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Innovations

Lost in Knowledge Translation: Time for a Map?

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Abstract

There is confusion and misunderstanding about the concepts of knowledge translation, knowledge transfer, knowledge exchange, research utilization, implementation, diffusion, and dissemination. We review the terms and definitions used to describe the concept of moving knowledge into action. We also offer a conceptual framework for thinking about the process and integrate the roles of knowledge creation and knowledge application. The implications of knowledge translation for continuing education in the health professions include the need to base continuing education on the best available knowledge, the use of educational and other transfer strategies that are known to be effective, and the value of learning about planned-action theories to be better able to understand and influence change in practice settings.

Key Words: Knowledge translation, continuing education, knowledge transfer, knowledge exchange, research utilization, continuing professional development

Despite the considerable resources devoted to health sciences research, a consistent finding from the literature is that the transfer of research findings into practice is often a slow and haphazard process.[1] This means that patients are denied treatment of proven benefit because the time it takes for research to become incorporated into practice is unacceptably long. For example, researchers from the United States and the Netherlands have estimated that 30% to 45% of patients are not receiving care according to scientific evidence and that 20% to 25% of the care provided is not needed or is potentially harmful.[2–4] Similarly, it is estimated that cancer outcomes could be improved by 30% with optimum application of what is currently known[5] and that at least a 10% reduction in cancer mortality could be achieved in the United States through widespread use of available state-of-the-art therapies.[6] Also, practice audits performed in a variety of settings have revealed that high-quality evidence is not consistently applied in practice.[7] For example, although several randomized trials have shown that statins can decrease the risk of mortality and morbidity in poststroke patients, statins are considerably underprescribed.[8,9] In contrast, several studies have shown that antibiotics are overprescribed in children with upper respiratory tract symptoms.[10] At the same time, there are problems with premature adoption of some treatments before they have been shown to be beneficial.[11] When this occurs, patients are exposed to potentially ineffective and even harmful treatments.[12] There is also the issue of the growing accumulation of evidence and practitioners' ability to keep up to date. Focusing on studies of cirrhosis and hepatitis in adults published between 1945 and 1999, by 2000, only 60% of the conclusions were still valid, 19% were considered obsolete, and 21% were consid-

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ered false.[13] For many reasons, research findings are not being taken up in practice settings, and many patients are not receiving the best possible care. This situation results in inefficient use of limited health care resources.

Although it has been ongoing since the early quality assurance work of Donabedian in the 1960s,[14] 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, has stimulated increased interest in finding ways to minimize what might be described as the knowledge-to-action (KTA) gap. We have elected to use the term *action* because it is more generic than *practice* and encompasses the use of knowledge by practitioners, policymakers, patients, and the public. Of particular concern to us is the misuse of the terms that in some settings has led to their status as buzz words and the lack of clarity about the concepts and components involved in the KTA process.

Our purpose in this article is to address the need for conceptual clarity in the KTA field and to offer a framework to help elucidate what we believe to be the key elements of the KTA process. For continuing education in the health professions, we highlight the importance of understanding (1) the complete KTA process, (2) the range of stakeholders involved beyond practitioners, and (3) conceptual frameworks that may be useful for facilitating the use of research in practice settings. We also emphasize the importance of continuing education being based on the best available knowledge and the need to incorporate into continuing education strategies that are known to more effectively transfer knowledge to practitioners.

It's All in the Name

Undoubtedly, contributing to the confusion in the area is the use of multiple terms to describe all or part of the process. For example, a recent study we conducted with 33 applied research funding agencies in 9 countries identified 29 terms used to refer to some aspect of the concept of knowledge to action.[15] Some of the more common terms applied to the KTA process are knowledge translation, knowledge transfer, knowledge exchange, research utilization, implementation, dissemination, and diffusion. The situation is further complicated by the use of the terms, often interchangeably. Some are used as nouns to describe the entire process that results in the use of knowledge by decision makers. Others are used as verbs to represent actions or specific strategies taken to cause the uptake to occur. To identify definitions of these terms, we undertook a Google search. The search generated 11,800 hits for knowledge translation, 300,000 for knowledge transfer, 114,000 for knowledge exchange, 59,800,000 for implementation, 18,400 for research utilization, 8,930,000 for dissemination, and 7,020,000 for diffusion. We reviewed the first dozen pages for each term. We were surprised by how difficult it was to actually find meaningful and consistent definitions despite the considerable and growing interest in the topic.

Selected definitions of various terms applied to the KTA process are presented in Table 1. Of all the terms, knowledge translation (KT) is the one gaining prominence in Canada[16–19] (http://www.ktp.utoronto.ca/whatisktp/definition; accessed Jan 24, 2006). The Canadian Institutes of Health Research defined the term in 2000 (http://www.cihrirsc.gc.ca/e/29418.html; accessed Jan 24, 2006). Based on the CIHR's definition, the US National Center for the Dissemination of Disability Research (NCDDR) subsequently produced its own definition of the term.[19] What is key in the CIHR and NCDDR definitions is that the primary purpose of KT is to address the gap between what is known from research and knowledge synthesis and implementation of this knowledge by key stakeholders with the intention of improving health outcomes and efficiencies of the health care system. Implicit in what is meant by *knowledge* is primarily scientific research, as made clear by the

Table 1 Definitions of Terms

Term	Definition & Source
Knowledge translation	"The exchange, synthesis and ethically-sound application of knowledge - within a complex system of interactions among researchers and users - to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system." Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/29418.html accessed Jan 24, 2006)
	"The collaborative and systematic review, assessment, identification, aggregation and practical application of high-quality disability and rehabilitation research by key stakeholders (i.e., consumers, researchers, practitioners, policy makers) for the purpose of improving the lives of individuals with disabilities."[19] US National Center for the Dissemination of Disability Research (NCDDR)
Knowledge transfer	"a systematic approach to capture, collect and share tacit knowledge in order for it to become explicit knowledge. By doing so, this process allows for individuals and/or organizations to access and utilize essential information, which previously was known intrinsically to only one or a small group of people." Government of Alberta (http://www.pao.gov.ab.ca/learning/knowledge/transferguide/index.html accessed Jan 24, 2006).
	"Successful knowledge transfer involves much more than a one way, linear diffusion of knowledge and skills from a university to industry; it depends on access to people, information and infrastructure." UK Particle Physics and Astronomy Research Council (PPARC) (http://www.pparc.ac.uk/in/aboutkt.asp accessed Jan 24, 2006).
	"Knowledge transfer is about transferring good ideas, research results and skills between universities, other research organisations, business and the wider community to enable innovative new products and services to be developed." UK Office of Science and Technology (http://www.ost.gov.uk accessed Jan 24, 2006).
Knowledge exchange	"Knowledge exchange is collaborative problem-solving between researchers and decision makers that happens through linkage and exchange. Effective knowledge exchange involves interaction between decision makers and researchers and results in mutual learning through the process of planning, producing, disseminating, and applying existing or new research in decision-making." Canadian Health Services Research Foundation (http://www.chsrf.ca/keys/glossary_e.php accessed Jan 24, 2006).
Research utilization	"process by which specific research-based knowledge (science) is implemented in practice"[20]
Implementation	"the execution of the adoption decision, that is, the innovation or the research is put into practice" (http://www.nursing.ualberta.ca/kusp/rustudy2/glossary.htm accessed Jan 24, 2006).

(continued)

Table 1 (continued)

Term	Definition & Source
Dissemination	"The spreading of knowledge or research, such as is done in scientific journals and at scientific conferences." (http://www.nursing.ualberta.ca/kusp/rustudy2/glossary.htm accessed Jan 24. 2006)
Diffusion	"The process by which an innovation is communicated through certain channels over time among members of a social system[21] (p5)
Continuing education	"Continuing Education for Health Professionals: planned educational activities intended to further the education and training of specific health professionals for the enhancement of practice, education, administration and research." Uniformed University Services for Health Sciences (http://www.usuhs.mil/che/definitions.htm accessed Jan 26, 2006)
	"Continuing education is a structured process of educating designed or intended to support the continuous development of pharmacists to maintain and enhance their professional competence. Continuing education should promote problem-solving and critical thinking and be applicable to the practice of pharmacy." (http://www.acpe-accredit.org/pdf/CEDefinition04.pdf accessed Jan. 24, 2006)
Continuing professional development	"Continuing professional development is the process by which health professionals keep updated to meet the needs of patients, the health service, and their own professional development. It includes the continuous acquisition of new knowledge, skills, and attitudes to enable competent practice."[22]
	"CPD...includes educational methods beyond the didactic, embodies concepts of self-directed learning and personal development and considers organizational and system factors."[23](p10)

CIHR clarification that the interactions are between *researchers* and users and researchers tend to only produce research or science. Another important element of this definition is the acknowledgement that the KT process occurs in a complex social system of interactions among stakeholders. Unfortunately, the CIHR definition is not explicit about what is meant by interactions that can range from simple communication to exchange of knowledge; however, the NCDDR definition is clear that the interaction is collaborative and two way.

The term *knowledge transfer* is probably the one most commonly used and is also used in fields outside of health care. Knowledge transfer is used to mean the process of getting knowledge used by stakeholders. Knowledge usually encompasses all forms of knowing (research as well as other ways of knowing). This term has sometimes been interpreted as, and criticized for, suggesting that the process is unidirectional, from knowledge producers to stakeholders. However, many using the term consider knowledge transfer a two-way process, although this is not always made explicit. The definitions from the UK Particle Physics and Astronomy Research Council and the UK Office of Science and Technology reveal that some users of the

term do see the complexity of the KTA process and consider transfer between all the stakeholders as critical. Another concern sometimes heard about this term is that *transfer* has been interpreted to mean simply the first step of disseminating knowledge or information to stakeholders and does not extend to the use of the knowledge (i.e., putting it into action).

Knowledge exchange is the term now preferred by the Canadian Health Services Research Foundation and was adopted to address some of the concerns about the term *knowledge transfer.* A key assumption behind this definition is that researchers and decision makers are normally separate groups with distinct cultures and perspectives on research and knowledge, with neither group fully appreciating the other's world. This has also been referred to as the "two-communities theory."[24] Knowledge transfer and exchange in this context involves bringing together researchers and decision makers and facilitating their interaction, which starts with collaborating on determining the research question. This ongoing exchange and knowledge transfer ensure that the knowledge generated is relevant and applicable to stakeholder decision making as well as useful to researchers (http://www.iwh.on.ca/kte/kte.php; accessed Jan 24, 2006). Implicit and unique to this definition is the focus on a collaborative research approach spanning the entire KTA process[25]: researchers and decision makers are engaged together from initially identifying the research question through to applying the knowledge. In contrast, with knowledge translation and transfer, there is no expectation that the same stakeholders will be involved in all phases of the process. Indeed, it is often assumed that there would be different individuals involved at different steps in the KTA journey.

The term *research utilization* has been used in nursing for decades. The defining characteristic here is that it is a subset of knowledge utilization whereby the knowledge has a research base to substantiate it (http://www.nursing.ualberta.ca/kusp/rustudy2/glossary.htm; accessed Jan 24, 2006). Research utilization is focused only on moving research findings into action. As with the other terms, this one is sometimes used as a noun to describe the KTA process and sometimes as a verb representing the doing of it.

The term *implementation* is more common in the United Kingdom and Europe. *Implementation research* has been defined as the scientific study of methods to promote the systematic uptake of clinical research findings and other evidence-based practices into routine practice and, hence, to improve the quality and effectiveness of health care.[26] It includes the study of influences on health care professional and organizational behavior and of interventions to enable them to use research findings more effectively (http://www.implementationscience.com; accessed Jan 24, 2006). Similar to research utilization, the term implementation in health care tends to refer to implementation of research as opposed to other forms of knowledge, but as with the other terms, the focus is on the application or uptake of knowledge. The journal *Implementation Science* was recently launched and will encompass all aspects of 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.

No discussion of the more prominent terms informing the KTA discourse would be complete without mentioning dissemination and diffusion. Both of these terms can be differentiated from those above by their general lack of emphasis on the development of the knowledge (i.e., the creation of the knowledge or the quality of the knowledge) or the actual uptake or implementation of the knowledge. They often refer to the promulgation of knowledge products to increase stakeholders' awareness of them or the specific and discrete strategies used to promulgate knowledge products. Although Rogers' definition of diffusion acknowledges the social nature of the phenomenon, this complexity is often not captured by those using the term. Perhaps adding to the confusion is that some use the term *dissemination* in a way similar to the above KTA

definitions, although this is not the definition commonly attributed to the term in health care. For example, in 1993, Hutchinson and Huberman defined dissemination as "the transfer of knowledge with and across settings, with the expectation that the knowledge will be 'used' conceptually or instrumentally."[27] More recently, Kerner and colleagues[28] have used the term to mean the complex process of moving research into practice.

Before leaving this discussion about terms and definitions, it is worth noting that there are many terms that are often confused with KTA, resulting in misperceptions about what KTA is. For example, translational research (the transfer of basic science discoveries into clinical applications) does not fall under our conceptualization of KTA because translational research falls short of widespread adoption. KTA is also often confused with continuing education. Traditionally, continuing education focuses on enhancing health care professionals' clinical competence. KTA has a broader focus with stakeholders including patients, policymakers, and health care professionals among others.[17] Moreover, the focus of KTA is to ultimately enhance health status. Similarly, KTA can be confused with continuing professional development (CPD), which advocates a more holistic approach to maintaining competence through the development of lifelong learning to meet the needs of patients, the health system, and individuals' own professional development. However, the audience for KTA is much broader than for CPD, which targets only the health care professional.[17]

Making Sense of the Black Box That Is KTA

For conceptual and illustrative purposes, we have divided the KTA process into two concepts: knowledge creation and action, with each concept comprised of ideal phases or categories (Figure 1). In reality, the process is complex and dynamic, and the boundaries between these two concepts and their ideal phases are fluid and permeable. The action phases may occur sequentially or simultaneously, and the knowledge phases may influence the action phases. Figure 1 presents our conceptualization of the KTA process. The funnel symbolizes knowledge creation, and the cycle represents the activities and processes related to use or application of knowledge (action). With our conceptualization, knowledge is empirically derived (i.e., research based) but also encompasses other forms of knowing such as experiential knowledge as well.

If taken as a whole with knowledge producers-researchers and knowledge implementers-users working collaboratively throughout the process, the model represents the Canadian Health Services Research Foundation's definition of knowledge exchange. Alternatively, the model can also accommodate different phases being accomplished by different stakeholders and groups (working independently of each other) at different points in time. For example, researchers can simply focus on knowledge creation activities, leaving the uptake of the knowledge to others to promote and facilitate.

Knowledge Creation

The knowledge funnel represents knowledge creation and consists of the major types of knowledge or research that exist and can be used in health care. Some of the phases are similar to those proposed by Haynes.[29] As knowledge moves through the funnel, it becomes more distilled and refined and presumably more useful to stakeholders. Another analogy would be to think of the research being sifted through filters at each phase so that, in the end, only the most valid and useful knowledge is left.

For example, the phase of knowledge inquiry represents the unmanageable multitude of primary studies or information of variable quality that is out there and that may or may not be easily accessed. This can be thought of as first-generation knowledge that is in its natural state and largely unrefined, like diamonds in the rough.

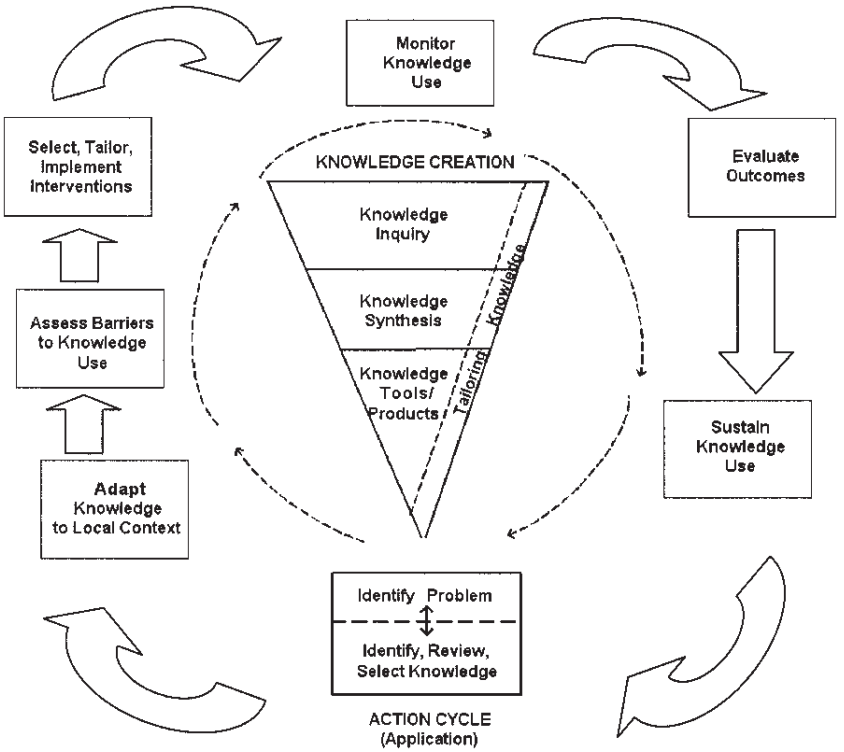

Figure 1 Knowledge to action process

Knowledge synthesis, or second-generation knowledge, represents the aggregation of existing knowledge. The process involves the application of explicit and reproducible methods to the identification, appraisal, and synthesis of studies or information relevant to specific questions. It is done to make sense of all the relevant knowledge. This knowledge often takes the form of systematic reviews, including meta-analysis and meta-synthesis.

Third-generation knowledge consists of knowledge tools or products. Synopses such as *ACP Journal Club,* practice guidelines, decision aids and rules, and care pathways are examples of such tools. The purpose of these tools is to present knowledge in clear, concise, and user-friendly formats and ideally to provide explicit recommendations with the intent of influencing what stakeholders do[30] and to meet the stakeholders' knowledge or informational needs, thereby facilitating the uptake and application of knowledge.

At each phase of knowledge creation, knowledge producers can tailor their activities to the needs of potential users. They can tailor their research questions to address the problems identified by users. When the results are available, they can tailor or customize the message for the different intended users (e.g., repackage their products for specific user audiences: the public, practitioners, policymakers). Furthermore, they can tailor or customize the method of dissemination to better reach the intended users. As Lavis et al.[31] and others[32] have noted, knowledge producers can facilitate the uptake of research by addressing five questions: What should be disseminated? To whom should it be disseminated? By whom should it be disseminated? How should it be disseminated? and With what effect should it be disseminated?

Action Cycle

The action part of the process can be thought of as a cycle leading to implementation or application of knowledge. In contrast to the knowledge funnel, the action cycle represents the activities that may be needed for knowledge application. These phases are dynamic, can influence each other, and can be influenced by the knowledge creation phases.

The action phases are derived from a review we are undertaking of planned-action theories, frameworks, and models. Planned action refers to deliberately engineering (not haphazardly) change in groups that vary in size and setting. Those who use planned-action theories or models may work with individuals, but their objective is to alter ways of doing things in social systems. Planned-action theories or models are intended to help planners or change agents control variables that increase or decrease the likelihood of the occurrence of change.[33,34] To date, we have identified over 60 such theories or frameworks.[35] Among the theories or frameworks are many commonalities. These commonalities are represented by the following phases:

- Identify a problem that needs addressing
- Identify, review, and select the knowledge or research relevant to the problem (e.g., practice guidelines or research findings)
- Adapt the identified knowledge or research to the local context
- Assess barriers to using the knowledge
- Select, tailor, and implement interventions to promote the use of knowledge (i.e., implement the change)
- Monitor knowledge use
- Evaluate the outcomes of using the knowledge
- Sustain ongoing knowledge use

As the knowledge cycle takes a planned-action approach, the first step can often involve a group or individual identifying that there is a problem or issue that deserves attention and searching for knowledge or research that might address the problem. Once the relevant research is identified, it is then critically appraised to determine its validity and usefulness for the problem at hand. Alternatively, a group or individual may start by identifying or becoming aware of the knowledge (e.g., a practice guideline) and then determining whether there is a knowledge-practice gap that needs filling with the identified knowledge.

Next comes a phase involving adapting the knowledge to the local context. By this we mean the process individuals or groups go through as they make decisions about the value, usefulness, and appropriateness of particular knowledge to their setting and circumstances. It also encompasses those activities that they may engage in to tailor or customize the knowledge to their particular situation. The process may be more or less formal[36] but is a critical step; as Huberman noted many years ago, research is not used as a can opener is used.[37] Generic knowledge is seldom taken directly off the shelf and applied without some sort of vetting or tailoring to the local context.

The uptake of knowledge can be influenced by issues related to the knowledge to be adopted, the potential adopters, and the context or setting in which the knowledge is to be used.[38–40] At the barriers assessment phase, those wanting to bring about change (implementers or change agents) should assess for potential barriers that may impede or limit uptake of the knowledge so that these barriers may be targeted and hopefully overcome or diminished by intervention strategies. The barriers assessment should also identify supports or facilitators that can be taken advantage of.

The next phase, which is the one usually equated with the concept of dissemination or transfer strategies, is about planning and executing interventions to facilitate and promote awareness and implementation of the knowledge. This involves selecting and tailoring interventions to the identified barriers and audiences. Lomas[41]

has provided a useful classification that differentiates diffusion (passive unplanned efforts such as publishing an article in a journal or making it accessible on the Web) from dissemination (tailoring the message and targeting it to a particular audience) and from implementation (systematic efforts to encourage adoption). The evidence, while limited, is fairly consistent that change is more likely to occur with more planned and focused interventions.[42–45] For example, barriers for potential adopters may be related to knowledge, attitudes, skills, habits, or the like. Interactive educational interventions and outreach visits can be useful for addressing these types of barriers. When the barriers are related more to the organization of service delivery, introducing reminder systems, modifying the documentation system, changing staffing levels, purchasing equipment, or altering the remuneration process may be useful strategies.

Once the implementation interventions have been launched, the next phase is monitoring knowledge use or application. Here it becomes important to define what constitutes knowledge use so that it can be measured. At least three types of knowledge use have been described.[46] There is conceptual use of knowledge that describes changes in levels of knowledge, understanding, or attitudes; instrumental use that describes changes in behavior or practice (and translates into improved health outcomes); and strategic use (the research-as-ammunition tradition[35]) that relates to the manipulation of knowledge to attain specific power or profit goals. Monitoring use of the knowledge is necessary to determine how and the extent to which it has diffused throughout the potential-adopter group. It can also be used to determine whether the interventions have been sufficient to bring about the desired change or whether more of the same or new interventions may be required. If the degree of knowledge use is less than expected and desired, it may be useful to reassess the potential adopters at this stage about their intention to use the knowledge. This could help to determine whether the lack of change is related to their lack of interest in changing, other barriers beyond their control, or new barriers that may emerge after the initial introduction of the adapted knowledge.

The subsequent phase is to determine the impact of using the knowledge. This is to evaluate whether application of the knowledge actually makes a difference in terms of such things as health, practitioner, and system outcomes. Evaluating the impact of knowledge use is the only way to determine whether the efforts to promote its uptake were successful and worth it.

The last phase on the action side is about sustaining the use of knowledge. Interest in sustainability of knowledge use is relatively recent, and so there has not been much research into this important aspect of the KTA process. While the barriers to ongoing use of the knowledge may be different from the barriers present when the knowledge was first introduced, the process for planning and managing the change should be the same: assess barriers to knowledge sustainability, tailor interventions to these barriers, monitor ongoing knowledge use, and evaluate the impact of initial use and sustained use of the knowledge. The sustainability phase should set in motion a feedback loop that cycles through the action phases.

As each action phase can be influenced by the phases that precede it, there may also be feedback between the phases. For example, the monitoring-adoption phase might reveal that the knowledge is not being acted upon; this would lead change agents to rethink the implementation strategies used and introduce more of the same or different ones to try to improve the uptake of the knowledge.

It is important to also emphasize that both local and external knowledge creation or research can be integral to each action phase. For example, local research can be done to determine the magnitude of the problem or the care gap, assess barriers to knowledge using qualitative or survey methods, and monitor knowledge use and outcomes. External knowledge or

Lessons for Practice

- Knowledge translation is about turning knowledge into action and encompasses the processes of both knowledge creation and knowledge application.
- Knowledge translation subsumes and builds on continuing education and continuing professional development.
- Health care professionals need to learn about planned-action theories and frameworks so as to be able to understand and influence change in their practice settings.
- Continuing education should be based on the best available knowledge, whether in the form of knowledge tools (e.g., practice guidelines), knowledge syntheses, or primary knowledge inquiries.
- Continuing education should apply strategies shown to be effective at transferring knowledge.

research from the literature can be used to identify potential barriers to knowledge use and implementation interventions shown to be effective. Integration of research at each action phase should not only help to develop the scientific basis of KTA but also bring about more effective uptake of knowledge.

Conclusions

Our description of the variability in the operational definitions of knowledge translation and knowledge transfer demonstrates that the KTA field, while not exactly uncharted territory, is territory that has differing views on its boundaries and on the nature of the terrain. In order to advance the science of KTA, consensus on terms and definitions is essential if knowledge producers and implementers and users are to effectively and meaningfully communicate with each other. The establishment of a common nomenclature is also often an important step in advancing a new field of scientific inquiry and is particularly useful in outlining the research agenda and highlighting its gaps.

Ensuring that knowledge to action occurs is complex and challenging. As we have outlined, KTA is about an exchange of knowledge between relevant stakeholders that results in action. To achieve this, appropriate relationships must be cultivated. The first step in this process is to identify the relevant stakeholders and to establish a common understanding of KTA. It is our hope that this discussion and clarification of terms, along with our presentation of a conceptual map for the KTA process, will help knowledge producers and users understand the nature of the terrain so that they can find their way through the complex, iterative, and organic process of knowledge translation.

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References

1. Agency for Health Research and Quality. Translating research into practice (TRIP)-II. Washington, DC: Agency for Health Research and Quality, 2001. http://www.ahrq.gov/research/trip2fac.htm
2. Schuster M, McGlynn E, Brook RH. How good is the quality of health care in the United States? *Milbank Q* 1998; 76:517–563.

3. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Med Care* 2001; 39:II46-II54.
4. McGlynn E, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, Kerr EA. The quality of health care delivered to adults in the United States. *N Engl J Med* 2003; 348:-2635-2645.
5. Canadian Cancer Control Strategy. Canadian strategy for cancer control. Draft synthesis report. Ottawa, Ontario: Canadian Cancer Control Strategy, 2001.
6. Ford L, Kaluzny AD, Sondik E. Diffusion and adoption of state-of-the art therapy. *Semin Oncol* 1990; 4:485–494.
7. Kong T, Missouris C, Murdah M, MacGregor G. The use of HMG CoA reductase inhibitors following acute myocardial infarction in hospital practice. *Postgrad Med J* 1998; 74:600–601.
8. LaRosa J, He J, Vupputuri S. Effects of statins on the risk of coronary disease: A meta-analysis of randomized controlled trials. *JAMA* 1999; 282:2340–2346.
9. Naylor CD, Tu JV, Slaughter P. Cardiovascular health and services in Ontario. An ICES Atlas. Toronto, Ontario: ICES, 1999.
10. Arnold S, Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Library,* 2005.
11. Reaume MN, Moja PL, Nurbhai M, McGowan J, O'Rourke K, Grimshaw J, Graham ID, and on behalf of the Life Cycle Study Group. Cumulative meta-analysis to determine key milestones in the Life Cycle of Evidence in Cancer Care. Paper presented at the 13th Cochrane Colloquium, Oct 22–26, 2005 Melbourne, Australia.
12. Roumie C, Arbogast P, Mitchel EF, Griffin M. Prescriptions for chronic high-dose cyclooxygenase-2 inhibitors are often inappropriate and potentially dangerous. *J Gen Intern Med* 2005; 20:879–883.
13. Poynard T, Munteanu M, Ratziu V, Benhamou Y, Di MV, Taieb J, et al. Truth survival in clinical research: An evidence-based requiem? *Ann Intern Med* 2002; 136:888–895.
14. Donabedian A. Evaluating the quality of medical care. *Milbank Mem Fund Q Health Soc* 1966; 44:166–206.
15. Graham ID, Tetroe J, Robinson N, Grimshaw J, and the International Funders Study Research Group. An international study of health research funding agencies' support and promotion of knowledge translation. Presented at the Academy Health Annual Research Meeting, Boston, 2005.
16. Jacobson N, Butterill D, Goering P. Development of a framework for knowledge translation: Understanding user context. *J Health Serv Res Policy* 2003; 8:94–99.
17. Davis D, Evans M, Jadad A, Perrier L, Rath D, Ryan D, et al. The case for knowledge translation: Shortening the journey from evidence to effect. *BMJ* 2003; 327:33–35.
18. Glasgow R, Lichtenstein E, Marcus A. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *Am J Public Health* 2003; 93:1261–1267.
19. National Center for Dissemination of Disability Research. What is knowledge translation? Technical brief number 10. 2005. Available at: http://www.ncddr.org/du/products/focus/focus 10. Accessed Feb. 17, 2006.
20. Estabrooks CA, Wallin L, Milner M. Measuring knowledge utilization in health care. *Int J Policy Eval Manage* 2003; 1:3–36.
21. Rogers EM. Diffusion of innovations. New York: Free Press, 1995.
22. Peck C, McCall M, McLaren B, Rotem T. Continuing medical education and continuing professional development: International comparisons. *BMJ* 2000; 320:432–435.
23. Barnes B, Davis D, and Fox R. The continuing professional development for physicians: From research to practice. Chicago: American Medical Association, 2003.
24. Wingens M. Toward a general utilization theory: A system theory reformulation of the two-communities metaphor. *Knowledge* 1990, pp. 27–42.
25. Denis JL, Lomas J. Convergent evolution: The academic and policy roots of collaborative research. *J Health Serv Res Policy* 2003; 8(suppl 2):1–6.

26. Foy R, Eccles M, Grimshaw J. Why does primary care need more implementation research? *Fam Pract* 2001; 18:353–355.
27. Hutchinson J, Huberman M. Knowledge dissemination and utilization in science and mathematics education: A literature review. Washington, DC: National Science Foundation, 1993.
28. Kerner J, Rimer B, Emmons K. Introduction to the special section on dissemination—Dissemination research and research dissemination: how can we close the gap? *Health Psychol* 2005; 24:443–446.
29. Haynes RB. Of studies, syntheses, synopses, and systems: The "4S" evolution of services for finding current best evidence. *ACP J Club* 2001; 134:A11-A13.
30. Hayward RSA, Wilson MC, Tunis SR, Bass EB, Guyatt G. Users' guides to the medical literature—VIII: How to use clinical practice guidelines. A. Are the recommendations valid? *JAMA* 1995; 274:570–574.
31. Lavis JN, Robertson D, Woodside J, McLeod C, Abelson J, Knowledge Transfer Research Group. How can research organizations more effectively transfer research knowledge to decision makers? *Milbank Q* 2003; 81:171–172.
32. Canadian Health Services Research Foundation. Communication notes: Developing a dissemination plan. Ottawa, Ontario: Canadian Health Services Research Foundation, 2004.
33. Tiffany C. Analysis of planned change theories. *Nurs Manage* 1994; 25:60–62.
34. Tiffany C, Cheatham A, Doornbos D, Loudermelt L, Momadi G. Planned change theory: Survey of nursing periodical literature. *Nurs Manage* 1994; 25:54–59.
35. Graham ID, Harrison MB, Logan J, and the KT Theories Research Group. A review of planned change (knowledge translation) models, frameworks and theories. Presented at the JBI International Convention, Adelaide, Australia, Nov 28–30, 2005.
36. Graham ID, Harrison MB, Lorimer K, Piercianowski T, Friedberg E, Buchanan M, et al. Adapting national and international leg ulcer practice guidelines for local use: The Ontario Leg Ulcer Community Care Protocol. *Adv Skin Wound Care* 2005; 18:307–318.
37. Huberman M. Steps toward an integrated model of research utilization. *Knowledge Creation Diffusion Utilization* 1987; 8:586–611.
38. Graham ID, Logan J. Innovations in knowledge transfer and continuity of care. *Can J Nurs Res* 2004; 36:89–103.
39. Rogers EM. Lessons for guidelines from the diffusion of innovations. Jt Comm J Qual Improv 1995; 21(7):324–327.
40. McCormack B, Kitson A, Harvey G, Rycroft-Malone J, Titchen A, Seers K. Getting evidence into practice: The meaning of "context." *J Adv Nurs* 2002; 38:94–104.
41. Lomas J. Diffusion, dissemination, and implementation: Who should do what? *Ann N Y Acad Sci* 1993; 703:226–235.
42. Bero LA, Grilli R, Grimshaw JM, Harvey E, Oxman AD, Thomas MA. Getting research findings into practice. Closing the gap between research and practice: An overview of systematic reviews of interventions to promote the implementation of research findings. *BMJ* 1998; 317:465–468.
43. Davis DA, Thomson MA, Oxman AD, Haynes RB. Changing physician performance: A systematic review of the effect of continuing medical education strategies. *JAMA* 1995; 274:700–705.
44. Oxman AD, Thomson MA, Davis DA, Haynes RB. No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. *CMAJ* 1995; 153:1423–1431.
45. Grimshaw JM, Thomas RE, MacLennan G, Fraser C, Ramsay CR, Vale L, et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technol Assess* 2004; 8(6). Available at: http://www.ncchta.org/project.asp?PjtId=994. Accessed Feb. 17, 2006.
46. Huberman M. Linking the practitioner and research communities for school improvement. Address to the International Congress for School Effectiveness and improvement, Victoria, British Columbia, 1992.