



A Pragmatic Review of Knowledge Translation: Moving Forward in Cardiovascular Disease and Hypertension

Report

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Main Messages

- ☞ Change is possible when a well-designed intervention is used. Most interventions that have been assessed empirically have demonstrated some effects (average of about 10% for main targets), however, no intervention is superior for all intended changes in all settings.
- ☞ Passive dissemination of information is generally ineffective in altering practices, no matter how important the issue or how valid the assessment methods.
- ☞ Different types of changes appear to require tailored interventions, but we do not have a good understanding of the probable effectiveness of different interventions for changes across all settings or with varied audiences and KT goals.
- ☞ Interventions developed with awareness of potential barriers to change seem to be more effective than interventions that are not.
- ☞ Various strategies, targeting a range of levels – patient, practitioner, unit, organization, health system – need to be incorporated into the KT plan.
- ☞ Innovations that require simple changes in clinical practice are more easily achieved than innovations that require complex changes, better collaboration between disciplines, or changes in the organization of care.
- ☞ Greater adherence has been observed in guidelines that involve acute conditions as opposed to chronic conditions.
- ☞ Arts-informed research holds great promise as a KT strategy; however, systematic evaluation of its role in dissemination of research results is needed.
- ☞ We need more research to gain a better understanding of the important processes and factors that play a role in knowledge translation.
- ☞ There is more evidence on interventions directed to professionals and practitioners (education, reminders, feedback) than are aimed at the organization or the patient level.
- ☞ There is very little evidence on economic assessment of performance strategies.
- ☞ There is little evidence on patients' outcomes relative to KT strategies.
- ☞ Both scientists and community-based stakeholders have roles to play in shaping KT evidence and KT practice.
- ☞ In order to improve implementation of evidence-based recommendations, one must engage a more multidisciplinary representation of experts and end users.

Introduction

Knowledge translation has become an important concept in the last decade in particular. While there are a variety of terms that are used interchangeably to reflect this area of science and practice – diffusion of innovation, dissemination, knowledge exchange, knowledge mobilization, knowledge management, commercialization - the term ‘knowledge translation’ is most widely accepted. In Canada, the definition provided by the Canadian Institutes of Health Research is most common; *Knowledge translation is 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* (CIHR, 2007).

This report provides an overview of research in the area of knowledge translation (KT). The review was shaped by the project scope and timeline rather than a specific research question. As such, the report constitutes a *pragmatic review*, the results of which are intended to assist HSFO in planning future KT initiatives. The report is supplemented by an annotated bibliography.

The scope of the work was to (1) focus on KT methods used in the health fields, including combinations of methods and technologies; (2) highlight the methods and technologies considered successful in consideration of the context, and those that are considered best practices; and (3) highlight multi-directional methodologies, and their comparative level of success vs. unidirectional, if available.

Review Methods

The review included literature on knowledge translation methodologies and technologies in the areas of cardiovascular disease and hypertension by selecting and summarizing the available empirical and non-empirical published and grey literature in knowledge translation and exchange across multiple health domains, including but not limited to cardiovascular disease and hypertension. The aim was to identify (a) evidence-based KT methods, and (b) promising KT methods, that can be applied in the areas of cardiovascular disease and hypertension.

The field of KT is a new one, and much work is currently underway to develop and evaluate KT methods that take into account characteristics of the method, audience/implementers, and the context. In addition, methods and approaches for studying KT are ever changing, and the complexities of this area are increasingly evident in the workshops and research discussions in Canada and abroad. As such, merely conducting a review of the most rigorous research methods, i.e., randomized control trial, will yield very little of relevance from which to move HSFO's initiatives forward. We do, however, include findings from the most recent systematic reviews in KT, but point out that these are now relatively outdated, ending with studies conducted in the late 1980s (e.g., Grimshaw, Shirran, Thomas, Mowatt, Fraser, Bero et al., 2001; Oxman, Thomson, Davis, & Haynes, 1995). To be comprehensive, we have also searched of the grey literature (see [Box 1](#)).

Box 1 Data Sources

- electronic databases pertaining to health (e.g. MEDLINE; Embase; HealthSTAR; CINAHL);
- hand-search of journals;
- Internet-based searches, which employ more than one search engine (e.g., Google®; Google Scholar®, SCOPUS);
- grey literature sources¹
- reference lists of review-relevant reports as well as key systematic or narrative reviews, or overviews (incl. key reviews predating 1997);

¹ Non-conventional literature (NCL, also called grey literature) comprises scientific and technical reports, patent documents, conference papers, internal reports, government documents, newsletters, factsheets and theses, which are not readily available through commercial channels. NCL specifically does not include normal scientific journals, books or popular publications that are available through traditional commercial publication channels.

We conducted a focused search of the health sciences and practice change literatures. Searching covered various types of data sources, which included but were not restricted to those listed in the [Box 1](#). Search rules were developed on a database-by-database basis to streamline the search terms based on the number of relevant citations that were identified.

Eligible for inclusion were published or unpublished empirical and non-empirical work reported in English, which were conducted with reference to KT, to research utilization, and/or practice change, using any research design and any audience-pertinent outcome to evaluate the effectiveness and/or efficiency of any type of KT strategy that is directed at any stakeholder audience (e.g., private sector; service providers; health organizations; policy- and decision-makers). The literature search was conducted on *MEDLINE*; *Embase*; *HealthSTAR*; *CINAHL* from 1997 to 2007 for the search terms listed below (see [Box 2](#) for a description of the databases searched).

We did not include the term *translational research* in our search methodology, as this term refers to the collaboration between scientists and clinicians to identify novel targets and develop new technologies that can lead to breakthrough therapies or products. "Translational medicine" or "translational science" are terms used synonymously to refer to scientific studies that bridge the chasm between basic science observations and clinical practice.

Search for the terms knowledge translation/transfer, practice change, program implementation and research utilization was conducted in relation to the cardiovascular search terms: cardiovascular (diseases), heart disease, hypertension, cardiac, high blood pressure, hyperemia, and vascular diseases.

This yielded 293 initial citations which were then reviewed for relevance before being included in the review and annotated bibliography. A second search was run with the KT terms in relation to allied diseases, including the terms: cancer, stroke, HIV/AIDS, diabetes, arthritis, and obesity. This search yielded 61 citations which were also reviewed for relevance before being added to the review and annotated bibliography.

A search on *SCOPUS* for articles or reviews with the terms knowledge translation and knowledge transfer yielded 74 citations from 1997-2007 in the areas of medicine, social sciences, nursing, health professions, pharmacology, decision science, psychology, multidisciplinary, neurosciences, and arts and humanities. *SCOPUS* covers 15,000 peer-reviewed journals from more than 4,000 international publishers, including coverage of: over 1,000 Open Access journals; 500 Conference Proceedings; over 600 Trade Publications; and over 125 Book Series.

Google hits for the term knowledge transfer approximate 1.5million, and 211,000 for the term knowledge translation; for *Google Scholar* the totals are 40,300 and 2,400 for these terms, respectively.

Box 2 Database Descriptions

MEDLINE (MEDlars onLINE) is the National Library of Medicine's (NLM) premier bibliographic database covering the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and the preclinical sciences. The MEDLINE file contains bibliographic citations and author abstracts from approximately 3,900 current biomedical journals published in the United States and 70 foreign countries. The file contains approximately 9 million records dating back to 1966. Coverage is worldwide, but most records are from English-language sources or have English abstracts.

EMBASE, the Excerpta Medica database, produced by Elsevier Science, is a major biomedical and pharmaceutical database indexing over 3,500 international journals in the following fields: drug research, pharmacology, pharmaceuticals, toxicology, clinical and experimental human medicine, health policy and management, public health, occupational health, environmental health, drug dependence and abuse, psychiatry, forensic medicine, and biomedical engineering/instrumentation. There is selective coverage for nursing, dentistry, veterinary medicine, psychology, and alternative medicine. EMBASE is one of the most widely used biomedical and pharmaceutical databases because of its currency and in-depth indexing. Frequent updates allow access to the latest medical and pharmacological trends. Approximately 375,000 records are added yearly.

HealthSTAR contains citations to the published literature on health services, technology, administration, and research. It focuses on both the clinical and non-clinical aspects of health care delivery. The following topics are included: evaluation of patient outcomes; effectiveness of procedures, programs, products, services and processes; administration and planning of health facilities; services and manpower; health insurance; health policy; health services research; health economics and financial management; laws and regulation; personnel administration; quality assurance; licensure; and accreditation.

The Cumulative Index to Nursing & Allied Health (CINAHL) database provides authoritative coverage of the literature related to nursing and allied health. Virtually all English-language publications are indexed along with the publications of the American Nurses Association and the National League for Nursing. Primary journals are indexed from the following allied health fields: Cardiopulmonary technology, emergency services, health education, medical laboratory technology, medical assisting, medical records, occupational therapy, physician assistant, radiologic technology,

The Evidence in Knowledge Translation: Approaches and Strategies

A review by Grol and Grimshaw (2003) concluded that none of the approaches for transferring evidence to practice is superior for all intended changes, in all situations; there is no ‘magic bullet.’ Research has, however, identified strategies that have demonstrated effectiveness under specific conditions, with specific populations, and in specific contexts. Moreover, we have now come to understand that factors other than the KT strategy are required for success, including the quality of the research evidence, the context in which the evidence is to be transferred, and facilitation process required to leverage the implementation and uptake into practice (e.g., Rycroft-Malone, 2004). The interplay and integration among these factors is thought to account for the complexity of implementing practice changes. Together, investigators have learned something about key influences on the process of research utilization and uptake. They include attributes of the innovation and the evidence of its effectiveness (quality), barriers and facilitators to changing practices, and the effectiveness of dissemination and implementation strategies (Grol and Grimshaw 2003).

Discussion of how best to facilitate the use of research knowledge in practice cuts across many disciplines, including nursing, medical, management, and education. The knowledge translation literature is highly multidisciplinary. Our earlier pragmatic reviews of knowledge translation have arrived at several main messages relative to KT in health care (Barwick, Boydell, Stasiulis, Ferguson, Fixsen & Blase 2005). There is evidence to suggest that passive knowledge translation activities alone are inadequate for changing practitioner behaviour (Azocar, Cuffel, Goldman et al., 2001; Bero, Grilli, Grimshaw, Harvey, Oxman & Thomson, 1998; O’Brien, et al., 2004). These passive approaches include unsolicited distribution of consensus recommendations or guidelines, and traditional didactic seminars or lectures. The more effective strategies tend to be active, multiple, based on accurate assessment of need, and aimed at overcoming barriers to change, both at the organizational and practitioner levels. Examples include audit and feedback by peers or opinion leaders, reminder systems, and multi-faceted interventions (Murtaugh, Pezzin, McDonald et al, 2006; Wright, Warren, Reeves et al, 2003). Such strategies, however, are not the staple of most knowledge translation approaches or implementation models. Furthermore, effectiveness may be limited by the nature of the target audience, setting, cost recovery mechanism, and process versus outcome focus. Reviews of syntheses suggest that implementation cannot be fully understood unless the *context* of health professionals’ practice is considered. The contexts in which new practices are introduced are central to understanding the dissemination process. We contend that *how* and *where* practitioners learn is important. Learning is a social activity that occurs on the levels of patient-practitioner interaction, organizational systems and processes, and the social, political, and economic systems that frame the practice. Change must occur at all levels of the system.

Knowledge Translation in Cardiovascular Science and Practice

The literature in cardiovascular disease has often referred to gaps in care and discrepancies between processes of care recognized as best practice and care provided in usual clinical practice. As an example, although use of automated external defibrillators (AED) leads to more successful advanced cardiac life support and they have been recommended by national resuscitation organizations worldwide (Laws, Zeitz & Fiedler, 2004), there has been slow uptake of this device and implementation of AEDs within hospitals has been sporadic and isolated. Knowledge translation has the potential to reduce care gaps.

Estimates of the size of the care gap indicate that 30% to 40% of patients fail to receive treatments of proven effectiveness, and 20% to 25% of patients may receive care that is not needed or is potentially harmful (Grol 2001). Many barriers have been posited for the failure to utilize evidence-based practice, including lack of time, lack of awareness of available research literature, negative beliefs, poor research skills, insufficient authority to change practice, and lack of support to implement research findings (Stromberg, 2007).

The Canadian Cardiovascular Society (CSS) has made important strides in KT for this field, building on the concepts of continuing medical education and continuing professional development (Tremblay et al., 2004). The CSS, among other organizations, is making significant gains in support of KT activities and the development, dissemination, and uptake of clinical practice guidelines (Tremblay et al., 2004). The *Canadian Hypertension Education Program (CHEP)* is a unique knowledge translation program that appraises the best data from clinical hypertension research on an annual basis and updates a set of clinical practice recommendations for the management of hypertension (Tobe et al., 2007). These recommendations are disseminated to target groups throughout the country, through the use of institutional databases.

The *Canadian Heart Health Initiative (CHHI)* was an initiative of the Cardiovascular Disease Prevention Unit of Health Canada, and brings together senior public health leaders and researchers in each province to conduct research within each provincial public health system and to promote the translation of research findings into public health practice (O'Loughlin et al, 2001). The dissemination phase of the project was preceded by three phases: (1) a developmental policy phase which laid the groundwork for the initiative; (2) a population survey phase to document cardiovascular disease prevalence in each province; (3) a demonstration phase which implemented and evaluated more than 300 demonstration projects in all provinces that identified heart health best practices for widespread dissemination.

An interactive workshop was used as a means of integrating the *Canadian Cardiovascular Society* clinical practice guidelines on congestive heart failure into Canadian family physician's practice (Borduas, Carrier, Drouin et al, 1998). The interactive, problem-based workshop was facilitated by local interested practitioners, and local experts served as consultants to reinforce key messages from the guidelines and to guide participants through the learning process. Chart evaluations before and after the workshop indicated that participants provided more complete chart information related to congestive heart failure and that they significantly increased their use of angiotension-converting enzyme inhibitor after the workshop. Participant evaluation of the workshop indicated high satisfaction with the presentation, content and relevance to clinical practice.

Lastly, the *Heart and Stroke Foundation of Ontario* initiated a *High Blood Pressure Strategy* in early 2005 with the intent of paving the way towards *optimal* blood pressure management that would result in a *dramatic* improvement in the future health of Canadians. The High Blood Pressure Strategy is a collaborative strategy among the Canadian Hypertension Education Program, the Ontario College of Family Physicians, the Registered Nurses Association of Ontario (RNAO), and the Ontario Pharmacists' Association.

The High Blood Pressure Strategy is comprised of a *Hypertension Management Initiative*, a primary care, inter-professional, evidence-informed, knowledge integration and mobilization initiative, to enhance the

management and control of the hypertension by primary care providers including doctors, nurses and pharmacists, and patients. The initiative is leveraged by toolkits for healthcare providers and patients designed to improve patient outcomes by optimizing detection/follow-up techniques, the management and treatment of hypertension incorporating both pharmacologic and non-pharmacologic interventions, and patient self-management.

The *healthcare provider toolkit* includes:

- automated office blood pressure monitors,
- a Hypertension Flowsheet with built-in clinical reminders and prompts,
- confidential provider practice audit reports,
- inter-professional workshops, and
- practice support

The *patient toolkit* includes educational/self-management resources:

- the “Take the Pressure Off” patient resource book that includes a log book for patients to track progress on a number of chronic conditions and lifestyle areas of change, and
- the Blood Pressure Action Plan/Heart and Stroke Risk Assessment, an on-line e-health patient tool that provides a confidential risk assessment, opt-in for e-mail support on a self-selected lifestyle goal and the ability to track progress.

Over 210,000 people have completed the on-line e-health patient tool, the *Blood Pressure Action Plan/Heart and Stroke Risk Assessment*, since its inception in 2003, and 50% have opted in for e-mail support.

Knowledge Translation Initiatives in Canada

A number of organizations have identified knowledge translation as an important activity (Grunfeld, Zitzelsberger, Hayter, Berman, Cameron, Evans and Stern, 2004). To begin with, the Canadian Institutes for Health Research (CIHR) website identifies university sites, local, provincial and national organizations, Canadian funding agencies, as well as US and international organizations as useful links on knowledge translation. Also, the *Canadian Population Health Initiative (CPHI)* of the Canadian Institute for Health Information (2001) identified 17 organizations (16 Canadian, one US) involved in health or social research and/or policy with an identified focus on knowledge translation. The purpose of the scan was to identify successful models of research-policy exchange that could be used in developing CPHIs KT activities. The strategies used by these organizations were analyzed according to three criteria: target audience (who was engaged), timing (when during the research process did this engagement occur) and method (how was the target audience engaged). The scan highlighted a number of specific methods organizations can use to engage policy makers in the results of research. Taken together, the strategies used by organizations in the scan represent a valuable tool kit for CPHI and others in applying research knowledge to policies affecting the health and wellbeing of Canadians. Their report, which can be accessed online provides a useful overview in table format of the target group (audience), timing, and methods for each strategy used in the reviewed organizations (see page 13 of their report).

(http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page=download_form_e&cw_sku=ENVIROSCANPDF&cw_ctt=2&cw_dform=null)

Another approach is that used by the *Asthma Plan of Action (APA)* in Ontario (Garvey, 2006). Instituted in 2002 with goal of reducing mortality, morbidity and health care costs for children and adults with asthma through integrated initiatives focused on health promotion and prevention, management and treatment and research and surveillance, the APA KT initiative uses a trans-disciplinary approach, bringing researchers, clinicians, representative agencies and policy makers together to integrate their varied perspectives into relevant programs and services. Behavioural change for patients, providers and targeted audiences—such as teachers and school staff and agricultural and industrial workers—is supported through dissemination and implementation activities related to the asthma guidelines. Specific knowledge translation (KT) activities designed to promote guideline uptake and research capacity include needs assessments, multidisciplinary pathways, self-management programs, small group case-based learning and community- and media-based programming.

Another example of integrated KT efforts comes from the *Canadian Heart Health Dissemination Project (CHHDP)* which was a six-year, CIHR-funded project (2000-2006) focusing on a synthesis of learnings from the provincial dissemination projects that make up the Canadian Heart Health Initiative (CHHI). Fifteen years of research has come to inform cardiovascular disease prevention policies and practices (Robinson, Elliott, O'Loughlin, Cameron, Eyles, & Harvey 2006). Their synthesis research program involved collaborative partnerships with researchers from the provincial dissemination projects, and has been built around linkage and exchange and through guidance from partnerships built into an advisory group. Their linkage activities were facilitated by annual face-to-face advisory group meetings; regular e-mail communication focused on review and feedback; regular one-on-one telephone communication; electronic newsletters; ad hoc regional teleconferences; and a national project website housing project publications, presentations, and meeting minutes. Through their efforts, they concluded that dissemination is best understood as an active and planned series of steps reflecting a transfer process as well as an uptake or implementation process. Capacity building—that is, efforts to enhance the ability of an organization to effectively plan, implement, evaluate and sustain health promotion efforts—was found to not only be a complementary and closely-related strategy to dissemination, but essential to ensuring uptake and use of research and practice innovations. They also concluded that, on their own, information sharing and communication are insufficient to successfully support knowledge uptake among public health organizations. The most commonly used capacity building and dissemination strategies across the projects included communication activities (meetings, electronic media, teleconferences and newsletters); collaboration/partnership development; resource provision (information and financial); workshops/training; networking (peer exchange); facilitation; and linking systems and individuals (to maintain communication between resource and user groups). The most frequently identified characteristics of effective capacity building and dissemination centered on having a leader or champion within the public health user group; cultivating relationships and buy-in among user groups; providing adequate resources to support capacity building and dissemination; providing user groups with access to central resource staff for technical assistance; and tailoring interventions to the needs of user groups (Robinson et al., 2006).

KT has also played an important role in efforts to address the burden of HIV/AIDS in our population. The *Canadian AIDS Treatment Information Exchange (CATIE)* grew out of the early community-based advocacy movement to improve HIV health policy and health care. At a time when the medical community had little to offer people living with HIV/AIDS, CATIE was one of the first organizations in Canada to systematically assemble and disseminate treatment information. The initiatives KT goals are

to promote the empowerment of people living with HIV/AIDS and their caregivers to make informed health care decisions; build the KT capacity of the loosely-structured HIV/AIDS treatment information network throughout Canada; and serve the evolving HIV/AIDS treatment information needs of diverse communities in partnership with community organizations. Their approach has been to provide research-based information (including developments in clinical and population-based research) in meaningful, plain-language formats through multiple channels (print, electronic, telephone, website and workshops/forums); develop partnerships with vulnerable communities to identify, research and address barriers to treatment and to knowledge building in health management; bring together communities of care (people living with HIV/AIDS, researchers, health care providers, caregivers) to facilitate knowledge exchange; and work in partnership to conduct community-based research and to inform research priorities and policy development. Their evaluations have shown that people want quality treatment information from trusted sources, and quality treatment information that is accurate, timely, research-based, unbiased and comprehensive. A 2002 evaluation found “the primary outcome of CATIE was accessible and trustworthy treatment information presented from a Canadian perspective and in a manner that empowered information users (both individuals and organizations)” (Love, 2002). It also found that the evolution of CATIE to a national organization has had an important impact on the overall network of HIV treatment information providers.

In the area of stroke research, tools have been developed to assist in KT efforts from science to practice (Landry, Lyons, Amara, Warner, Ziam, Halilem, Kéroack, 2006). Entitled, *Maximizing Dissemination: Two Knowledge Translation Planning Tools for Stroke Research Teams*, the report provide a comprehensive overview of factors to consider in the transfer of stroke research. The tools are based on a series of questions to help individuals and their research teams to identify the key aspects of an effective knowledge translation strategy and to enhance the knowledge transfer potential of your research. For example, they can be used to help answer the following questions: (1) What are the most important aspects to consider when establishing a KT strategy? (2) What are the outputs of your research? (3) Who are the potential users of your research outputs? (4) What is the most effective way to reach and interact with those users (e.g. how to bring knowledge to the clinician)? (5) How is it possible to involve the users in meaningful ways throughout research projects? And (6) What do users really need to know about your research? To address these differences, there are two tools, each for a distinct audience: (1) *Biomedical Researchers Knowledge Translation Planning Tool*, and (2) *Clinical, Health Services and Population/Public Health Researchers Knowledge Translation Planning Tool*. The tools can be accessed on the web at <http://kuuc.chair.ulaval.ca/ctci/intro.php?PHPSESSID=ba341b6392379c3c6843bb2baa7c43fe>), and the full report provides greater detail (Landry et al., 2006).

More recently, *StrokEngine*, an evidence-based website developed by McGill University researchers, has been made available to deliver stroke rehabilitation interventions tailored for stroke patients, their families, clinicians, and policy makers. The site, www.medicine.mcgill.ca/strokengine also includes an e-learning module is also available for clinicians at <http://elearning.strokengine.org/>. StrokEngine's content is derived from multiple sources including the Evidence-Based Review of Stroke Rehabilitation (EBRSR) headed by Dr. Teasell in London, Ontario and extensive reviews of databases including MEDLINE, CINAHL, the Cochrane Library, HealthSTAR, Health and Psychosocial Instruments, CANCERLIT, PsycINFO. The goal is to provide best practice information that is based on scientific evidence of its effectiveness. A dedicated team of senior researchers, graduate fellows and research assistants with expertise in specific areas also contribute to creating and evaluating the quality of each topic.

Knowledge Translation in Allied Sciences and Practices

The literature regarding knowledge translation in the areas of cardiovascular disease, obesity, stroke, diabetes, cancer, rehabilitation sciences, musculoskeletal, HIV/AIDS, and mental health have, to date, provided a rich start toward understanding the utility of a variety of strategies. These sources of KT knowledge are reported here.

Role-Based Strategies

Opinion Leaders. Opinion leaders are considered to be knowledgeable, trustworthy, accessible and approachable and they have a willingness to share their knowledge (Thompson et al., 2006). They are well-connected individuals who have a wide peer and social network (Rogers, 1995). Evidence on the effectiveness of opinion leaders in translating research knowledge are clouded by a lack of consensus on the operational definition of ‘opinion leaders’ and the manner/ method in which they are identified. Some authors of intervention studies have employed a process of peer-nomination to select opinion leaders (Kelly et al., 1991; Seto et al., 1991, Borbas et al., 2000), while others have used sociometric instrumentation developed by Hiss et al., (1978) or the King and Summers (1970) opinion leadership scale (Lomas et al., 1991; Hodnett et al., 1996; Soumerai et al., 1998, Gifford et al., 1999; Guadagnoli et al., 2000; Lam & Schaubroeck, 2000). Some studies have looked to those who appear to have positions of power, such as chiefs of surgery, heads of state, or school superintendents (Williamson et al., 1989; Gist et al., 1997; Howard et al., 2000, Denton et al., 2001). There appear to be two types of opinion leaders: peer and expert (Leacock et al., 2001). They are similar in that both are seen as credible and having the ability to persuade others. More recently, Al Gore provides a high profile example of a opinion leader who has effectively shaped new thinking about climate change by conveying environmental science to the public at large. This is also a perfect example of how the ‘messenger’ of research knowledge needn’t be the scientist. KT is inherently a social process, and opinion leaders primarily exert their influence via word-of-mouth and face-to-face communication (Venkatraman, 1989; Chan & Misra, 1990; Cosens et al., 2000; Thomson, O’Brien et al., 2000).

Although now somewhat dated, one of the latest reviews of systematic reviews on KT identified 15 out of 41 systematic reviews that focused on the effectiveness of specific interventions including the use of opinion leaders (Grimshaw et al., 2001). They concluded that when opinion leaders were used there was variable effectiveness in achieving the desired behavior change among healthcare providers. Oxman et al., (1995) and Thomson et al., (2000) found that interventions using opinion leaders tended to be moderately successful. We do not know, however, what makes opinion leaders successful when they are, or unsuccessful when they are not. Generally, experts have been used to provide education, champion a cause or product, or to give support to staff around the diffusion and implementation of a clinical practice guideline, protocol, or research evidence (Thompson et al., 2004).

Facilitators. Facilitators can also be helpful by assisting an individual or group through the process of implementing a change in practice. This practice change inherently involves the transfer of research based knowledge. The process of ‘facilitation’ has been described as ‘ a goal-oriented dynamic process in which participants work together in an atmosphere of genuine mutual respect in order to learn through critical reflection’ (Burrows, 1997). Facilitators are active and dynamic and must have strong interpersonal, group, and communication skills in order to create supportive environments (Thompson et

al., 2004). The general consensus is that facilitators are appointed and trained for their role (Routhieaux & Higgins, 1999); a role that cuts across disciplinary boundaries (Kitson et al., 1998).

Several studies have found the facilitator role to be effective (Fullard et al., 1987; Cockburn et al., 1992; Dietrich et al., 1992; Crotty et al., 1993; Logan & Davies, 1995; McCormack & Wright, 2000; Kelly et al., 2002). Facilitator roles are highly dynamic. Although they often come from outside a particular group, it has been suggested that facilitators who sustain their relationship with the group, and those that align themselves with opinion leaders, may have more success in moving the group towards change (Rogers, 1995).

Knowledge Brokers. Knowledge brokers have emerged more recently in the field of knowledge translation, with a specific purpose to link researchers and the users of research knowledge so that they are able to better understand each other's goals and professional cultures, influence each other's work, forge new partnerships, and promote the use of research-based evidence in decision-making (CHSRF 2007a). Knowledge brokering involves finding the right players for knowledge exchange, bringing these players together, creating and helping to sustain relationships among them, and helping them to engage in collaborative problem-solving. Knowledge brokering in this context is ultimately about increasing evidence-based decision-making in the organization, management, and delivery of health services. While there is some variation in the titles used to identify these roles, i.e., knowledge transfer specialist, knowledge exchange officer, they are characterized by individuals who can synthesize, contextualize, and translate or interpret research for a variety of user audiences. Typically, these individuals have wide communication networks; have extensive knowledge of research and health care, and skills in social marketing. The Canadian Health Services Research Foundation (CHSRF) is currently evaluating six knowledge broker demonstration sites in order to understand the impact of knowledge brokering on health organizations (CHSRF, 2007b).

The use of knowledge brokers to increase interaction between researchers and decision makers has attracted increasing attention as a knowledge translation (KT) approach. Researchers at the Atlantic Health Promotion Research Centre and Dalhousie University investigated how knowledge brokers affected decision maker uptake of best practices in integrated stroke care in the Atlantic Provinces. They found that knowledge brokers can enhance partner interactions, but needed to develop effective strategies for creating partnerships and engaging participants. They also required excellent communication skills and a high level of proficiency in the subject matter. Knowledge brokers were able to identify opportunities where best practices for stroke care could be integrated into existing provincial initiatives and where training and education was needed to improve care. As a result, decision makers were more aware of best practices for stroke care and researchers had a better understanding of the context affecting decision makers' uptake of research (Lyons, Warner, Langille & Phillips, 2006).

Champions. The use of champions has also been given some attention in the KT field. Stemming initially from work in military innovation (Schon, 1963) and the promotion of products and technological innovations (Markham, 1998), a champion is defined as an individual who is internal to the organization and who emerges, unsolicited, from within any organizational level (Lau et al., 1998; Wager et al., 2000; Markham & Aiman-Smith, 2001) to advocate for new ideas, products or projects. They have been described as transformational leaders (Howell & Higgins, 1990; Martinsons, 1993) characterized by the ability to influence others to support projects.

As an example of the emergence of a champion in a medical setting, the education coordinator of a medical centre in Tennessee identified deep vein thrombosis (DVT) as a significant problem, created an education program for nurses and implemented an evidence-based practice change (Van Wicklin, Ward & Cantrell, 2006). Inclusive educational presentations were made to physicians, nursing staff, and patients, including electronic slide presentations, as well as exchange among staff in the form of question and answer discussion periods. The next stage was implementation of a standardized DVT prophylaxis protocol designed to improve quality of patient care and save lives. Staff members increased the frequency of their assessments for DVT risk and became more focused on their efforts to decrease the possibility of recurrence.

Organizational Strategies

Learning Organizations. The practice of KT is often facilitated within learning organizations. A study of the diffusion of a complex evidence based innovation initiated by the Heart and Stroke Foundation of Ontario elucidated the ways in which knowledge is shared across organizational and professional boundaries (Lemieux-Charles, McGuire & Blidner, 2002). Networks were successful in facilitating the processes that led to creation of knowledge and the implementation of this knowledge into practice when dialogue around stroke evidence was incorporated into tools and care protocols. This led to resource allocations, staff training and reorganization of care. These authors found that networks with additional resources had a stronger infrastructure for the dissemination of the *Coordinated Stroke Strategy* (CSS), and, evidence was more likely to be valued and used by clinicians if they had previous experience and expertise with it. It was concluded that diffusion of evidence in a complex system is a social process wherein the type of interactions occurring between stakeholders affects the extent to which evidence is picked up and new knowledge is created.

Leadership. The importance of leadership figures in many models of research utilization and implementation (Oetting et al., 2001, Ferlie & Shortell, 2001). Leadership that is active and energetic, and results in decisions being made regarding what will be done and who will do it, is a key attribute to success. However, leadership is but one level that needs to be considered in achieving successful research utilization in practice settings. Some investigators have found unit or team leadership to be the most important predictor of research use among nurses. Work by Cummings, Hayduk and Estabrooks (2005) found that nurses working for resonant leaders reported significantly less emotional exhaustion and psychosomatic symptoms, better emotional health, greater workgroup collaboration and teamwork with physicians, more satisfaction with supervision and their jobs, and fewer unmet patient care needs than did nurses working for dissonant leaders. It is important for management to “lead from the front door” and develop direction that is capable of sustaining evidence-based practice. The strong support of senior management increases the success of adoption of new practices. Effective clinical leadership also speeds adoption (Barratt, 2003, Berenholtz & Pronovost, 2003, Bradley et al., 2004).

Educational Strategies

Patient Education. Programs that guide participants to integrate knowledge improvement activities can affect organizational processes, and to a more modest degree, patient outcomes - in a very short time period, but with a supportive framework of education, consultation, and team building (Stevenson, Dahl,

Berry et al, 2006). For instance, education regarding increasing women's knowledge of heart disease and how to prevent it is of critical importance, as many women believe the myth that heart disease affects men primarily. Ruesch and Gilmore (1999) addressed this issue by implementing a cardiovascular health promotion program and accompanying manual that included a spirituality message to encourage behaviour change. Results indicated that overall, the women were participating in some type of healthy heart behavior along with future plans to continue to engage in activities that would enhance their heart health. In this study, churches were an effective method of communicating health promotion information and for providing legitimacy and support to health promotion programs.

Disease management strategies (DMPs) – a complete approach to the care of a particular disease encompassing prevention, treatment and follow-up care, including implementation of guidelines -have been associated with marked improvement in outcomes. Heart failure DMPs have been found to be effective in reducing hospital admissions, improving quality of life, reducing costs and possibly lengthening survival (Editorial, 2007). Despite this, DMP remains restricted in application as it is usually reserved for the sicker group of the heart failure population, and should be applied earlier in the syndrome.

Continuing Medical Education / Continuing Professional Development. Continuing medical education (CME) can refer to any medical education received after certification and licensure. The field of continuing professional development (CPD) refers often to self-directed learning and can include reflection and other practices driven by accreditation standards and needs-based learning. CME takes place primarily in teaching settings, while CPD can occur in multiple learning situations and KT finds its place among primary practice settings (Tremblay et al., 2004).

CME encapsulates the range of educational activities used to improve competencies of practicing physicians. CME interventions include (1) educational materials, (2) conferences, lectures, workshops, trainee ships; (3) outreach visits; (4) local opinion leaders; (5) patient-mediated interventions; (6) audit and feedback; (7) reminders; (8) marketing; (9) multifaceted interventions; and (10) local consensus process (Oxman et al., 1995). There is a large body of evidence in support of formal CME intervention as capable of changing physician knowledge and skills (Kaufman et al., 1992). Two influential systematic reviews concluded that physician performance may be altered by many CME interventions, and to a lesser extent, so may health care outcomes (Davis et al., 1995; Davis et al., 1992). However, key principles of best practice need to be followed in order to achieve success and guidelines for effective CME have been developed for providers (citation). In brief, the guidelines for effective CME include: (1) conduct an appropriate needs assessment; (2) use a planning process involving target audience representatives from program inception to completion; (3) state clear learning objectives; (4) use appropriate educational strategies, i.e., practice-based and multifaceted; (5) incorporate principles of adult learning (Kaufman et al., 2000).

Practitioner Education On-Site (i.e., In-Service). Thurston and King (2004) describe an innovative mentorship program aimed at enabling nurses in the clinical community to understand and implement an evidence-based approach to practice. Participants were provided with in-depth education and hands on experience during half day program meetings every 6-8 weeks throughout the year. A theoretical model (Rosswurm & Larabee, 1999) was used for change to evidence-based practice. The EBP program was highly successful, benefiting administrators and nursing faculty, management, staff nurses, and

potentially, patients. Working relationships and use of resources were improved. Staff nurses and managers blossomed as their critical thinking abilities and sense of professionalism grew.

Audit and Feedback. This strategy can be viewed as educational in nature, with a focus on practitioner behaviour. It involves the creation of a summary of clinical performance for a health care behaviour over a specified period of time. The summary is provided back to the practitioner in a written, electronic, or verbal format. GroL and Grimshaw (2003) report on 16 reviews that judged this intervention and found mixed effects. Its' effectiveness seems to be targeted to test ordering and prevention targets. The use of feedback is recommended in combination with education, outreach visits, or reminders.

In a more recent systematic review by Jamtvedt, Yong, Krisoffersen, O'Brien, and Oxman (2006), the effects of audit and feedback on both professional practice and health outcomes was synthesized from 118 randomized controlled trials published between 1977 and 2004. Here too, we find mixed effects, ranging from negative findings to very large positive effects. The authors concluded that audit and feedback could be effective in improving professional practice, probably more so when the baseline adherence to a recommended practice is low and the audit and feedback efforts are high.

An investigation of the impact of feedback characteristics on effectiveness in six Veterans Affairs Medical Centres in the US identified four characteristics that distinguished high- and low-level performing facilities: (1) the timeliness with which practitioners provide feedback; (2) the individuality of the feedback received; (3) the punitive or nonpunitive nature of the feedback provided; and (4) the customization of feedback to make it meaningful to the practitioner (Hysong, Best, and Pugh, 2006).

Interactive Workshops. Taenzer and his colleagues (2006) developed and tested an ambassador model that would serve as a successful prototype for KT, increase clinician knowledge about best evidence in chronic pain management, and encourage clinicians to incorporate research evidence into the management of chronic pain patients. They used a workshop format for the program to present research evidence on specific chronic pain interventions to local clinicians. A team that included a clinical ambassador who was a well-recognized provincial leader in continuing education related to pain management, and a research ambassador who was available to explain how the evidence presented was derived from the research literature, conducted each workshop. For each intervention, a comprehensive search and selection process for the best research evidence was undertaken. The focus was on making participation at the workshops appealing, convenient and not too time-consuming. Workshops were held in local communities, at a convenient time of day, with participants (family physicians and pharmacists) able to claim continuing education credits. Strategies for enhancing learning included minimizing didactic material, using a case-based interactive format for KT, inviting a multidisciplinary group of participants and keeping the workshop format flexible so that participants could direct the content to their areas of need. The session was wrapped up by having participants focus on what they learned, on how they might apply it in their practices, and on changes they would like to see in their health region's policies and practices. An independent evaluation of the program six weeks after each workshop indicated that the workshop participants found the ambassadors highly credible, appreciated the evidence-in-brief summaries, found the workshop format effective and reported a significant increase in their knowledge of key treatments for chronic pain management. They had begun sharing the evidence and evidence-in-brief summaries with colleagues and with patients. One third of the participants indicated they had made changes to their practice based on what they learned at the workshop.

School Health. Schools occupy a significant position in the everyday lives of families and communities, and thus, have the potential to help young people live healthier, longer and more satisfying lives. Consequently, many innovative technologies and supports have proliferated for school-based health promotion (Roberts-Gray, Solomon, Gottlieb et al, 1998). Unfortunately, very few schools actually make use of the packages and programs made available to them. One key example of this is the fact that, although more than 5,000 schools in Texas received health lifestyle curriculum kits from the American Heart Association (AHA), most teachers did not know about the AHA product and did not know whether it was in their schools (Roberts-Gray, Solomon, Gottlieb et al, 1998). In response to the small number of schools actually implementing the program, the AHA developed a program called *Heart Health* to assist in bridging the implementation gap. This innovative, person-to-person program relied heavily on volunteers to help disseminate and implement the guide. Evaluation of the program demonstrated a twofold to fourfold increase in actual use and reach of health promotion packages and programs in schools.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) was another school based health promotion program that had multiple components and ran for several years as a trial to decrease fat, saturated fat, and sodium in children's diets, increase physical activity, and prevent tobacco use (Perry et al, 1990; Perry et al., 1992). This controlled trial was conducted in 96 schools in four states in the US. The trial was successful in lower fat consumption, increasing physical activity outside of school. In addition, school cafeterias provided meals lower in fat and students were more physically active in physical education classes (Luepker et al., 1996). These effects were maintained three years later (Nader et al., 1999). While the program was effective, it reached only a relatively small number of school-aged children in the US.

This teaches us that the impact of prevention programs depends not only on the efficacy of the program but also on the extent to which the program is implemented among the target population. In a study of the dissemination of the CATCH program in Texas, Hoelscher et al (2001) applied elements from Rogers' diffusion theory (Rogers 1995), Social Cognitive Theory (Bandura 1986) and Social Marketing (Siegel & Doner 1998) leading to the adoption of the CATCH program by more than 728 elementary schools in Texas, impacting more than 435,000 school children in the state. Several factors influenced the spread of CATCH in Texas, and these reflect factors that could be applied to dissemination efforts for other health programs. The important elements for dissemination and uptake in this instance included (1) a focus on networking; (2) the programs' compatibility, trialability, and observability leading to positive experiences and compelling testimonials that were important for adoption decisions; (3) financial support and underwriting of program costs that would have deterred schools from adopting a new program; (4) training sessions that were fun and involved peer trainers, hands-on activities, and featured testimonials from other teachers and opinion leaders, and led to networking; (5) provision of ongoing support from the CATCH team providing technical assistance and continuity through the CATCH diffusion network; (6) reduction of complexity by implementing the program in stages, targeting various groups in a stepwise fashion. The main lesson learned from this endeavor is that it is possible to disseminate a multi-component, multiyear coordinated school health program in a large, diverse state (Hoelscher et al., 2001).

Evidence Based Guidelines

Clinical practice guidelines are intended to help practitioners apply scientific knowledge to patient care (Tremblay et al., 2004). They are designed to establish criteria for the appropriate use of medical services and procedures, decrease inappropriate utilization of services, and improve patient outcomes. Clinical practice guidelines are systematically developed statements that assist in decision making about appropriate care for specific clinical conditions. They are based on systematic reviews of the evidence that are translated into guidelines by an assembled group of experts (Eccles & Grimshaw 2004). There is evidence to suggest that clinical guidelines that are appropriately disseminated and implemented can change practice and lead to improvements in health care (Kinsman and James 2001). Specifically, a rigorous systematic review of the impact of tools to guide evidence-based practice revealed that all but 4 of the 59 published evaluations detected significant change in the process of care (Grimshaw and Russell, 1993). Important to note is that fact that the rigor of the guidelines included in their review would not represent most available clinical guidelines. Moreover, the publication and dissemination of clinical guidelines is not sufficient by itself to change clinical practice (Walker et al., 1999). The most effective guidelines are those that are disseminated through specific educational initiatives that require ‘active’ participation by professionals, and which are implemented by focused initiatives such as patient specific reminders (University of Leeds, 1994). Work conducted in acute services in Scotland found that guidelines need to be implemented at a local level (Walker et al., 1999).

Implementation of guidelines has decreased variation in practice patterns, reduced length of stay, lowered costs, and improved outcomes in patients with and without cardiac disease (Grimshaw & Russell, 1993; Weingarten, Agocs, Tankel et al, 1993). The *Canadian Hypertension Education Program (CHEP)* was specifically developed to improve the treatment and control of hypertension in Canada through knowledge translation (Campbell, 2006). CHEP has three task forces which annually update evidence-based management recommendations, implement the recommendations, and document the impact of CHEP on hypertension management and complications. Key implementation messages are developed to highlight critical recommendations and an annual theme is selected to profile an important CHEP initiative. Dissemination includes scientific and clinical summaries, manuscripts, brief handouts, posters, pocket cards, advertisements, power point education kits, text books, slide sets and workshops. Train the trainer sessions have been developed in which local opinion leaders learn to provide workshops on the most recent CHEP recommendations.

In the United States, the *American Heart Association* developed the “*Get with the Guidelines*” program to help acute care providers bridge the gap from guideline development to practice. Cardiac rehabilitation nurses were used to successfully implement the program using a prospective case-management model in the acute care setting (Flynn et al., 2007). Based on estimates that 80,000 lives could be saved annually by closing the treatment gap for patients with cardiovascular disease and stroke, this program was award-winning in its efforts to span the gap. The program used a systems approach to implementing standardized guideline tools, including order sets and protocols, in order to increase adherence to secondary prevention guidelines for cardiovascular disease. The basic steps for the program were as follows:

- Identify physician champion and establish multidisciplinary team
- Measure and evaluate baseline outcome data
- Implement standardized protocols and processes to improve adherence to guidelines
- Use Patient Management Tool (see section below) to monitor and benchmark outcomes

- Reevaluate outcomes using the continuous quality improvement process plan (Plan, Do, Study, Act)

Several keys to success were identified in the implementation process. Among them, (1) administrative and leadership support, (2) strong physician champion, (3) internal marketing, (4) reputation (credibility) of the AHA, (5) monitoring and reporting progress, and (6) physician and nursing involvement, (7) dedicated staff, (8) prospective nurse case-management model, and (9) training and ongoing education (Flynn et al., 2007). In the end, focused implementation phases came together to make the program successful.

Provider knowledge is an oft cited barrier to clinical guideline adherence. Limited awareness of and insufficient familiarity with guidelines are among the most frequently reported barriers to physician adherence (Cabana, Rand, Powe et al, 1999). Welke and colleagues (2003) assessed the impact of organizational, provider, and guideline factors on provider knowledge of congestive heart failure clinical practice guidelines. Institutions where informants reported that physicians believed that guidelines were applicable to their practice were assessed as having higher levels of provider knowledge of the guideline. Two dissemination approaches that emphasized summarizing key aspects of the guidelines (provider receipt of brief summary and posted storyboards) were positively associated with provider knowledge. The use of technology and the establishment of checkpoints and deadlines were also positively associated with provider knowledge. Clearly, enhancing provider knowledge of a guideline is a key element of a successful implementation approach.

In a qualitative study of family physician's views on the application of evidence in caring for patients with cardiovascular disease, it was found that Canadian primary care physicians are incorporating evidence-based medicine into their daily encounters with patients, even if they are not fully embracing it (Putnam, Twohig, Burge et al, 2002). Physicians reported that they had limited time to read and review individual articles, thus valued evidence when it was part of a practice guideline produced or endorsed by an independent professional association. They also reported that tools such as cardiovascular risk tables or evidence-based decision aids may be effective for demonstrating the applicability of research findings to individual patients. Putnam et al (2002) concluded that greater involvement of family physicians in guideline development would help to ensure sufficient details are provided to make the guidelines of optimal value to family practice.

Technology Enabled Knowledge Translation

Information technology (IT) is widely recognized as important in supporting knowledge translation (Holroyd, Bullard, Graham, & Rowe, 2007) and essentially accomplishes two support functions. First, IT can support the management of knowledge – how people organize, store, and access explicit knowledge and information. Second, IT serves to connect people in order to facilitate communication and networking. Modern information and communication technologies – e.g., computers, the Internet, personal digital assistants (PDAs) and videoconferencing – can play a key role in attaining a multilayered system for the "just-in-time" delivery of information (Ho et al., 2004). For example, the Internet can be used for information retrieval and online continuing education, to inform evidence-based patient management, and in the development of health information systems that provide just-in-time

support for clinical and policy decision-making. Such technologies can also play a pivotal role in synthesizing knowledge, building shared capacity for knowledge exchange, and minimizing duplication of decision support systems. As a result, there is an increasing interest in discussing and researching a technology-enabled approach to knowledge translation.

Web 2.0: Wikis, Podcasts, Webinars. Increasingly, knowledge is being shared using web 2.0 technology although its tremendous potential for knowledge creation and exchange has not yet been sufficiently studied. In combination, they may represent powerful learning experiences because they invite the user to be active and dynamic in their learning (Boulos, Kamel, Maramba, Wheeler 2006).

A *blog* refers to a “Web log” - a user-generated Web site that files entries (or “posts”) in reverse chronological order, with the most recent entry first. It is too early to know how successful they can be for knowledge translation purposes, however, their real potential appear to be as networking opportunities. One example of a medical blog is the *Dermatology Interest Group’s* blog at the University of Texas Medical Branch in Galveston. This blog was started in 2004 by medical students interested in dermatology and it is run by two student editors who collect, edit, and post information regarding fellowships, conferences, awards, and other news relating to the field. It also advertises meetings of the group and visits by guest speakers. A recent user poll shows visits to the blog are increasing and student editors recently decided to start e-mailing new entries in addition to posting them (Mathieu. 2007). The well-known health Web site *WebMD* (www.webmd.com) operates on a wider scale and offers site visitors a large variety of blogs to choose from, ranging in topics from pregnancy to asthma to sleep disorders. . Reportedly, 30 million individual users come to *WebMD* every month (Mathieu, 2007).

Podcasts are media files that can be distributed via the Internet and played on computers and handheld devices such as iPods or other digital audio players (Mathieu 2007). *Vodcasts* operate on the same principle, but video images are transmitted in addition to audio. Many medical journals are offering their articles as well as added content via *podcasts*. *The New England Journal of Medicine* started podcasting in April 2005 and data show that more than 30,000 people a week are receiving the information (Mathieu 2007). We do not know, however, how many people actually listen to the *podcast* after it is downloaded. There is anecdotal evidence to suggest the *podcasts* are popular with medical students and doctors because they tend to have busy schedules (Mathieu 2007).

In addition to journals using this technology as another way to distribute their print content, some hospitals are branching into developing content for *podcasts*. On such hospital is Johns Hopkins Medicine, where staff members produce a weekly *podcast* that discusses the top four or five stories published that week in peer-reviewed literature (<http://www.hopkinsmedicine.org/mediaII/Podcasts.html>) (Mathieu 2007). According to Elizabeth Tracey, director of electronic media for Johns Hopkins Medicine, tens of thousands download the *podcast* each Friday directly from the Johns Hopkins Web site. Credibility is key here, however and in this instance, the podcast comes with the stamp of approval of Johns Hopkins Medicine. It will be essential for users to consider the source when they download and listen. Grayson Wheatley, MD, cardiovascular surgeon at the Arizona Heart Institute and founder and director of the Cardiovascular Multimedia Information Network, says the podcasts help create a more educated patient and improves the quality of the office visit. Wheatley lends iPods to patients while they’re waiting to see him. “It’s better than a *People* magazine from 1999. Even 90-year-old great-grandfathers think it’s awesome.”

A *wiki*, which comes from the Hawaiian word for fast (Wikipedia, 2007)), is an interactive kind of Web site where visitors can edit content or co-create and are often used in collaborative projects to document knowledge. *Wikipedia* (<http://www.wikipedia.com>) is arguably the most famous *wiki* online. Medical wikis exist as well, including <http://wikimd.com>, <http://www.fluwikie.com>, and the British medical wiki *Ganfyd* (<http://www.ganfyd.org>) (Boulos, Kamel, Maramba, & Wheeler 2006). While the fact that so many users can work quickly to create an enormous amount of entries is appealing, some medical professionals worry that the information produced won't be accurate. More research is needed to determine their utility as tools of knowledge translation.

Continuing medical education has not yet fully taken advantage of the technology that enables on-line communication and collaboration (Wiecha & Barrie, 2002). There is evidence to support interactive online CME platforms as effective in supporting active learning and in establishing an additional stimulus for knowledge translation into daily medical practice (Vollmar, Shurer-Maly, Frahne, et al, 2006). While the Internet offers an educational distribution system accessible to practicing physicians, most CME online programs are text-based and not often interactive or guideline based (Casebeer, Allison & Spettell, 2002). Casebeer and colleagues (2002) report on an innovative course that provides individual office feedback on performance, compares physician's responses with those of their peers, and gathers responses to determine readiness to change practices. The authors state that they plan to evaluate this course. A recent randomized control trial compared the instructional efficacy of Internet-based CME with live interactive CME workshops (Fordis, King, Ballantyne et al, 2005). Physicians were randomly assigned to an Internet-based CME that could be completed in multiple sessions over 2 weeks, or to a single, live, small group, interactive cholesterol education CME workshop. Knowledge was assessed immediately before, after and 12 weeks following the intervention. Both interventions produced similar and significant immediate and 12 week knowledge gains. The Internet-based intervention was associated with a significant increase in the percentage of high-risk patients treated with pharmacotherapeutics according to guidelines. Thus, appropriately designed, evidence-based online CME can objectively measured changes in behaviour as well as sustained knowledge that are comparable or superior to those realized from effective live activities.

Research has shown that physician's perspectives of interactive on-line CME are shaped by program design and quality as well as the quality and quantity of interpersonal interaction (Sargeant, Curran, Jarvis-Selinger et al, 2004). Instructor roles in enhancing on-line learning have also been examined, and two facilitation roles appeared critical (Sargeant et al., 2006). These included creating a comfortable learning environment and enhancing the educational value of electronic discussions. Comfort developed over time and specific interventions such as enhancing introductions and sharing experienced in a friendly, informative manner were helpful. They concluded that preparation for on-line facilitation should include instruction in the roles and techniques required and the theories that inform them.

Reminders. Computerized reminders have been found to have the largest average effect of all interventions studied (Grol & Grimshaw, 2003). They are reported to be most effective for prevention in the areas of vaccination and cancer screening. One randomized study examined the effectiveness of two psycho-educational interventions designed to improve the adoption of evidence-based practices among nurses caring for heart failure patients (Murtaugh, Pezzin, McDonald et al, 2006). The interventions tested were a basic intervention consisting of a single just-in-time reminder to nurses; an augmented

intervention in which an e-mail reminder was supplemented by additional provider prompts; follow up outreach by an expert peer; and patient education materials. Results strongly supported the efficacy of just-in-time reminders of evidence-based guidelines as a means of changing clinical practice among home health nurses.

Roumie and colleagues (2006) wanted to see whether educational reminders emphasizing adequate treatment of hypertension could lower blood pressure in patients with hypertension. They also wanted to assess the effects of reminders directed at health care providers compared with those directed at patients. The researchers sent providers an e-mail with an electronic link to standard guidelines for treating high blood pressure. They then randomly assigned each provider to 1 of 3 groups. Providers in the first group were only sent the e-mail. Providers in the second group encountered patient alerts each time they signed on to a hospital or clinic computer. The alerts reminded the providers of ideal blood pressure levels and their patients' last 3 blood pressure measurements. Providers in the third group encountered the same alerts as those in the second group. In addition, the researchers sent a letter to the patients cared for by those providers. The letter provided basic information about hypertension, including what patients could do to lower blood pressure through changes in lifestyle. After about 6 months, the researchers compared the blood pressures of patients in each group. It was found that educational reminders directed at providers and patients can lower blood pressure in patients with hypertension. Reminders directed at both providers and patients may be more effective than those directed at providers alone.

Patient Management Tools. LaBresh and his colleagues (2003) developed “Get with the Guidelines” program (described above), an interactive web-based patient management tool (PMT) using quality measures from the American College of Cardiology (American Heart Association) secondary prevention guidelines. This tool provided data entry, embedded reminders and guideline summaries, and online reports of quality measure performance, including comparisons with aggregate performance at all hospitals. Results demonstrated that electronic data management tools offer specific advantages over paper-based guidelines. Such tools can effectively disseminate guidelines and facilitate decision-support and benchmarking. Following a pilot of this program, the AHA adopted it as a national program.

Clinical Decision Support Systems. Clinical decision support systems (CDSSs) have been defined as systems “designed to aid directly in clinical decision making, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations that are then presented to clinicians for consideration” (Kawamoto, Houlihan, Bals, Lobach, 2005). In consideration of how best to deploy CDSSs, the importance of the context and environment plays an important role (Wears & Berg, 2005). In particular, there is a need to consider workflow, cultural interaction of the organization, and organizational motivation for its use in order for the CDSS tool to meet its’ target goals (Wears & Berg 2005).

The key factors for successful implementation of CDSSs have been summarized in at least two systematic reviews (Garg et al., 2005; Kawamoto et al., 2005). Garg and colleagues (2005) identified that practitioner performance was improved in 64% of the studies. They postulated that success of CDSS implementation resulted when systems automatically prompted the user as compared to systems where the user had to initiate the system. One confound in this area of research is whether the evaluators of the CDSS system are also the developers, as was the case in the Garg study. When the authors are not also the developers, success rates drop to under 50% (Wears & Berg, 2005).

While we are not yet certain what factors detract from CDSS implementation support, Liu et al (2006) argue that the failure of clinicians to use the CDSS could stem from lack of understanding or support, lack of effective output and time needed to influence clinical decisions, output that is unconvincing from a clinical perspective, or lack of clinician's ability to change their practice. Barriers to CDSS uptake were also identified in an observational study conducted in Veteran's Administration medical centres (Saleem et al., 2004). Here, the investigators identified a number of barriers, including lack of coordination among the health care providers, reminders that were not provided while the clinician was with the patient, workload factors for clinical staff, lack of flexibility in the clinical reminder system, and poor interface design and usability. The same study identified factors that facilitate uptake of CDSSs, including placing a limit on the number of reminders that clinicians receive integration of computer prompts with existing processes and workflow, the physical location of the computer workstation, and the ability to provide feedback regarding problems with the computer system.

Kawamoto et al.'s review (2005) identified a success rate of 68% for CDSS implementation. Using multiple logistic regressions, they identified four independent predictors of improved clinical practice: (1) automatic provision of decision support as part of clinician workflow; (2) provision of recommendations in addition to assessments; (3) provision of decision supports at the time and place of decision making, and (4) computer based decision support. In addition, the speed at which the knowledge is provided seems to be a key feature for success. Hayward et al., (2006) demonstrated that if highly quality evidence was less than 5 seconds or five clicks from the clinical information sought, utilization was facilitated. If information appeared in 3 minutes or less, this was more highly valued. Implicit in these findings is the notion that the quality of the evidence is also a key feature.

In summary, the key factors of successful implementation of clinical decision support systems are as follows (Bates et al., 2003): (a) speed is everything; (b) anticipate needs and deliver in real-time; (c) fit into the user's workflow; (d) usability testing - little things can make a big difference; (e) physicians resist recommendations that suggest they stop a course of action – providing an alternative approach to the same order with associated rational works better; (f) a simpler single screen format works best; (g) don't overwhelm with information; get additional information only when you need it; (h) monitor patterns of use and frequency of compliance to learn how to modify for optimal support of the workflow; (i) manage and maintain your information systems and update them to reflect current (new) knowledge, utilization patterns, and workflow processes.

Group Learning

Networks. The exchange component of knowledge translation acknowledges that expertise resides in both the creators of knowledge as well as in the users of knowledge (Lee & Garvin, 2003). Rier and Indyk (2006) have embraced this notion in their work with inner-city HIV/AIDS services. They question the concept of dissemination and are critical of typical hierarchical or 'top-down' approaches. They discuss the borders between credentialed scientists and non-scientists in what they term the 'new geometry of care'. This web model of dissemination minimizes distinctions between scientists (as knowledge creators) and networks of others (as knowledge users), and rather, views all parties as centrally involved in the production of knowledge. Their approach is designed to build and maintain an infrastructure of interorganizational linkages designed to generate and sustain knowledge development and integration

between and within systems. By cultivating a critical mass of diverse providers and patients to question, learn and teach together, a framework is emerging through which to combat complex sociomedical challenges.

Robinson and her colleagues (2005) highlight the need for more *interactive* dissemination approaches such as linking systems. They describe the use of linking systems between public health resource and user organizations to build capacity and enhance dissemination in heart health promotion. Linking activities included meeting, skill building, resources, collaborations, networking and research feedback to facilitate capacity building for and implementation of heart health promotion activities. Results from the Canadian Heart Health Initiative Dissemination Phase indicated that the presence of (1) committed and/or skilled people, (2) funds, and/or resources, and (3) priority and/or interest are the three main facilitators and barriers across capacity building, implementation, evaluation and research. Geographical barriers such as distance across rural communities are major barriers to capacity building and implementation. There was a clear need for organizations to foster health promotion champions who can push organizations forward and guide staff.

Communities of Practice. Communities of practice (CoPs) are groups of people who share a concern, set of problems, or enthusiasm about a topic, and who deepen their knowledge and expertise about a topic by interacting on an ongoing basis (Wenger, McDermott & Snyder, 2002). They are part of a wider tradition of collaborative small group learning environments related to CME, education, and adult learning theory. The term was coined in 1991 by Jean Lave and Etienne Wenger in their exploration of Situated Learning (Lave & Wenger 1991) - learning skills on the job. Lave and Wenger saw the acquisition of knowledge as a social process where people can participate in communal learning. Much of what practitioners know is tacit or implicit and gained in the course of interaction with colleagues, systems, and patients (Lockyer, Gondocz, & Thivierge 2004). The CoP provides an opportunity for the exchange of tacit knowledge and for reflection and solutions to real world problems to emerge. Often there is little time for reflection and critical analysis in everyday practice because too many things may be going on simultaneously to create space for an explicit exploration of the reasons why things are not working well (Lockyer et al., 2004). Over the years, other researchers and practitioners have extended the notion of a CoP and applied it in a knowledge management context in commercial settings. Since then, much work has undertaken to observe CoPs, learn how they work (process), examine their defining characteristics and the resulting outcomes – mainly economic, and return on investment terms.

The CoP concept has emerged in business management and education in the past decade as an effective method of knowledge management and collaborative learning, and it is only now diffusing slowly into the health care sector. Defined as a group of people who share knowledge, learn together, and create common practices, CoPs are a unique combination of three structural concepts: the *domain of knowledge*, which creates common ground, a sense of common identity, and inspires members to contribute and participate; a *community of people* who care about the domain, thus creating the social fabric for learning, sharing, inquiry, and trust; and the *shared practice* made up of frameworks, tools, references, language, stories, documents, that community members share (Wenger et al., 2002). CoP members are bound together by common interests and a desire to continually interact. CoPs differ from formal work groups, project teams or informal networks in emphasizing the development of members' capabilities and the building and exchange of knowledge. CoPs are more informal and self-managed than other forms of business meetings. They are based on collegiality, not on reporting relationships, and membership

depends on participation rather than on institutional affiliation. CoPs are hugely versatile as a KT strategy because they can change their agenda to suit the needs of members, they can exist in real world or virtual space, and they cross topical and geographical boundaries.

Because CoPs extend learning over time, they address many of the problems typically associated with many short courses and workshops that are (i) divorced from their context, (ii) located somewhere other than the workplace, (iii) may not relate directly to actual work circumstances, and (iv) involves other participants who are not colleagues (Moon, 2004). Reflection is what brings current practice and new skills and knowledge together. Moon defines reflective learning as a form of mental processing – a form of thinking – that we may use to fulfill a purpose or to achieve some anticipated outcome. CoP's provide a suitable format for reflective practice. It can be incorporated by using “stop and think” breaks during the CoP event. These are periods of 5 to 10 minutes during which participants are asked to take time for themselves to jot down reflections, ideas, thoughts, and so on into a CoP journal. Reflective writing is guided according to the phase of the CoP or course. In early stages of CoPs, reflective work can involve clarifying the nature of the present practice. Later, as the CoP evolves, reflective work can relate to the nature of improved practice. The evidence from a wide range of therapeutic techniques indicates that the request to imagine how things will be different can be a powerful aid to enacting the changes in order to behave differently (Moon, 2004).

CoP is consistent with three principles of adult learning theory: practicality, participation, and multiple demands (Slotnick & Kristjanson, 1999). First, practitioners want to learn solutions to problems they already have. Second, practitioners want to participate in their own learning. Third, learning must respect that practitioners have multiple demands on them and so the amount they learn must be appropriate given the time available. Relatedly, practitioners must be shown the range of ways in which they can use what they are learning.

Literature in adult learning and CME suggest that small group formats are preferred for enhanced learning because they highlight the value of learner-directed agendas, use of peers and opinion leaders, and employment of multifaceted interventions (Oxman et al., 1995; Davis et al., 1995; Davis & Taylor-Vaisey 1997; Thomson et al., 1998; Pereles, Lockyer & Fidler 2002). Studies have demonstrated that the ability to change practice is enhanced if skills are endorsed by trusted colleagues and supported by published literature, and there is an opportunity for practice and feedback (Fox, Mazmanian, & Putnam 1989). There also must be some motivation for learning and change, and this can be ensured if the issues discussed derive from the learner's own context and clinical practice (Mann & Ribble 1994). In a small group format, such as CoP, learners are involved in providing the topics, motivation is high and relevance to clinical practice is obvious. The format is highly interactive and readily allows for peer-to-peer discussion. The CoP, as with other small group formats, provides an opportunity to measure one's practice against that of one's peers and content experts are available to direct learners to scientific literature and shape practice change. The small group format has been shown to be feasible with general practitioners and experts (Peloso, Bell, Anderson, et al. 1996). Some have shown that specialists are motivated to facilitate this method of learning (Purdy, Kaufman, Sargeant & Langille 1997), and controlled studies have shown that this format leads to knowledge improvement (Premi, Shannon, Hartwick, Lamb, Wakefield & Williams, 1994).

Communities of practice are being piloted in healthcare. Researchers in the UK are undertaking two action research projects to develop CoPs (Lathlean & Le May, 2002) in primary care groups and outpatient services for dermatology and Ear, Nose, and Throat specialties. Observations, field notes and interviews will 1) describe the development and workings of each CoP, and 2) explore the use of knowledge within each CoP. Elsewhere, a virtual (web) CoP for cardiovascular health had nurses share their knowledge and experience on cardiovascular illness and patient care using the Knowledge Forum™ discussion software (Paquet, Leprohon & Cantin, 2004). Questionnaire data showed the CoP had positive effects on the acquisition and maintenance of knowledge in cardiovascular care but had little impact on the resolution of problems relative to cardiovascular treatment. Nurse respondents felt they benefited from sharing the diverse experiences of other members of the community and 80 percent reported they would continue to participate in the community. Emergency care CoPs are being studied by National Institute of Clinical Studies in Australia with a view toward improving mental health care in emergency using qualitative case study methods (Huckson & Davies, 2007). These are ongoing projects and results are not yet available. Communications with these teams suggest that none involve random assignment to CoP and non-CoP conditions.

In Ontario, Cancer Care Ontario is supporting five CoPs for the next year in the areas of ovarian, colorectal, thoracic, & pancreatic/hpb cancer surgery, in addition to an Ottawa regional CoP (Sequiera, 2005). CoP has been used to support tobacco prevention (Lambraki, Atkinson, Leatherdale, Lineker, Manske, Robinson, Skinner, Wong & Wong 2004) and Parboosingh and colleagues are examining CoP in selected clinical areas (Parboosingh, 2005, 2002). Lastly, CoPs are being studied as facilitators of practice change in the child and youth mental health system (Barwick, Peter, Barwick, unpublished).

Action Research / Participatory Research

The main methodologies used in KT research are experimental and quasi-experimental, useful for learning about what strategies work, with what audiences, etc. Their disadvantage, however, is that they tend to disregard issues related to context and environment, and focus mainly on causal relationships between a few variables (Potvin, 1996; Waterman et al., 2007). So, in an effort to achieve generalizability of research findings, important contextualizing factors are stripped away (Greenhalgh, Robert, Bate, MacFarlane & Kyriakidou, 2005) and we lose the effect of such factors as local resources, power relationships, leadership, methods of communication.

Action research can be conceptualized both as a method used to study KT and as a means to encourage KT through the knowledge creation process. As stated by Waterman and colleagues (Waterman, Marshall, Noble, Davies, Walshe, Sheaff & Elwyn (2007), the strength of action research is its propensity to innovate, transfer knowledge, and research the transfer of knowledge simultaneously. Essentially, features of action research map directly onto key elements of effective KT: involve user audiences early, develop partnerships and shared research goals, maintain active communication and knowledge exchange throughout the research process, and provide knowledge to users via active versus passive methods that incorporate their preferences and attend to the user contexts and organizational factors that often play a role in successful implementation.

Consulting

There has been some work in the area of consulting as a strategy to support knowledge translation. Jacobson, Butterill and Goering (2005) argue that consulting can be a strategy for transferring knowledge between researchers and decision makers and is effective at promoting the “enlightenment” and “interactive” models of knowledge use. Jacobson and colleagues analyzed several case studies of consulting projects in order to create a model of knowledge transfer–focused consulting and to identify some of the factors that appear to promote the effective transfer and use of knowledge in consulting projects. They found that three main categories of factors facilitate the use of knowledge in consulting projects. First, the urgency of the problem that initiates the project is important because when clients identify a pressing need and are willing to pay consultants to help them respond, they are likely to be motivated to use the knowledge generated by the consultants. Alternatively, when the need is perceived to be less urgent or when the problem is not recognized by the clients themselves, the chances of the knowledge being used are reduced. Second, knowledge use is promoted by specific characteristics of both consultants and clients. From the clients' point of view, knowledge is more likely to be used when the consultants are perceived to be accessible, organized, expert, and credible. From the consultants' point of view, clients need to be open (and open-minded), communicative, and committed to the consulting process. Third, the use of knowledge seems to be facilitated by several strategies directed at promoting the clients' participation and collaboration (i.e., steering or advisory committees). They concluded that consulting appears to be an effective strategy for carrying out an interactive model of knowledge transfer to enhance the use of research-based knowledge in decision-making environments.

Report Cards

Health care report cards provide stakeholders with information on health care outcomes and other measures of care, and they are most well developed in cardiac care (Bensimon et al., 2004). The New York State Department of Health pioneered this practice in 1991 by developing the Cardiac Surgery Reporting System to report surgeon-specific risk-adjusted mortality data for every cardiac surgeon in New York State (New York State Department of Health, 1991). Research conducted on stakeholders' views regarding cardiac report cards have identified two purposes: (i) accountability for quality care, and (ii) public education and informed decision-making. The latter purpose can be said to relate to knowledge translation, insofar as the reports convey practice knowledge to multiple stakeholders (Bensimon et al., 2004). Report cards have been criticized for inadequately accounting for the complex mix of variables that affect patient outcomes, and because they cannot portray sufficiently nuanced risk-adjustments (Topol et al., 1994; Krumholz et al., 2002; Davies, 2001; Epstein, 1998). Dissemination of report cards is thought to be ‘best’ via the Internet and the media, although this not without challenges (Bensimon et al., 2004). Bensimon et al., (2004) qualitative interviews with a variety of stakeholders (administrators, nurses, cardiologists, outcomes researchers, cardiac surgeons and members of the media who report on health care), conducted across seven major Canadian cities, found that since the specifics of report cards are largely influenced by their purpose, the purpose(s) should be first identified for intended audiences, i.e., for quality assurance or for educational purposes.

Report cards for acute myocardial infarction (AMI) are being developed using administrative databases in many areas, however, little is known about their acceptance by and their usefulness to the medical community (Green & Wintfeld, 1995). Tu and Cameron (2003) found that although a majority of

respondents had a favourable view of the AMI report card, a significant number did express important concerns about some limitations. Most common among these limitations were the potential for hospital discharge data to be miscoded. Clinicians were reluctant to accept any model that does not include prognostic indicators such as infarct location, admission heart rate, and blood pressure – not captured in most administrative databases. They concluded that to improve the acceptance and use of report cards, future report initiatives should include incorporating more information on process of care measures, rather than the exclusive focus on patient outcomes.

Arts-informed Qualitative KT Approaches

Arts-informed research is a mode and form of qualitative research in the social sciences that is informed or extended through acknowledgement and use of the processes and the representational forms of the arts, broadly defined (Cole, 2002). This may include the use of drama, dance, poetry, song, painting, evocative forms of writing, as well as diagrams, metaphors, films, photographs and videos.

It has been noted that few authors of qualitative studies move beyond the passive dissemination of their work, for example, peer reviewed manuscripts (Bochner & Ellis, 2003; Keen & Todres, 2006). Traditional methods of dissemination frequently restrict audiences to fellow academics (Barnes, Clouder, Pritchard et al, 2003) and pose a barrier to research use, often separating researchers from practice and action (Sandelowski, Trimble, Woodard et al, 2006; Mullen, 2003). Consequently, qualitative researchers have increasingly turned to alternative modes of research dissemination commonly associated with the humanities and arts (Ellis & Bochner, 1996), in part, to address this problem. The turn to more artistic forms has also formed in response to the inadequacies of the traditional scientific research report to represent the lives of research participants.

Arts-informed methodology brings together the “systematic and rigorous qualities of scientific inquiry with the artistic and imaginative qualities of the arts” (Cole and Knowles, 2001, p. 10). Arts-informed research is not only about the representational form, but rather how the whole process of researching is informed by the creative arts. It has been noted that arts-informed research has the potential to reach out beyond academia to communities beyond (Cole & Knowles, 2001). There is an increasing scholarly literature on the use of art as a basis for inquiry, a means for producing knowledge and contributing to human understanding, and representing the complexities of human experience (Gray, 2003). Many research products now contravene the conventional boundaries and forms of social scientific writing and include auto ethnographies, poetry, performance texts, layered accounts, and visual representations (Keen & Todres, 2006; Richardson, 1992; Bochner & Ellis, 2002; Nisker, Martin, Bluhm et al, 2006). In addition, the arts-informed educational community has also contributed much to the field (Barone, 2000) by demonstrating the power of alternative media in communicating research messages.

Similar work has recently proliferated in the medical community, exploring a wide variety of health care issues. Keen and Todres (2006) reviewed 62 texts using non traditional dissemination strategies in qualitative health research. These studies included modes of dissemination closely associated with media and art genres, that is, research-based theatre/ethnodrama (Gray, 2000; Gray, 2003; Gray, Fitch, Phillips et al, 2000; Gray & Sinding, 2002; Gray, Sinding et al, 2000; Mieniczakowski, 1995, 1996, 1997, 2003), three dimensional multi media presentations (Cole & McIntyre, 2004), dance (Bagley & Cancienne, 2001), patchwork quilts including audio and photographs (Brackenbury, 2004), documentary film (Tilleczek,

Chui, Pong et al, 2004), and poetic texts (Glesne, 1997; Richardson, 1992). Their review identified that many of the authors did move beyond the most traditional of passive techniques (the journal article) to disseminate their findings. A smaller subset of authors relied on an empirical foundation for dissemination, and only three projects attempted to address the communicative concern of qualitative research findings by evaluating their impact. The first of these was a dramatic production of two qualitative research studies: focus groups with women living with metastatic breast cancer and interviews with medical oncologists exploring their views on the issues women had raised (Gray, Fitch, Phillips et al, 2000). A partnership was forged with a theatre group for older adults at a local university in order to provide input into the first draft of the dramatic production (Gray, 2000). Study participants were involved in this partnership as investigators and consultants. Most of the words for the script of *Handle with Care* were taken directly from the transcripts of the two studies. Over 200 performances in Canada and the United States ensued. Evaluation questionnaires were sent out to the general public attendees in seven Ontario cities and all (N=507, 65% of total audience) agreed that they had enjoyed the production and had benefited from seeing it. Nearly all indicated a desire to see further productions about living with cancer. Additional feedback from 249 health care professionals (50% of total audience) demonstrated that the use of the research transcripts increased the validity of the engaging presentation. Further, they indicated that the drama helped them in their clinical practice.

The play "*No Big Deal?*" represents another theatrical production that was set up as a series of vignettes that depicted the shock of diagnosis, coping with impotence, and additional challenges faced by men with prostate cancer and their wives (Gray, Fitch, Labrecque et al, 2003). The goal of the play was to increase awareness about issues regarding prostate cancer by using the findings of the research to engage both service users and professionals. Self-selecting physicians, nurses and other health care staff were asked in advance of the performance to participate in three telephone interviews – prior to the production, within two weeks of attending, and six month later. Many of the 26 participants indicated that they possessed a new level of awareness and understanding resulted from viewing the play, particularly regarding the ways in which service users are affected by diagnosis and treatment. In addition, the humanizing impact of engaging with lives on stage was highlighted as increasing insight and empathy.

A third exemplar reflects an attempt to use research and a public performance to provide insight into the lives of those with mental illness (Mienczakowski, 1995, 2003). Specifically, the aim was to help audiences better understand mental health problems by creating an experience of psychosis. The drama was put together following an intensive study of experiences of psychosis and schizophrenia and service user attitudes toward treatment. The drama was set during a fictional psychiatric care conference wherein attendees present papers on mental health and issues about schizophrenia. This project informed Mienczakowski's next project, *Busting*, an ethnodrama aimed at giving voice to health consumers and workers on life in an urban drug and alcohol detox unit. For both projects, repeated recorded discussion of meanings followed performances. Student nurses gained the greatest insight, many expressing a significant change in their understandings of both psychosis and experience of alcohol withdrawal. Script versions have been used as teaching materials for both nursing and performing arts students.

These three exemplars move beyond the forms of dissemination that traditionally serve academic communities and provide scholarly examples of where the dissemination and impact of qualitative research findings have made a difference to practice and policy. This in no way intended to diminish or replace the scholarship of qualitative research or the peer reviewed journal manuscript (Morse, 2004).

However, in communicating findings from qualitative data, researchers have a wide range of presentational approaches and formats to select from that best fit their research purposes (Sandelowski, 1998). This array of approaches offers the potential to broaden the perspective of what counts as knowledge and evoke different ways of knowing and understanding (Simons & McCormack, 2007).

KT Plans and Tools

Best Practice for Developing KT Plans

Best practices in KT support collaborative approaches that tailor strategies to specific audiences with specific and measurable goals in mind. An effective KT plan should consider the following elements for each KT goal:

- Who is(are) the intended audience(s)
- When will they become involved in the development of the KT plan?
- How will they be involved?
- What strategies will be employed to attain the KT goals?
- What role will each partner play in developing, implementing, and measuring the KT outcomes?
- What resources will be required?
- What resources will partners contribute to the KT plan?
- How will the impact of the KT strategy for each audience be measured?

The following guidelines can be of assistance in choosing KT strategies that will be most effective. Grol and Grimshaw's (2003) overview of original studies and systematic reviews on the effectiveness of interventions to change clinical practice identified the range of effectiveness among the strategies studied thus far.

KT Strategies – Mostly Effective

Participatory research
 Interactive small group meetings
 Educational outreach – especially for prescribing and prevention
 Reminders – particularly for prevention
 Computerized decision support -for drug dosing and prevention
 Use of computers in practice
 Multi-disciplinary collaboration - effective for a range of different chronic conditions
 Mass media campaign
 Financial intervention or incentive – fundholding and budgets effective, mainly on prescribing
 Combined interventions – found most effective than single interventions, but not supported in recent reviews

KT Strategies – Mixed Effects

Conferences, courses
 Use of opinion leaders / champions
 Educational materials
 Patient-mediated interventions – reminding by patients is effective in prevention
 Performance feedback
 Education with different educational strategies – dependent on combination of strategies

KT Strategies - Limited Effects

Total quality management / continuous quality improvement
Didactic professional meetings

KT Strategies – Unknown Effects

Press release
Patent license
Social marketing
Arts-based KT

KT Tools

Several organizations have made important and useful efforts in the development and dissemination of tools that can assist in the development of KT plans. One that is highly recommended was developed by the *Institute for Work and Health* (http://www.iwh.on.ca/assets/pdf/IWH_kte_workbook.pdf). Included in this toolkit are planning guide worksheets that are well thought out and easy to work with.

Mentioned earlier is the *Stroke* toolkit developed in collaboration between l'université de Laval. While developed with stroke researchers in mind, the toolkit can be useful to other health domains and is highly recommended (Landry et al., 2006).

(<http://kuuc.chair.ulaval.ca/ctci/intro.php?PHPSESSID=ba341b6392379c3c6843bb2baa7c43fe>)

The Website Design Toolkit was developed by the University of British Columbia Centre for Health and Environment Research with a view toward providing a resource that can assist in the transfer of knowledge via the web (<http://web.cher.ubc.ca/toolkit/>). Similarly to concept and skills needed when creating *PowerPoint* presentations, this toolkit explains how to use web templates to create a website for a research project; <http://www.cher.ubc.ca/investigators/knowledgetransfer.asp>

Knowledge Translation for Indigenous Communities, a policy making toolkit for use at the First Nation, Inuit or Métis community level (Hanson & Smylie, 2006) acknowledges that knowledge that is generated in a context that is non-Indigenous and far removed from community realities may be “lost in translation” as it comes into the community and may create more harm than good. There is a need to ensure the meaning and the value of the knowledge is not lost and that it is filtered by the community, if necessary, to ensure the most positive impact. The purpose of the toolkit is to briefly review issues in KT, provide an overview of a possible process for policy making, and suggest principles and elements to think about when drafting a KT policy at the community level. This tool can be accessed on the web at http://www.iphrc.ca/resources/KT_Policy_Toolkit_Sept26%5B1%5D.pdf

Toolkits on knowledge exchange were also developed by the Provincial Centre of Excellence for Child and Youth Mental Health at CHEO (2006). *Doing More With What You Know*, and *Doing More in Partnership* are intended to provide tools to help groups choose and implement the most appropriate knowledge exchange strategies for their projects. A knowledge exchange checklist is included which

highlights starting points, audiences, communication, dissemination, and use and feedback. (<http://www.onthepoint.ca/resources/toolkits.htm>).

Lastly, it is worth mentioning a new training tool recently developed at the Hospital for Sick Children with the purpose of educating health scientists in the practice of knowledge translation (Barwick, Butterill, Lockett, Buckley, Goering, 2005). The premise underlying the *Sick Kids Knowledge Translation Training Course* is that scientists have an important role to play in ensuring that their science is disseminated appropriately to key audiences beyond the academic realm so that they might achieve the best impacts and outcomes possible. A pilot evaluation has just been completed and a national evaluation in selected health science centres and research funding bodies is planned for 2008-2009.

Summary

The transfer of research knowledge to inform policy and decision-making and to change practice, and behaviour more generally, is a long term, iterative process that involves many stages. It is influenced by a complex interplay of factors that operate in the health care system as well as factors in the environment in which the system operates. Key among these – and central to understanding the dissemination process – is the context in which new practices are introduced. Currently, the research evidence points to strategies that have shown promise with some populations, in some contexts, and with certain goals. However, we have not yet arrived at a KT ‘recipe’ that can work in all situations, nor are we ever likely to do so because there are too many subtleties and factors involved. We know that KT must be dynamic, designed with a particular audience in mind, with knowledge of the organizational context and the learning and practice preferences of the intended users.

We also know that the KT process takes time, particularly when the intent is to change practitioner behaviour. Policy and decision makers should consider a long time horizon for dissemination and set realistic expectations for intended changes. KT researchers are now working to understand how theories of behaviour change can inform our research in this area (e.g., ICEBeRG Group, <http://www.iceberg-grebeci.ohri.ca/>). More research is also needed to develop and test new strategies in KT. The elements of successful KT that have received support include attention to individual practitioner and organizational readiness for change, involvement of key stakeholders in the change process, inclusion of facilitators, knowledge brokers or other KT supportive roles, tailoring of KT strategies to particular audiences and to the intended goals of the knowledge exchange, employing strategies that have demonstrated effectiveness with similar groups, and continuing to support the translation process well into implementation until behavior change or the intended goals of the KT endeavor have been achieved.

As the field of KT progresses to uncover both new strategies and the underlying factors that lead to success, health practitioners, advocacy organizations, and voluntary sector organizations such as HSFO can move forward on the strategies and best practices summarized in this report. Begin with good planning, leadership, and project management; bring together the right mix of stakeholders – those who have valuable input for the initiative and how it will proceed, and who can assist with all aspects of the KT plan; select a set of strategies and associated measures of outcome or impact geared to each KT goal; and set aside the required resources to make the plan successful, including human resources, financing, technology, and time. Lastly, evaluation of KT efforts needs to be continuous, building in opportunities to monitor progress and successes and identify needed refinements as contexts, policies, and new scientific discoveries create shifts in the health landscape.

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