

Knowledge Translation Research: The Science of Moving Research Into Policy and Practice

JANET A. CURRAN, RN, PhD; JEREMY M. GRIMSHAW, MBChB, PhD, FRCGP; JILL A. HAYDEN, DC, PhD; BARBARA CAMPBELL, RN, PhD

Research findings will not change health outcomes unless health care organizations, systems, and professionals adopt them in practice. Knowledge translation research is the scientific study of the methods to promote the uptake of research findings by patients, health care providers, managers, and policy makers. Many forms of enquiry addressing different questions are needed to develop the evidence base for knowledge translation. In this paper we will present a description of the broad scope of knowledge translation research with a reflection on activities needed to further develop the science of knowledge translation. Consideration of some of the shared research challenges facing the fields of knowledge translation and continuing professional development will also be presented.

Key Words: knowledge translation, knowledge translation research, theory-based interventions

Introduction

Knowledge derived from research will only improve patient care if it is applied in clinical, policy, and administrative decision making. The gap between the best available scientific evidence and policy/clinical decision making is a common finding in health services research. Current estimates suggest that it takes 1 to 2 decades for original research to be incorporated into routine practice.¹ Given the pace of research and innovation in health care, the knowledge-to-practice gap is a concern.

Knowledge translation (KT) is the process of moving from what has been learned through research to application in different decision-making contexts. The Canadian Institutes of Health Research (CIHR) defines knowledge translation as

a dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide

more effective health services and products and strengthen the healthcare system.²

While this definition has been adopted locally and internationally by many health researchers and health care organizations, at least 100 terms have been used in the literature to describe some aspect of KT.³ The use of multiple terms across different disciplines, research traditions, and countries poses a barrier for understanding and using the KT literature.

Successful KT requires understanding and attending to the multidimensional barriers and facilitators that influence the knowledge decision-making gap. Knowledge translation research is the scientific study of the determinants of knowledge use and the methods to promote the uptake of research findings by health care providers, policy makers, and patients.⁴ The term *knowledge translation research* is often used interchangeably with *implementation research* or *quality improvement research* and involves investigating the methods, mechanisms, and measurements, which influence the KT process.

In this article, we present a brief historical overview of the development of KT research in the health sciences and a review of the scope of KT research. The article concludes with reflections on common research challenges facing the fields of KT and continuing professional development (CPD).

Historical Overview

The existing literature on KT is distributed across different disciplines with roots that can be traced back to the field of agriculture at the beginning of the 20th century. Early diffusion research was situated within disciplinary silos (primarily sociology, anthropology, and education); however,

Disclosures: The authors report none.

Dr. Curran: Clinical Epidemiology Program, Ottawa Hospital Research Institute; *Dr. Grimshaw:* Clinical Epidemiology Program, Ottawa Hospital Research Institute; *Dr. Hayden:* Community Health and Epidemiology, Dalhousie University; *Dr. Campbell:* Webster Centre for Teaching and Learning and Faculty Development Office, School of Nursing, University of Prince Edward Island.

Correspondence: Janet A. Curran, Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, K1Y 4E9, Canada; e-mail: jacurran@ohri.ca.

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• Published online in Wiley Online Library (wileyonlinelibrary.com).
DOI: 10.1002/chp.20124

by the mid-1960s, with Roger's publication of the *Diffusion of Innovation*, the disciplinary boundaries began to break down.⁵ Estabrooks et al⁶ used citation mapping to document the historical development of the field of knowledge utilization from 1945 to 2004, highlighting four relevant domains of study: diffusion of innovation, knowledge utilization, technology transfer, and evidence-based medicine.

During this same time period, health care organizations were focused on implementing quality improvement (QI) initiatives to measure performance and implement change.⁷ An analysis of QI methodologies between 1988 and 2007 revealed continuous turnover of methodologies in health care organizations with little substantive difference separating them and limited empirical evidence of the benefits or costs.⁸ Grol⁹ identified the need to halt the trend toward quick fixes and move toward sustained QI research.

Infrastructure to support the expanding field of KT research has grown over the past decade. In 2006, an open-access journal, *Implementation Science*, was launched, with a mandate to publish research relevant to the scientific study of methods to promote the uptake of research findings into routine health care in both clinical and policy contexts. Efforts to strengthen the development of KT research include initiatives such as the CIHR Knowledge Translation Strategy 2004–2006 and the Knowledge Utilization Studies Program (KUSP) at the University of Alberta. Knowledge Translation Casebooks, which highlight exemplars of translating knowledge into practice, have also been published in both the United Kingdom and Canada.

Scope of KT Research

The goal of KT research is to develop a generalizable empirical and theoretical basis to optimize KT activities. While the field of KT research is growing, it continues to face a number of conceptual and methodological challenges.¹⁰ KT interventions are generally complex to design and evaluate. To date, many KT interventions have been selected using intuitive/nontheoretical methods.^{4,11} In 2008, the Medical Research Council (MRC) published updated guidelines to assist researchers with developing and evaluating complex interventions.¹² The guidelines emphasize the use of existing evidence and theory throughout the process. Theory-based KT research presents a number of benefits, including development of a generalizable framework for assessing barriers and facilitators, optimizing selection of intervention components, and design of a comprehensive evaluation strategy.^{13,14} Although the body of knowledge is growing, it remains difficult to draw conclusions about what are the most effective approaches in specific settings. Many forms of inquiry addressing different questions are needed to develop the evidence base for knowledge translation. The following examples highlight some of the gaps in the specific areas of inquiry.

Research Into the Evolution of and Critical Discourse Around Research Evidence

Ioannidis has undertaken a series of studies exploring the evolution of basic and applied research. He demonstrated the “Proteus effect” where the initial published findings in both basic and applied health research tend to be more optimistic than subsequent published findings.¹⁵ In another study he demonstrated the unreliability of highly cited randomized controlled trials (RCTs).¹⁶ Based on his results, Ioannidis has suggested that approximately 50% of published research is false.¹⁷ These findings suggest that the development of reliable evidence depends on empirical demonstration of its reproducibility, validity, and generalizability over a specified range of instances and contexts. A mature and valid evidence base is essential before expending scarce resources on intervention strategies in implementation research.¹⁸ However, there are a number of barriers which hinder appropriate replication of KT research findings, including the lack of a generalizable framework to guide replication of complex interventions.

Identification of Knowledge to Action Gaps

Identifying and measuring the gap between evidence and practice is one of the first steps in the KT process.¹⁹ Strategies used to measure the gap can vary depending on whether the gap is being measured at the individual, population, health care provider, or organizational level. Needs assessment, individual studies and systematic reviews are useful tools for understanding gaps in practice. However, appropriate quality indicators can provide a more expedient means for assessing the gap. The Institute for Clinical Evaluative Studies (ICES) has produced a series of health care reports in Ontario which highlight evidence-practice gaps and could be used to identify priorities for knowledge translation research.^{20,21} Researchers and policy makers have also used ICES data in combination with other data sources for projects such as assessing the rates of hyperkalemia following publication of an RCT on aldactone²² or examining the association between variations in the use of antipsychotic drugs and variations in their clinical indications in older adults with dementia.²³ Further work is needed to better understand the best methods for selecting important indicators, identifying relevant measures and collecting and reporting the data at different levels of the health care system.

Knowledge Syntheses

Knowledge syntheses involve “the contextualization and integration of research findings of individual research studies within the larger body of knowledge on a topic.”²² A number of different approaches can be used to conduct knowledge syntheses, including systematic reviews, narrative reviews, realist reviews, and scoping reviews.²⁴ The trustworthiness of findings of any knowledge syntheses depends

on the use of rigorous review methods. A number of international initiatives support the conduct of high-quality syntheses. The Cochrane Collaboration is an international not-for-profit organization that has conducted over 4,500 systematic reviews on the effectiveness of health care interventions and policies.²⁵ The Cochrane Effective Practice and Organization of Care (EPOC) group in collaboration with the Canadian Agency for Drugs and Technologies in Health (CADTH), produced the Rx for Change database, which includes appraised summaries of over 300 reviews of health professional behavior change strategies.²⁶ Unfortunately, the conclusions that one can draw from systematic reviews of complex interventions is limited by poor descriptions of the functional components of the interventions and inconsistencies with terminology.¹³ The recent launch of an open access international database for registering systematic reviews, PROSPERO, will provide a public record of planned systematic review methods and should reduce inappropriate duplication and promote prospective specification of key elements of reviews.²⁷

Research Into Knowledge Retrieval, Evaluation, and Knowledge Management Infrastructure

The substantial increase in the volume of research evidence produced over the past 20 years has created a challenge for finding the right information at the right time. The development of specialized search strategies can be used to retrieve clinically important information from electronic databases.²⁸ However, emerging technology can also facilitate knowledge dissemination among health care professionals, researchers, caregivers, and patients.²⁹ Technologies and tools such as *ACP Journal Club*, *McMaster KT+*, and *Evidence Updates* are products that interpret and disseminate synthesized evidence,³⁰ and present the evidence in a more user-friendly way.³¹ A field of research is developing in response to the need to better understand the factors that impact how clinicians use these electronic information sources.^{32,33}

Development of Methods to Assess Barriers and Facilitators to KT

Multiple factors at different levels of the health care system (structural, organizational, peer group, individual) influence use of research in decision making.^{34–36} Understanding these factors is a critical first step in designing effective intervention strategies. A number of tools exist to assess barriers to knowledge use^{37–39}; however, further validation is required in a range of settings and contexts.

Knowledge translation frequently requires patients, clinicians and policy makers to change their behaviors. Understanding the health behavior of providers and policy makers requires attention to the cognitive and social factors that impact decision making in practice.⁴ A variety of social cognitive theories have been used to explain health care professional cognitions across a range of behaviors and

settings.⁴⁰ Focus has been on theories that have been empirically tested, explain behavior in terms of factors that are amenable to change and include nonvolitional factors. However, the number of available social cognitive theories and the overlapping constructs present a challenge for knowing how to select and apply psychological theories when exploring specific health behaviors. To maximize the accessibility and usefulness of psychological theory, Michie et al⁴¹ developed a theoretical domains framework (TDF). The framework was developed through a process of expert consensus and draws on 33 behavior change theories and 128 explanatory constructs. The ability to identify determinants of specific behaviors will assist design of appropriate behavior change interventions. Theory based interventions allow the developer to make explicit the causal pathways that underlie the intervention.⁴² The TDF has been used to explore provider behavior across a number of health settings. In a recent cluster RCT the TDF was used to assess the barriers and enablers for general practitioners use of an evidence-based clinical practice guideline to manage acute low back pain.^{43,44} The TDF has also been used to assess barriers to reducing blood transcribing behavior of physicians in neonatal intensive care and surgical care areas in the United Kingdom and Canada.⁴⁵ Further testing is required to refine methods for identifying important constructs and domains and for use in complex behaviors.

Development of Methods for Optimizing KT Strategies

MRC guidelines recommend a systematic approach for developing interventions using appropriate theory and the best available evidence.¹² Choice of intervention should be based on assessment of barriers, understanding the causal pathway of the intervention, empirical evidence about the effects of the interventions and knowledge of available resources. At present, the process for selecting appropriate interventions, even when relevant theoretical domains have been identified, is unclear. Intervention mapping is a systematic way of moving from knowledge about behavioural determinants to change goals and ultimately to intervention strategies.⁴⁶ Preliminary work is currently under way to assist with mapping theoretically derived behavioral determinants to behaviour change techniques.⁴² This work represents the first step toward developing an evolving taxonomy of behavior change techniques that could be used for designing theory-based behavior change interventions.

Evaluation of KT Strategies

Evaluating KT inventions in practice can be challenging as evaluation takes place in a wide range of settings that can place restraints on the researchers' choice of intervention and evaluation methods.¹² In addition, KT interventions often contain multiple components, which may act independently or interdependently. Quantitative and qualitative

methods can help develop a comprehensive understanding of complex interventions however, choice of design should be driven by the research question, the setting and the feasibility.⁴⁷ The goal of producing local or generalizable knowledge will also influence choice of study design.¹⁰ Randomized trials are considered the gold standard for assessing causality but may be difficult to operationalize in certain settings.⁴⁸ Cluster randomized trials are useful if there is concern with contamination of the control group,¹² as is often the case with complex interventions in health care organizations. Well designed quasi experiments may be used when randomization is not possible.⁴⁸ Evaluations should also reveal information about the processes and mechanisms of actions of the intervention^{49,50} and incorporate an economic analysis.⁵¹ Qualitative methods are useful for exploring the “active ingredients” of the intervention.⁵² Theory-based process evaluations which run alongside the trials can provide insight into the “black box” of intervention effectiveness.^{53,54} There is an ongoing need for adequately designed, powered, and analyzed trials evaluating KT interventions.

Development of KT Research Methods

The past decade has seen an increase in KT research. In general, contributions to the science of knowledge translation research are compromised by weak study designs with poor justification of intervention selection, limited use of theory and inadequate evaluation.^{55,11} However, collaborative structures which support the development of KT research methods are beginning to appear internationally. Dagenais et al⁵⁶ spearheaded an initiative in Quebec to foster coherence in KT research and intervention activities in the field of population health. In 2007, the Academic Emergency Medicine Consensus Conference was held to address the specific research methodologies most appropriate for studying knowledge translation interventions in emergency medicine.⁵⁷ In 2008, the National Institute of Health Research (NIHR) supported the development of nine Collaborations for Leadership in Applied Health Research and Care (CLAHRCs), to develop and investigate methods for translating research into practice.⁵⁸ Each CLAHRCs represents a collaboration between a local university and surrounding health service organizations. KT Canada, a network of over 50 researchers from six Canadian universities, was formed in 2009 to improve how research results are communicated and to develop consensus on KT terminology and methods. These structures and networks should contribute to building programs of research in KT which will strengthen the evidence base in the field. Important methodological issues will need to be identified and resolved through continued multi- and interdisciplinary endeavors.⁵¹

Development of KT Theory

Although a relatively new field study, KT is quickly accumulating a number of descriptive theories dispersed across

a range of disciplines as scientists and interested stakeholders attempt to describe the phenomena of KT. Typically, the relationship between theory and research in science is described as codependent; theory is needed to guide research and research is needed to test and refine theory. In the field of KT, explanatory or predictive theory is needed to design and test interventions.⁵⁹ Rothman suggests that theory should evolve based on empirical evidence and intervention research is useful for testing and refining behaviour change theory.⁶⁰

A number of evidence-based practice (EBP) and KT models exist in the health services literature and constructs vary according to different disciplines and context perspectives.^{61–63} In a narrative review of the KT literature, Ward⁶⁴ identified 28 different models, which explained all or part of the KT process. Five common components emerged:

1. Problem identification and communication.
2. Knowledge/research development and selection.
3. Analysis of context.
4. Knowledge transfer activities or interventions.
5. Knowledge/research utilization.

While theory development appears to be outpacing the use of theory in research, the following examples and those presented in previous sections of this paper suggest that theory-based KT research is beginning to gain some traction. The *Knowledge-to-Action* framework⁶⁵ (FIGURE 1) has been used as the organizing framework for a number of international KT programs and projects.^{66,67} Gardner et al⁶⁸ used behavior change theory as an organizing framework to conceptualize and categorize audit and feedback. As an emerging field, the theoretical background for knowledge translation is complex and at times contradictory. Choosing the right theory to test a particular intervention in a given setting is challenging. As a multidisciplinary field, theory

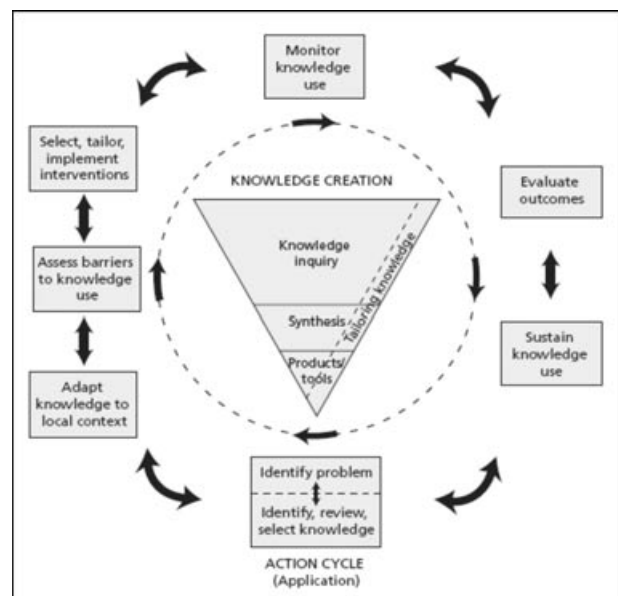


FIGURE 1. The Knowledge-to-Action Framework

Lessons for Practice

- Knowledge translation interventions are generally complex to design and evaluate.
- Theory should be used to optimize the design and evaluation of interventions.
- Opportunities for collaboration between CPD and KT exist across a range of research activities.

scholars should look for opportunities to incorporate insight from different disciplines and seek to develop generalizable theories which may be useful across behaviors.

Shared CPD and KT Research Challenges

“Health professionals serve as the bridge between patients, the knowledge generated by scientific evidence, and the policies and practices to implement that knowledge.”⁶⁹ CPD and KT share a similar goal; changing the behavior of health professionals to enhance best practice and improve patient outcomes. CPD and KT draw on a range of theories and methods to inform their practice. However, both fields fall short in maximizing the use of theory and empirical evidence when designing strategies. Opportunities for collaboration exist across a range of activities including building an evidence base of successful health professional behavior change techniques. CPD and KT researchers face similar problems when conducting real-world intervention research in complex health care organizations. There is a need to assess barriers at multiple levels and draw on best practice evidence when selecting interventions across different settings. Weak designs and poor reporting in the CPD and KT research literature results in limited insight into the rationale and specification of the intervention, the true effect, and the likely confounders. The use of rigorous designs (RCTs, Controlled Before After, Interrupted Time Series) with comprehensive evaluations, including information about the processes, mechanisms of action, and economic analysis are needed. Researchers working within the field of KT and CPD need to pay particular attention to their use of language and report rich descriptions of the context and implementation strategy to make explicit reasons for success or failure of the interventions. Finally, careful consideration of sustainability as it relates to the effects of interventions over time, research funding and a research workforce requires further attention in both fields.

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