and place a boundary on the subject matter of that discipline. By doing so the metaparadigm of a discipline distinguishes that discipline from others.

A *philosophy* or world view can be defined as a statement of beliefs and values about human beings and their world. It encompasses claims about the nature of human beings and the goal of the discipline, epistemic claims regarding how knowledge is developed, and ethical claims about what the members of the discipline should do¹⁰. Different philosophies or world views lead to different conceptualizations of the central concepts of a discipline and to different statements about the nature of the relationships among those concepts. Philosophy does not follow directly the metaparadigm of a discipline nor does it directly precede conceptual models. Rather, the metaparadigm identifies the phenomena about which philosophical claims are made. The content and focus of each conceptual model and theory then reflect the philosophical claims. A philosophy is not empirically testable but it can be defended¹⁰.

The terms *conceptual models*, *conceptual frameworks*, and *conceptual systems* are often used synonymously and represent global ideas about a phenomenon. They are used to clarify, describe, and organize¹¹. Conceptual models have the basic purpose of focusing, ruling some things in as relevant and ruling others out due to their lesser importance. The usefulness of conceptual models comes from the organization they provide for thinking, for observation, and for interpreting what is seen. They provide a systematic structure and a rationale for activities. In general, conceptual models are less abstract than metaparadigms and but more abstract than theories. They are made up of concepts and propositions. The concepts are quite abstract and general. They may not be directly observable in the real world. The propositions that describe or link conceptual model concepts are also quite abstract and general and therefore not amenable to direct empirical observation or testing. Conceptual models provide different perspectives or frames of reference for the phenomena identified by the metaparadigm of a discipline. Examination of the content of various conceptual models reveals that each model reflects the philosophical stance, cognitive orientation, research tradition, and practice modalities of a particular group of scholars. The abstract and general nature of the content of a conceptual model precludes definitive directives for practical activities. Each conceptual model, however, may include general guidelines for research, practice, education, and administration. As research is the vehicle for theory development, suggestions for research that are associated with a conceptual model function as guidelines for the generation and testing of theories.

A *theory* is an organized, heuristic, coherent, and systematic articulation of a set of statements related to significant questions that are communicated in a meaningful whole¹². It describes observations, summarizes current evidence, proposes explanations, and yields testable hypotheses. It is a symbolic depiction of aspects of reality that are discovered or invented for describing, explaining, predicting, and controlling a phenomenon^{11;12}. A theory is a hypothetical, conjectured, symbolic construction¹³. Theories can be described in terms of their scope. A *metatheory* is a theory about theory.

A *grand or macro theory* is a very broad theory that encompasses a wide range of phenomena. It is a general construction about the nature and goals of a discipline, or in this case KT. Grand theories are substantially non-specific and are made up of relatively abstract concepts that lack operational definitions and relatively abstract propositions that are not amenable to direct empirical testing^{8;14}. They

tend to be developed through thoughtful and insightful appraisal of existing ideas or creative leaps beyond existing knowledge. Some scholars use the terms grand theory and conceptual model interchangeably because of their high level of abstraction¹⁵. *Mid-range theory* is more limited in scope, less abstract, addresses specific phenomena and reflects practice. It encompasses a limited number of concepts and a limited aspect of the real world. Mid-range theories are made up of relatively concrete concepts that are operationally defined and relatively concrete propositions that can be empirically tested. Mid-range theory is designed to guide empirical inquiry. A *micro, practice or situation-specific theory* (sometimes referred to as prescriptive theory) has the narrowest range of interest and focus on specific phenomena that reflect clinical practice and that are limited to specific populations or to a particular field of practice.

Conceptual models/frameworks and theories vary in their levels of abstraction and a continuum exists within the structural hierarchy of knowledge. Boundaries between conceptual models and levels of theory sometimes overlap making it difficult to clearly differentiate between conceptual models and grand theory and between grand theory and mid-range theory and between mid-range theory and practice theory. The situation can be further clouded as conceptual models can inform grand theories which in turn inform mid-range theories or may inform mid-range theories directly (see Figure 2 below for graphical representation of this).

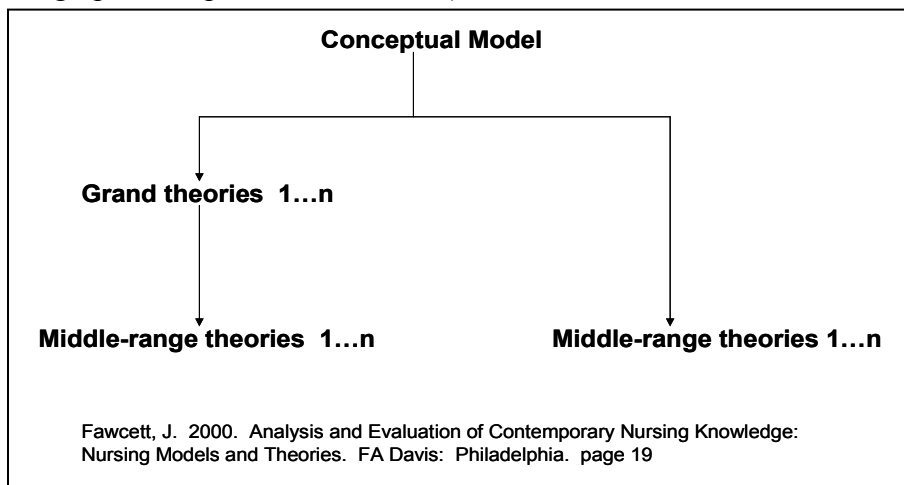


Figure 2
Role of conceptual models in theory development

What Is Known About Conceptual Models and Grand Theories of Knowledge Translation?

Conceptual models and grand theories of knowledge translation are essentially models or theories of change. Change theories/models fall into two basic kinds: classical and planned¹¹. Classical theories/models of change (sometimes referred to as descriptive or normative theories) are passive; they explain or describe how change occurs. An example of a classical theory of change is Rogers' diffusion theory^{4;16} or Kuhn's¹⁷ conceptualization of scientific revolutions. These theories describe change but were not specifically designed to be used to cause change. Other implementation theories falling within this category would be the frameworks or models that have been proposed as ways of thinking about or conceptualizing knowledge translation such as CIHR's KT Opportunities Within the Research Cycle diagram (<http://www.cihr-irsc.gc.ca/e/about/7518.SHTML>) or Lomas's Coordinated Implementation Model^{18;19}. While classical theories/models of change can be quite informative and helpful for identifying the determinants of change, researchers, policy makers, and change agents tend to be more interested in planned change theories/models that are specifically intended to be used to guide or cause change¹¹.

A planned change theory/model is a set of logically interrelated concepts that explain, in a systematic way, the means by which planned change occurs, that predict how various forces in an environment will react in specified change situations, and that help planners or change agents control variables that increase or decrease the likelihood of the occurrence of change^{20;21}. Planned change, in

this context, refers to deliberately engineering (not haphazard) change that occurs in groups that vary in size and setting. Those who use planned change theories/models may work with individuals, but their objective is to alter ways of doing things in social systems. Examples of planned change theories/models are Bartholomew's Intervention Mapping model²², Kitson's Research into Practice framework^{23;24}, the Ottawa Model of Research Use²⁵, and Green's Precede-Proceed model, to name a few.

As a relatively new field of inquiry that is becoming a science, practice/micro and mid-range KT theories have yet to be fully developed or articulated. For this reason the proposed project will focus exclusively on KT conceptual models, conceptual frameworks and grand theories. We will focus exclusively on planned change conceptual models, frameworks, and theories as these are specifically intended to guide implementation activities and are currently of greatest interest to organizational decision makers and researchers wanting to facilitate the uptake of evidence into practice. As the primary KT focus of many members of the team is organizational and professional behaviour, we are restricting the study to only models/theories that may be relevant to health care organizational and professional behaviour. The team does not have sufficient expertise to evaluate models/theories specific to policy maker or patient/public behaviour.

What Will the Proposed Study Add To Our Current Understanding Of Knowledge Translation?

Over the past five years a considerable body of implementation research has developed^{26,27}. However, this research provides little information to guide the selection choice of interventions to facilitate knowledge translation. The effectiveness of KT strategies appears to vary across different clinical problems, contexts and organizations. There is currently an imperfect evidence and theoretical base to support decisions about how to go about doing knowledge translation and few KT studies provide any theoretical or conceptual rationale for the approach taken to bring about change^{2;28}. In a recent review of 235 studies evaluating the effectiveness of KT interventions to increase the uptake of practice guidelines, only 14 (6%) of the studies were explicitly theory based and another 39 (17%) reported some conceptual basis²⁸. Clearly, our understanding of how to do KT is limited and hindered by a lack of a 'basic science' (theoretical and empirical work) related to the topic³. The proposed project will begin the process of bringing the various implementation theories together by creating an inventory, critically reviewing the models/theories by conducting a theory analysis.

A theory analysis is a systematic examination of a theory or theories and is an essential component of theory development¹⁵. The purpose of a theory analysis is to determine the strengths and limitations of a theory. Knowing the strengths of a theory is important for everyone needing to decide about which theory to use to guide practice or change. Determining the limitations of a theory is useful for identifying where to focus research efforts on the theory or the linkages between the concepts of the theory.

Cataloguing and evaluating KT conceptual models/theories offers a number of benefits. As Meleis¹² notes, theory analysis can be used to:

- compare and contrast different explanations of the same phenomenon
- identify schools of thought
- identify effective theories
- identify gaps in knowledge
- enhance the potential of constructive changes and further theory development
- identify strategies for theory development
- define research priorities

By describing and evaluating the theoretical base of implementation science, the proposed research should also facilitate users' decision making about which theory is more appropriate to use as a framework for research, teaching, or administration in their given situation. It will also hopefully encourage the critical and judicious use of KT theories.

In summary, the proposed work will added to the KT knowledge base by making KT theories easily accessible to all researchers, policy makers, and change agents, regardless of their discipline. It may also provide the basis and impetus for KT scholars and researchers to rethink, refine KT conceptual models/frameworks or even develop new mid-range KT theories. It may also provide impetus and a knowledge base for researchers to test KT models/theories.

Team Members' Prior and Current Work in KT

Members of the team have been interested in KT for some time both in terms of theory/model development, theory testing, and empirical evaluation of KT strategies. Jo Logan and Ian Graham's interest in planned change theories originated with the development of an interdisciplinary model of health care research use (the Ottawa Model of Research Use (OMRU))^{25;29}(see Append 1 for copy of the paper). This model attempts to assemble diverse aspects of the process of research use into a simple but broadly useful conceptual framework to guide implementation. Although not explicitly linked to Donabedian's germinal work describing health care quality production in terms of structure, process, and outcomes³⁰, the model captures these characteristics along with important social factors. The elements of the model are supported by evidence, where available, and are drawn from the literature related to research utilization, the diffusion of innovations, practitioner behaviour change, and the development and implementation of practice guidelines.

The OMRU has six constructs (see Figure in Appendix 1). These constructs address what is believed to be the central elements in the research use process: the practice environment, potential adopters, the evidence-based recommendations or innovations (knowledge) to be used in practice, strategies to transfer evidence into practice, adoption of the evidence (knowledge), and outcomes. A defining characteristic of the model is that it provides a broad comprehensive frame to direct the study of a complex topic. However, it does not provide detailed information about which interventions to use under different circumstances, either because there are insufficient theories for each element or because potentially relevant theories may not yet be validated on health care professional or organizational change. As the OMRU variables within each construct are expected to differ within diverse settings over time, the model calls for an analysis of the state of each model element, prior to, and following research use interventions, monitoring of the KT process throughout, and evaluation of the outcomes. In this way one can increase one's chances of success as well as determine which elements contributed to or hindered the attempt to change professional or organizational behaviour.

A number of underlying assumptions are implicit in the model. The first is that research use is an interactive dynamic process of interconnected decisions and actions by different individuals related to each of the model elements rather than a sequential stage model of change³¹. The process takes place over time and in an order that depends on the specific state of each element within a given context. Although presented as a linear diagram, the nature of the process should not be interpreted as unidirectional; all the model elements influence and are influenced by each other, thus reflecting the complexity of the research use process. As patients and their health outcomes should be the primary focus of evidence-based practice, another assumption is patients play a key role in all aspects of the process. A third assumption is that both the societal and health care external environments will affect all aspects of the process and must be considered. As a framework, the OMRU is intended to provide a holistic approach that considers all aspects of knowledge translation and its impact on health outcomes; provide a parsimonious view of the major elements of knowledge translation, and take an interdisciplinary perspective.

Other experiences team members have had with KT theories include participating in the development of Registered Nurses Association of Ontario's "Clinical Practice Guideline Implementation Model."^{32;32} Barb Davies, Ian Graham, Margaret Harrison, and Jo Logan were all on the RNAO panel that created this model which is designed to guide the implementation of practice guidelines. The steps

in the model are: 1) selecting a clinical practice guideline to implement, 2) identifying, analyzing, and engaging stakeholders, 3) assessing environmental readiness for change, 4) selecting implementation strategies, and 5) evaluating the implementation efforts. Martin Eccles and colleagues have also developed a planned implementation framework for identifying behaviour change strategies to improve health care³³. This framework is intended as a practical tool to assist health care professionals analyse the change process in a structured manner and develop potential strategies for achieving behaviour change within their own or others' practice. The key elements of the model are: 1) identify the problem/need for change, 2) examine the current context (the target population and their current practice, interrelationships and the structure within which they work), 3) consider the relevant theoretical and empirical literature, 4) strategy planning- the change process part I, 5) implementing change- the change process part II, and 6) feedback and maintenance.

The team also has some experience synthesizing implementation models. Barb Davies has recently published a paper on the sources and models for moving research evidence into nursing practice³⁴. In this paper she reviews a number of research utilization theories.

For some time, members of the team have also independently and in collaboration been studying the determinant of practitioner behaviour at the level of the individual. Jeremy Grimshaw has conducted a study to assess the value of the Theory of Planned Behaviour (TPB) to describe variations in UK family physicians' intentions to prescribe antibiotics for sore throat.³⁵ Gaston Godin has a number of publications based on his research using the Theory of Planned Behaviour as an assessment and prediction tool. He has conducted a review of applications of the theory of planned behaviour to health related behaviours and has applied TPB constructs to a wide range of individual and professional behaviours³⁶⁻⁴¹. He and France Légaré have collaborated to study women's use and physicians' prescribing of hormone therapy using the Theory of Planned Behavior⁴²⁻⁴⁵. France Légaré has also collaborated in the past with Ian Graham to study shared decision-making in the context of clinical care using the Ottawa Decision Support Framework⁴⁶. Légaré has collaborated in a study of patient-physician interaction using the Transactional Model from Kleinman⁴⁷. Barb Davies has used Lomas'¹⁸ Coordinated Implementation Model and Bandura's⁴⁸ Social Cognitive Theory to develop an intervention to facilitate the transfer of evidence-based recommendations into practice at four hospitals^{49,50}.

On the empirical side, several members of the team have also been involved in evaluating the effectiveness of dissemination and implementation strategies using randomized and quasi experimental designs⁵¹⁻⁵³.

Ongoing Complementary Work

The proposed study will build on two currently funded CIHR research projects which involve: 1) conducting an environmental scan of Canada's capacity for investigating the theory, methodology and practice of KT (PI: Jeremy Grimshaw and Ian Graham), and 2) examining KT policies and practices of Canadian and international funding agencies (PI: Ian Graham and Jeremy Grimshaw). As part of our KT environmental scan grant we are scanning the websites of Canadian centres engaged in KT research looking for documents and references to the theory, practice, and methodology of KT. We have also used sociometric techniques to identify key Canadian knowledge translation researchers and are asking them about what KT theories/frameworks they are aware of and/or use and have evaluated. As part of the second grant mentioned above, we are currently searching websites of health care research funders in Australia, Canada, France, the Netherlands, the Scandinavian countries, and the USA for information on their KT activities and any models of KT that the agencies might be using to guide their KT activities. The data from both projects will be added to the results of our search for KT theories. With both of these currently funded projects, the focus is on identifying KT activities and theories that might be in use in Canada. Neither project calls for a critical evaluation of the identified theories. The proposed project will complement these already funded studies by taking advantage of work that is being done to identify KT theories Canadian KT researchers and funding agencies are familiar with. The proposed study does

NOT duplicate any of the work currently funded and extends it considerably by conducting a literature and internet search for more theories and then conducting a formal theory analysis.

METHODS

Objective 1: to conduct a focused search for planned change conceptual models, frameworks, and grand theories of KT.

To identify potential implementation conceptual models, frameworks, and theories we will conduct a focused literature search of the social science, education, management, and health sciences literature. We will search the following electronic bibliographic databases from 1983 forward: sociological abstracts, SOCIOFILE, Applied Social Science Index and Abstracts (ASSIA), Bath Information and Data Services- Social Science Citations (BIDS), PsychINFO, International Public Affairs Information Service (PAIS), Education Resource Information Center (ERIC), MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Dissertation Abstracts. We will also search the following French language databases: Repères, Système universitaire de documentation (SUDOC) de l'Agence bibliographique de l'Enseignement supérieur (ABES), and UNESCO Recherche documentaire.

We will also conduct an internet search for models/theories using Google and other meta search engines such as OMNI (Organizing Medical Networked Information site, a searchable catalogue of Internet sites covering health and medicine). We also propose to hand search a small number key journals, for example Science Communication (formerly the journal Knowledge: Creation, Diffusion, Utilization), Knowledge, Technology and Policy (formerly Knowledge and Policy: the International Journal of Knowledge Transfer and Utilization). The libraries of major universities (e.g. University of Ottawa, McMaster University, University of Toronto, McGill University, Queen's University, Laval University, University of Newcastle upon Tyne) and the NRC Canada Institute for Science and Technology Information (CISTI) will also be searched for manuscripts and books about implementation theories. All searches will be restricted to literature published in the English or French language. The list of search terms will be developed by the co-investigators which includes a senior information scientist with a Master's of Library Science (JM). At the first team meeting decision rules will be developed to determine which hits are likely to be relevant implementation theories (e.g. theories must consider the KT takes places within a social system, the theories must be relevant to organizational and professional behaviour (as opposed to patient or public behaviour), conversely theories that assume the individual has complete and total control over changing behaviour would be excluded). At least two co-investigators from two different disciplines will initially screen all the results of the searches to identify potentially relevant hits. The full bibliographic reference will be downloaded into a Reference Manager database. To this list of theories will be added any additional ones identified through the survey of Canadian knowledge translation experts and the search of funding agency websites as part of our currently funded grants (see section above). Full text copies of these papers will be retrieved and their bibliographies reviewed for references to other implementation theories.

Two co-investigators (from 2 disciplines) will then assess each model/theory to determine relevance using a standardized screening form based on inclusion/exclusion criteria developed at the first team meeting. These criteria will be determined at our first team meeting. When possible, one of the reviewers will have expertise in the discipline from which the theory was located (i.e. for a theory published in the nursing literature, one reviewer will be a nurse). This is to ensure accurate content interpretations. Disagreement about whether a theory is relevant to the project will be resolved through consensus or appeal to one of the Principal Investigators.

Objective 2: to undertake a theory analysis of the identified models/theories to determine their strengths and limitations and to determine similarities and differences between them.

The steps in a theory analysis¹⁵ are:

- 1) to determine the origins of the theory. The “origins of a theory” refers to the original development of the theory. Who developed it? Where are they from (institution, discipline)? What prompted the originator to develop it? Is it inductive or deductive in form? Is there evidence to support or refute the nature of the theory? When it was developed/published? When was it revised or modified?
- 2) to examine the meaning of the theory. The meaning of a theory has to do with the theory’s concepts and how they relate to each other. What are the concepts comprising the theory? How are the concepts defined? What is the relationship between concepts?
- 3) to analyze the logical consistency of the theory. The logical adequacy of a theory is the logical structure of the concepts and statements. Are there any logical fallacies in the structure of the theory?
- 4) to define the degree of parsimony and generalizability of the theory. Parsimony refers to how simply and briefly a theory can be stated and still be complete in its explanation of the phenomenon in question. Generalizability refers to the extent to which generalizations can be made from the theory.
- 5) to determine the testability of the theory. Testability is about whether or not the theory can be supported with empirical data. A theory that can not generate hypotheses that can be subjected to empirical testing through research is not testable, and
- 6) to determine the degree of usefulness of the theory. Usefulness of the theory is about how practical and helpful the theory is to the discipline in providing a sense of understanding and/or predictable outcomes.

We will review all theories for all of the above criteria except for the sixth one (usefulness) as this must be left to each potential user of a theory to determine for him/herself depending on what he/she would like to use the theory for.

To address the first 3 steps of the theories analysis (origins of the theory, meaning of the theory, logical consistency of the theory), we proceed as following: all relevant theories will be subjected to a data abstraction process. Two co-investigators will independently review each theory and using a structured form, abstract key information on the theory related to the items comprising the theory analysis. A draft of some of the information to be collected on each theory is presented in Appendix 2. These items will be revised and finalized at the first team meeting. The two reviewers will compare abstracted information and disagreements will be resolved through consensus or appeal to one of the Principal Investigators if necessary. Next, the research associate will enter these data into a data matrix⁵⁴ which will permit easy comparison of how each theory performs on each item of interest. During the data abstraction phase we will have monthly team teleconference calls (months 5-8). During the analysis phase, we will have a second full day meeting in month 9 and conference calls during months 10 and 11. During these meetings/calls the team will collectively review each theory, summarize it, interpret our findings by comparing the concepts included in each theory for similarities, differences, and inclusiveness, and finally, synthesize the results into what might be called a *KT Theories User’s Guide* (see objective 4 below).

Objective 3: to determine the extent to which each theory: has been used and/or tested and the contexts and populations in which it has been used and/or tested.

This objective will attend to steps 4 (generalizability) and 5 (testability) of the theories analysis as well as examining what has been called the “the cycle of contagiousness”¹². What is meant by this is the extent to which a theory has been adopted by others and provides an indication of its acceptability and influence. To do this one asks questions such as, where and in what contexts has the theory been used (where: geographically and institutionally, what contexts: with what populations and under what circumstances)? How has it been used (for research, education, administration, clinical practice)? Has it

been used cross-culturally or trans-culturally? Related to this is determining whether the theory, or any of its constructs, has been subjected to testing.

A bibliometric analysis can be used to describe features of publications and to track publication activity^{55;56}. We intend to use this approach to identify who is citing a KT model/theory (i.e. using it), why the theory is being cited, and when the theory is being used, in what area of practice and with what results. Data to be collected will include: who the authors of these papers are, their institutions, their geographic location, in what journal the paper was published, how the theory was used or tested, with what population in what context, and what the results were (see Appendix 2 for example of information to be collected). For the English language literature we will be able to perform a simple count of how many times each theory has been cited. We will perform the bibliometric analysis using the Science Citation Index (SCI), the Social Science Citation Index and PASCAL. The SCI has tracked 3,500 journals and 400,000 articles annually since 1945. The SCI is the only database to provide citations appearing in each article. PASCAL is the French language equivalent to the SCI and is a product of the Centre national de la recherche scientifique (CNRS) and tracks 7,000 journals annually. This database is indexed by keywords. We will also attempt to locate any instruments that may have been used to measure any of the theory constructs.

The data from the bibliometric analysis will be supplemented by a survey of the originators of each of the models/theories we identify. The survey will be designed to elicit information on whether the theorist, or others they are aware of, have used and/or tested their theory. It will also be used to clarify the citation of the most recent version of the theory as well to identify previous versions and the types of modification made (see Appendix 2 for draft questions). We will not be asking the theory originators' about their perceptions of the usefulness of the theory. The survey will be administered following Dillman's⁵⁷ tailored design method for mail surveys. Email and telephone contact may also be used to access the respondents.

Objective 4: To develop a KT Theories User's Guide.

The result from objectives 1-3 will be synthesized and compiled into KT Theories User's Guide. The guide will include the inventory of all the KT models/theories identified, the results of the theories analysis (the origins of the theories, the concepts comprising the theories, the logical consistency of the theories' concepts, the generalizability of the theory, the extent to which it has been tested, and information from the bibliometric analysis on who has used/cited the theory, etc). The User's Guide will be designed to permit easy comparison of the theories. The User's Guide will be sent to the originators' of the included theories who responded to our survey requesting information on their theory. This will be used to assess the face validity of the User's Guide and serve a member checking function⁵⁸. We also intend to send the User's Guide to the Canadian KT experts identified in our previous environmental scan and have them evaluate it for content accuracy and user friendliness. The survey will be developed during a team meeting and pilot tested before being administered using the Dillman's⁵⁷ tailored design method for mail surveys.

ETHICAL CONSIDERATIONS

With the exception of our survey of KT theorists (objective #3, #4) and survey of Canadian KT experts (objective #4), all other data collected for this project will be obtained from publicly available documentary materials or from other funded projects that have already received ethics approval. We will seek ethics approval from the Research Ethics Board of the Ottawa Hospital for the survey.

STUDY TEAM AND PROJECT MANAGEMENT

We have assembled a strong *transdisciplinary* team with the necessary theoretical and methodological expertise to carry out this project. We have considerable content expertise in the field of knowledge translation and experience successfully undertaking KT research. It includes nationally and

internationally recognised researchers in implementation and knowledge translation research (BD, RF IG, JG, JL, MPE, MW), social (MB, MD, GG, JT, LL), management (DA, MPP) and information (JM) scientists. Team members (JL, SL) have considerable expertise in teaching theory development, and SL⁵⁹⁻⁶² has taught advanced seminars on concept analysis and is frequently called upon to sit on thesis committees for her expertise in this area.

Disciplines and specialties represented within the team include: community and public health (FL, GG) education (JL, JT), decision science (DS, FL, IG), geography (MD), management (DA, MPP), medicine (FL, RF, JG, MPE), nursing (BD, DS, JL, SL, MH), population health (DS, FL), health and social psychology (MB, LL), and health and medical sociology (IG, MW). Several members of the team have career scientist support including a Tier 1 Canada Research Chair in Knowledge Transfer and Uptake (JG) and another in health behaviour (GG), a CIHR New Investigator (IG), Ontario Ministry of Health Career Scientists (MB), and the William Leech Professor of Primary Care Research (MPE). We see a major strength of our team as the mix of researchers, scholars, and clinicians.

While the team might appear large, we consider the composition of the research team essential and desirable given the task. Each co-investigator is needed for their disciplinary expertise and knowledge. All will directly participate in determining criteria for considering a model/theory a relevant implementation theory, directing the focused literature search of their disciplines' literature, reading the theories, abstracting data on the theories, and participating in the theory analysis and syntheses of the identified implementation theories. The high level of abstract thinking necessary for the data extraction and theory analyses components of the project requires seasoned scholars and researchers.

The Co-Principal Investigators of the project are Ian Graham and Jo Logan. Ian Graham is a health sociologist, Senior Social Scientist at the Ottawa Health Research Institute, Associate Professor in the School of Nursing and Departments of Medicine and Epidemiology & Community Medicine, University of Ottawa, and CIHR New Investigator. His research on improving quality of health care delivery centers on describing, understanding, and facilitating the use of evidence and practice guidelines by health care professionals, and assessing the quality of practice guidelines^{63;64}. He has written a book on the factors that have influenced changes in maternity care practice over time⁶⁵. He and Jo Logan are the originators of the Ottawa Model of Research Use, an interdisciplinary model for understanding and directing research use efforts²⁵(see Appendix 1).

Jo Logan is a nurse with a PhD in education. She is an Associate Professor of Nursing, Faculty of Health Sciences, University of Ottawa. Her research interests include evidence-based practice (implementation research) and supportive care, including decision support. She is a qualitative researcher. She teaches a nursing theories course. She co-authored the book⁶⁶, 'Reading Research: A User Friendly Guide for Nurses and Other Health Professionals' with Barbara Davies that has consistently been a best seller and is used in Canadian universities, colleges and clinical agencies. The OMRU has been the basis for research and has been used in several practice settings to guide change in practice. Her work on the team led by Margaret Harrison to design and evaluate an evidence-based CHF educational program is currently being distributed by Heart & Stroke. 20,000 copies have been requested in six months rather than the predicted twelve.

A project management team comprising of IG, JL, JT, the research staff and one other co-investigator will meet at least monthly to oversee the day-to-day management of the project. As CO-PI, IG and JL will contribute to and oversee all aspects of the project. To ensure a transdisciplinary approach, the entire team will assemble three times during the project. The first meeting will be used to finalize the project plan and make decisions about how to search for implementation theories, establish decision rules for including or excluding a theory from the analysis, determine the items to be abstracted from the models/theories, finalize and approve the theory analysis methodology. The other full team meetings will be used to analyse the abstracted data and synthesis of the findings (because of distance RF, MPE, MW will attend the first team meeting and one near the end of the project). As noted above,

all team members will be actively participating in the reading of the implementation theories and the theories analysis and synthesis.

COLLABORATIONS

Recently, Jeremy Grimshaw and Ian Graham (Co-PIs) were awarded a CIHR Interdisciplinary Enhancement Capacity (ICE) grant entitled, “Building Capacity: Development of a Transdisciplinary Team for Improving the Quality of Health Care.” The overall aims of the ICE are to: 1) generate sustainable transdisciplinary research capacity to address the scientific questions raised in the implementation of evidence based healthcare to improve quality, 2) conduct transdisciplinary research into the barriers and enablers to the development, dissemination and uptake of clinical best practices and evaluations of dissemination and implementation strategies to improve quality, and 3) undertake a series of knowledge translation activities directed at key stakeholders interested in improving quality of care. Three of the specific *research objectives* of the ICE are to: 1) systematically identify, appraise, and catalogue validated theories of individual, professional, and organizational behaviour change, 2) evaluate the applicability of candidate theories to professional and organizational behaviour and their utility to increase our understanding of barriers and enablers to change, and 3) develop methods of testing theoretical constructs alongside rigorous evaluations of interventions to improve quality. Most of the applicants on the current proposal are investigators or new investigators on this ICE and the project will help meet the first research objective and will inform the second and third.

TIMELINE AND DELIVERABLES

Project Timeline

Time (Month)	Activity
1-3	Determine decision rules for inclusion/exclusion criteria Develop, refine and run search strategies Retrieve relevant models/theories for review
4-9	Data abstraction on models/theories Theory analysis Survey of KT theorists
9-12	Data analysis Data synthesis Drafting of KT Theories User Guide Report writing
12	Host workshop Knowledge translation activities

Deliverables

1. An inventory or list of KT models, frameworks or grand theories.
2. A KT Theories User’s Guide which would synthesize all the KT models/theories and identify common elements of each and provide information on their use.
3. Academic manuscripts describing the results of the theory analysis.
4. A manuscript reflecting on the advantages and challenges of conducting transdisciplinary research on KT theory (see Appendix 1 for an example of what this type of manuscript might look like).

KNOWLEDGE TRANSLATION PLAN

We consider the work proposed to be fundamental and basic research needed to advance the theoretical base of the science of knowledge translation. As such, we expect that the results will be primarily of interest to KT researchers, behavioural scientists, knowledge brokers (change agents), funders of KT research and those in disciplines interested in behaviour change and research use. We envisage that our efforts will result in a number of academic papers, an inventory of implementation theories and a KT Theories User's Guide.

We intend to publish widely in health services research and discipline based journals. In addition, we will encourage presentation of our findings at health care and discipline based conferences. This will include the Canadian Research Transfer Network (CRTN) which includes KT researchers and knowledge brokers. We have budgeted for a one day workshop at the end of the project to bring key stakeholders together (leading KT researchers within Canada and knowledge brokers) to discuss the meaning and implications of the research for practice and future KT research. We will attempt to have this coincide with a meeting of the CRTN, a meeting of the recently launched Interdisciplinary Capacity Enhancement grant on Improving Quality led by Jeremy Grimshaw and Ian Graham (see Collaboration section), or another appropriate conference/meeting. This workshop will be the occasion of the third full team meeting. These approaches should ensure that our findings are disseminated to both health care and disciplinary research communities. The inventory and KT Theories User's Guide would be made available on the OHRI website as well as possibly through the CIHR ResearchNet portal.

We will also email a synoptic report of the KT Theories User's Guide to the Canadian KT centres consulted as part of our current KT environmental scan project. They are a highly appropriate group of researchers to inform about the results of our work and the precise target audience who would have the most theoretical and practical interest in it. In addition, we will take advantage of our large research team by using our combined informal networks nationally and internationally to disseminate our findings and to engage in dialogues about the implications of our findings. Bearing in mind that the results of our work should be of use to teachers, health practitioners, and public health administrators as well as theoreticians and scientist/researchers, we will consistently attempt to bridge theory with actual settings where it will be applied to ensure both translation and utility/applicability to applied settings.

One of the Co-Is (JG) is establishing a Canadian C.H.A.I.N. network (similar to the UK National Health Service (NHS) C.H.A.I.N. network)⁶⁷. This is an electronic network of researchers, professionals and policy makers interested in using research evidence to improve policy and practice. Members sign up to the electronic network using key words that identify their particular interests and expertise. The network encourages peer-to-peer linkage and a highly targeted 'push' of information relevant to self identified needs and interests of members. Once this network is up and running, we shall inform interested members about the proposed work and progress to date as the work unfolds.

Finally, members of the team will create a 2-3 hour workshop/seminar that synthesizes the results of our work. It will be offered at the Universities of Ottawa, Laval, McMaster, Queens, etc, as well as at conferences and on demand for targeted audiences, such as interested decision makers. This will provide many opportunities for knowledge translation and two way exchange as well as opportunities for refinement of key ideas and concepts emerging from our work.

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