Defining knowledge translation

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We cannot pick up a magazine or surf the Internet without facing reminders of the challenges to health care and the "sorry state" of health systems.[1] All health care systems are faced with the challenges of improving quality of care and reducing the risk of adverse events.[2] Globally, health systems fail to use evidence optimally. The result is inefficiency and a reduction in both quantity and quality of life.[3,4] For example, McGlynn and colleagues[5] found that adults in the United States received less than 55% of recommended care. Providing evidence from clinical research (e.g., through publication in journals) is necessary but not enough for the provision of optimal care. Recognition of this issue has created interest in knowledge translation, also known as KT, which we define as the methods for closing the gaps from knowledge to practice. In this series of articles, we will provide a framework for implementing knowledge for clinicians, managers and policy-makers.

What is knowledge translation?

Many terms have been used to describe the process of putting knowledge into action.[6] In their work to create a search filter for knowledge translation, McKibbon and colleagues have so far identified more than 90 terms for use of research (Dr. Ann McKibbon, McMaster University: unpublished data, 2009)! In the United Kingdom and Europe, the terms implementation science or research utilization are commonly used. In the United States, the terms dissemination and diffusion, research use, and knowledge transfer and uptake are often used. In Canada, the terms knowledge transfer and exchange and knowledge translation are commonly used. Knowledge translation has been adopted in Canada because translation of research is embedded in the mandate of the Canadian Institutes of Health Research (the federal agency for the funding of health research). In this series, we use the terms knowledge translation and knowledge-to-action interchangeably.

Formally, knowledge translation is defined by the Canadian Institutes of Health Research as a dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically sound application of knowledge to improve health, provide more effective health services and products, and strengthen the health care system. This definition has been adapted by others, including the United States National Center for Dissemination of Disability Research and the World Health Organization (WHO). The common element among these different terms is a move beyond the simple dissemination of knowledge into actual use of knowledge.

> **Key points**
> - Gaps between evidence and decision-making occur at all levels of health care, including those of patients, health care professionals and policy-makers.
> - Knowledge translation involves using high-quality knowledge in processes of decision-making.
> - The knowledge-to-action framework provides a model for the promotion of the application of research and the process of knowledge translation.

Knowledge creation (i.e., primary research), knowledge distillation (i.e., the creation of systematic reviews and guidelines) and knowledge dissemination (i.e., appearances in journals and presentations) are not enough on their own to ensure the use of knowledge in decision-making.

We should also clarify what knowledge translation isn't. Some organizations may use the term synonymously with commercialization or technology transfer. But this use does not take into consideration the various stakeholders involved (including patients, health care providers and policy-makers) or the actual process of using knowledge in decision-making. Similarly, some confusion arises around the definition of continuing education versus that of knowledge translation. Educational interventions (e.g., audit and feedback, journal clubs) are a strategy for implementing knowledge. But the audience for knowledge translation is larger than the health care professionals targeted for continuing medical education or professional development. Strategies for knowledge translation may vary according to the target audience (e.g., researchers, clinicians, policy-makers, the public) and the type of knowledge being translated (i.e., clinical, biomedical or policy-related).[3]

Why is it important?

Failures to use evidence from research to make informed decisions in health care are evident across all groups of decision-makers, including health care providers, patients, informal caregivers, managers and policy-makers. These failures are also evident in both developed and developing countries, in both primary and specialty care and in care provided by all disciplines. Practice audits performed in a variety of settings

have revealed that high-quality evidence is not being used consistently in practice.[5] For example, statins are considerably underprescribed even though several randomized trials have shown that statins can reduce the risk of mortality and morbidity in poststroke patients.[7,8] By contrast, antibiotics are overprescribed in children with upper respiratory tract symptoms.[9] A synthesis of 14 studies showed that many patients (26%–95%) were dissatisfied with the information they received from their physicians.[10]

Policy-making can involve several stages, including prioritization, development, and implementation. Lavis and colleagues[11] studied 8 processes for policy-making in health. They found that citable research in health services was used in at least 1 stage of the policy-making process for only 4 policies, and it was used in all stages of the process in only 1 of those 4. Similarly, evidence from systematic reviews has been found to be used infrequently by WHO policy-makers.[12] Dobbins and colleagues[13] observed that, although systematic reviews were used in making guidelines for public health in Ontario, the recommendations were not adopted at the level of policy.

Increasing recognition of these gaps in translating knowledge to action has led to efforts to change behaviour, practices and policy. Changing behaviour is a complex process requiring the evaluation of an entire health care organization. This evaluation includes the identification of barriers to change (e.g., lack of integrated health information systems) and targets all those involved in making decisions.[3] Efforts must be made to improve health outcomes by using effective interventions to close the gaps in translating knowledge to practice. These initiatives must include all aspects of care, including access to and use of valid evidence, patient safety strategies, and organizational and systems issues.

What are its determinants?

Multiple factors influence the way research is used by different stakeholders in making decisions.[14–18] A common challenge that all decision-makers (i.e., clinicians, patients, managers, policy-makers) face relates to the lack of skills in knowledge management and infrastructure (i.e., the sheer volume of research evidence currently produced, access to research evidence, time to read and the skills to appraise, understand and apply research evidence). For example, if a general internist wanted to keep abreast of the primary clinical literature relevant to this field, she would need to read 17 articles daily.[19] Given that this finding was reported almost 20 years ago and that more than 1000 articles are indexed daily in MEDLINE, the number of articles the internist would need to read today would be double that estimate. In one study of the use of evidence, clinicians took more than 2 minutes to identify a Cochrane review and its relevant clinical bottom line. This resource was therefore frequently abandoned in "real-time" clinical searches.[20] Lack of skills needed for appraising evidence has been a challenge to all stakeholder groups because, until recently, this skill set has not been a traditional component of most educational curricula.[21,22] For example, Sekimoto and colleagues[23] found that physicians in

their study believed a lack of evidence for the effectiveness of a treatment was equivalent to the treatment being ineffective. Similarly, in another study, public health decision-makers identified a lack of skill in critical appraisal of evidence.[24]

The content of evidence resources is often not enough for the needs of the end-users. Criteria have been developed to enhance reporting of systematic reviews.[25] But their focus has been on the validity of evidence rather than its applicability. For instance, when attempting to use evidence from systematic reviews for clinical decision-making, Glenton and colleagues[26] found that reviews often lacked details about interventions and did not provide adequate information on the availability of interventions or the risk of adverse events. Glasziou and colleagues[27] observed that, of 25 systematic reviews published over 1 year in *Evidence-Based Medicine*, only 3 systematic reviews contained a description of the intervention that was adequate to allow clinical decision-making and implementation. This finding was true for even "simple" interventions, such as medications.

Better management of knowledge is necessary but is not enough to ensure effective knowledge translation. Challenges exist at different levels,[18] including the health care system (e.g., financial disincentives), the health care organization (e.g., lack of equipment), health care teams (e.g., local standards of care may not be in line with recommended practice), individual health care professionals (e.g., variations in knowledge, attitudes and skills in critically appraising and using evidence from clinical literature) and patients (e.g., low adherence to recommendations). Frequently, multiple challenges are present that operate at different levels of the health care system. A subsequent article in this series will tackle the barriers to knowledge translation, summarizing more than 250 barriers that have been identified.[28]

The knowledge-to-action framework

Many proposed theories and frameworks exist for the practice of knowledge translation, which can be confusing in practice.[29–33] A conceptual framework developed by Graham and colleagues,[6] termed the knowledge-to-action cycle, provides an approach that builds on the commonalities found in a review of planned action theories. A process of knowledge creation was added to this model. It has been adopted by the Canadian Institutes of Health Research as the accepted model for promoting the application of research and for the process of knowledge translation.

In this model, the process of translating knowledge to action is an iterative, dynamic and complex process. It concerns the creation and application (action cycle) of knowledge. Although it is drawn as a cycle, users may need to use the phases out of sequence, depending on the project. When using this process, it is essential that the end-users of the knowledge are included to ensure that the knowledge and its subsequent implementation are relevant to their needs. The funnel of knowledge creation and the major action steps or stages comprising the model for translating knowledge to action are illustrated in Figure 1.[4] This series of articles will use this framework to illustrate a strategy for the practice of knowledge translation.

Knowledge creation

Knowledge creation, or the production of knowledge, is composed of 3 phases. These phases are knowledge inquiry, synthesis of knowledge and creation of knowledge tools. As knowledge is distilled through each stage in the knowledge creation process, the resulting knowledge becomes more synthesized and potentially more useful to end-users. Knowledge inquiry includes the completion of primary research. The synthesis stage brings together the disparate research findings that may exist globally on a topic and attempts to identify common patterns. Systematic reviews are the foundation of most activities related to knowledge translation, reflecting that the totality of the evidence should be considered rather than the results of individual studies. We must also consider the quality of the evidence. For example, if we are considering a management issue, ideally we need evidence from a systematic review of good-quality randomized trials. Information on adverse events may not be captured in these studies, however, so consideration of observational studies may be required. At the stage of development of tools and products, the best-quality knowledge is further synthesized and distilled into decision-making tools such as practice guidelines, aids for patient decisions or algorithms. These knowledge tools are discussed in more detail in the next article in this series.

Figure 1: The knowledge-to-action framework.

We must be cautious of the assumption that all knowledge must be translated. We need to ensure instead that a mature and valid base of evidence exists. The realities of health care systems are that we cannot do everything and thus we must work with stakeholders (including patients and the public, clinicians and policy-makers) to establish an explicit process for prioritizing activities related to knowledge translation.

The action cycle

The 7 action phases can occur sequentially or simultaneously and the knowledge phases can influence the action phases at any point in the cycle. For example, as knowledge is updated, we may need to reconsider barriers that exist to this knowledge. The action parts of the cycle are based on theories of planned action that focus on deliberately causing change in health care systems and groups.[29,30] Included are the processes needed to use knowledge in health care settings. Specifically, these processes are identifying the problem; identifying, reviewing and selecting the knowledge to implement; adapting or customizing the knowledge to the local context; assessing the determinants of knowledge use; selecting, tailoring, implementing and monitoring interventions related to knowledge translation; evaluating outcomes or impacts of using the knowl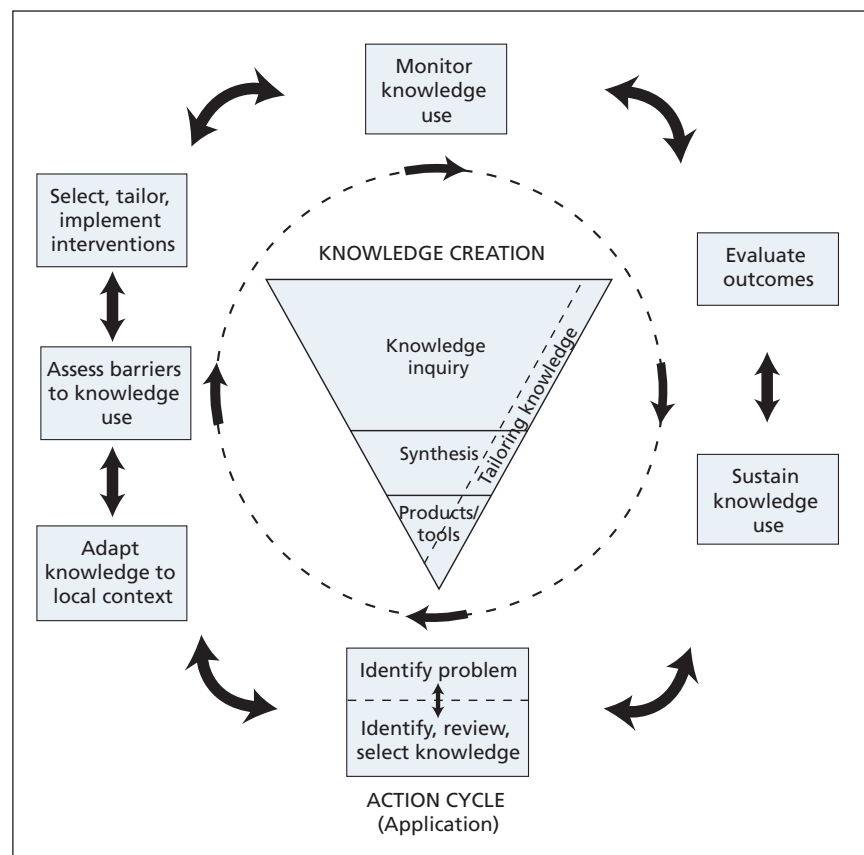edge; and determining strategies for ensuring sustained use of knowledge. Integral to the framework is the need to consider the various stakeholders (including patients, clinicians, managers or policy-makers) who are the end-users of the knowledge that is being implemented.

To illustrate this cycle, consider a local group that includes patient advocates, public health clinicians, home care clinicians and internal medicine clinicians. This group reported that many people in its region who were admitted to a local hospital with falls and fractures were not subsequently assessed for osteoporosis or risk for falls.[34] Evidence from systematic reviews suggests that therapy for osteoporosis (such as bisphosphonates) can reduce the risk of fractures.[35] Evidence around prevention of falls is more controversial[36] but the group was interested in tackling this problem. Its members completed a local audit and found that less than 40% of patients aged 65 and older who were admitted to hospital with fractures were subsequently assessed for osteoporosis. To adapt the evidence to their context, the group created tools for patients to implement the evidence (i.e., recommending weight-bearing exercise and use of calcium and vitamin D) because many did not have a primary care physician or may not have tended to discuss this issue with their physician. The barriers to implementing these tools included the lack of an integrated health record that could be used to identify patients at risk and and a population that was spread over a large region. The group developed a multicomponent, nurse-led strategy that incorporated patient education, self-management, review of medications and

assessment of homes for fall-related risks. Because the group did not know if their strategy for knowledge translation was effective, its members performed a randomized trial of the intervention. The outcomes of interest in the trial included appropriate use of osteoporosis medications and falls at 6 and 12 months. The trial also considered quality of life, patient satisfaction and fractures. Another outcome was the strength of collaboration this group developed. The group grew to include representatives from the provincial government, pharmaceutical companies and insurance companies. This example highlights the collaboration that is necessary for the practice of knowledge translation and the need to address questions that stakeholders are interested in tackling.

This series of articles uses the knowledge-to-action framework to provide an introduction to the science and practice of knowledge translation. We will present the key elements of the action cycle and outline strategies for successful knowledge translation targeted to relevant stakeholders, who include the public, clinicians, policy-makers and others. Each article was created following a systematic search of the literature and appraisal of individual studies for validity. Gaps in the literature will be identified. The science of knowledge translation is a relatively new field and we will attempt to reflect this fact, highlighting future areas of research.

This article has been peer reviewed.

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