



# Knowledge Translation

## Introduction to Models, Strategies, and Measures

**Pimjai Sudsawad, ScD**  
The University of Wisconsin–Madison

Published By

**The National Center for the  
Dissemination of Disability Research**

at the Southwest Educational Development Laboratory



# **Knowledge Translation:** **Introduction to Models, Strategies, and Measures**

**Pimjai Sudsawad, ScD**  
The University of Wisconsin–Madison

Published By  
The National Center for the Dissemination of Disability Research

PUBLICATION DATE: AUGUST 2007

Copyright © 2007 The Board of Regents of The University of Wisconsin System.

*Knowledge Translation: Introduction to Models, Strategies, and Measures* was prepared by Pimjai Sudsawad, ScD, University of Wisconsin–Madison. This document has been printed and distributed by the National Center for the Dissemination of Disability Research (NCDDR) at the Southwest Educational Development Laboratory under grant H133A060028 from the National Institute on Disability and Rehabilitation Research (NIDRR) in the U.S. Department of Education’s Office of Special Education and Rehabilitative Services (OSERS).

SEDL’s NCDDR project is a knowledge translation project focused on expanding awareness, use, and contributions to evidence bases of disability and rehabilitation research. This NCDDR publication is designed to provide knowledge translation overview information targeted to stakeholders in disability and rehabilitation research. SEDL is an equal employment opportunity/affirmative action employer and is committed to affording equal employment opportunities for all individuals in all employment matters. Neither SEDL nor the NCDDR discriminates on the basis of age, sex, race, color, creed, religion, national origin, sexual orientation, marital or veteran status, or the presence of a disability.

The contents of this document do not necessarily represent the policy of the U.S. Department of Education, and you should not assume endorsement by the federal government.

**Suggested citation:**

Sudsawad, P. (2007). *Knowledge translation: Introduction to models, strategies, and measures*. Austin, TX: Southwest Educational Development Laboratory, National Center for the Dissemination of Disability Research.

[Online]. Available: <http://www.ncddr.org/kt/products/ktintro/>

[Online]. Available PDF: <http://www.ncddr.org/kt/products/ktintro/ktintro.pdf>

# Contents

## INTRODUCTION

Definitions of Knowledge Translation.....	1
Characteristics of Knowledge Translation .....	2
Knowledge Translation and Evidence-Based Practice .....	3

## KNOWLEDGE TRANSLATION MODELS

CIHR Model of Knowledge Translation.....	4
Other Models and Frameworks Applicable to Knowledge Translation .....	5
Interaction-Focused Frameworks.....	5
Understanding-User-Context Framework .....	5
Context-Focused Models and Frameworks .....	7
The Ottawa Model of Research Use.....	7
The Knowledge-to-Action Process Framework .....	8
The Promoting Action on Research Implementation in Health Services Framework .....	10
The Coordinated Implementation Model.....	11
Individual-Focused Models.....	12
The Stetler Model of Research Utilization .....	12

## EFFECTIVENESS OF KNOWLEDGE TRANSLATION STRATEGIES

Overall Effectiveness of Implementation Strategies .....	14
Effectiveness of Specific Implementation Strategies.....	16
Audit and Feedback.....	16
Tailored Interventions .....	17
Organizational Structures.....	18
Interactive Strategies.....	18
Evidence in Rehabilitation .....	18

## MEASURES OF KNOWLEDGE USE

Background Information.....	21
Types of Knowledge Use .....	21
Considerations in Measuring Knowledge Use.....	21
Framework in Evaluating Knowledge Use .....	22
Methodologies and Focus of Measuring Knowledge Use .....	24
Examples of Approaches in Measuring Knowledge Use .....	25

<b>EPILOGUE</b> .....	<b>33</b>
-----------------------	-----------

<b>REFERENCES</b> .....	<b>35</b>
-------------------------	-----------

## FIGURES

1. CIHR research cycle superimposed by the six opportunities to facilitate KT .....	4
2. The Ottawa Model of Research Use.....	7
3. The Knowledge-to-Action Process.....	9
4. The Coordinated Implementation Model .....	11
5. The Stetler Model of Research Utilization .....	12
6. Conner's conceptual model for research-utilization evaluation.....	23

## Introduction

Knowledge translation (KT) is a complex and multidimensional concept that demands a comprehensive understanding of its mechanisms, methods, and measurements, as well as of its influencing factors at the individual and contextual levels—and the interaction between both those levels. This literature review, although not intended to be an in-depth or systematic review of any one aspect of knowledge translation, is designed to bring together several aspects of it from selected literature for the purpose of raising awareness, connecting thoughts and perspectives, and stimulating ideas and questions about knowledge translation for future research of this area of inquiry in rehabilitation. The body of work included in this review was selected from frequently cited and thought-provoking literature and represents a variety of thoughts and approaches that are applicable to knowledge translation.

This paper begins by presenting the definitions of knowledge translation and discussing several models that, together, can be used to delineate components and understand mechanisms necessary for successful knowledge translation. Then the knowledge translation strategies and their effectiveness are explored based on the literature drawn from other health-care fields in addition to rehabilitation. Finally, several methods and approaches to measure the use of research knowledge in various dimensions are presented.

### Definitions of Knowledge Translation

*Knowledge translation (KT)* is a relatively new term coined by the Canadian Institutes of Health Research (CIHR) in 2000. CIHR defined KT as “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, 2005, para. 2).

Since then, a few other definitions of KT have been developed. Adapted from the CIHR definition, the Knowledge Translation Program, Faculty of Medicine, University of Toronto (2004), stated its definition of knowledge translation as “the effective and timely incorporation of evidence-based information into the practices of health professionals in such a way as to effect optimal health care outcomes and maximize the potential of the health system.”

The World Health Organization (WHO) (2005) also adapted the CIHR’s definition and defined KT as “the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health.”

At around the same time, the National Institute on Disability and Rehabilitation Research (NIDRR) developed a working definition of KT in its long-range plan for 2005–2009. NIDRR refers to KT as “the multidimensional, active process of ensuring that new knowledge gained through the course of research ultimately improves the lives of people with disabilities, and furthers their participation in society” (NIDRR, 2005).

Most recently, the National Center for the Dissemination of Disability Research (NCDDR) proposed another working definition of KT as “the collaborative and systematic review, assessment, identification, aggregation, and practical application of high-quality disability and rehabilitation research by key stakeholders (i.e., consumers, researchers, practitioners, and policymakers) for the purpose of improving the lives of individuals with disabilities” (NCDDR, 2005).

### **Characteristics of Knowledge Translation**

A prominent characteristic of KT, as indicated by CIHR (2004), is that it encompasses all steps between the creation of new knowledge and its application to yield beneficial outcomes for society. Essentially, KT is an interactive process underpinned by effective exchanges between researchers who create new knowledge and those who use it. As stated by CIHR, bringing users and creators of knowledge together during all stages of the research cycle is fundamental to successful KT.

*Knowledge* in KT has an implicit meaning as research-based knowledge. CIHR envisioned that KT strategies can help define research questions and hypotheses, select appropriate research methods, conduct the research itself, interpret and contextualize the research findings, and apply the findings to resolve practical issues and problems. As outlined by CIHR (2004), continuing dialogues, interactions, and partnerships within and between different groups of knowledge creators and users for all stages of the research process are integral parts of KT. Examples of different interactive groups are as follows:

- Researchers within and across research disciplines
- Policymakers, planners, and managers throughout the health-care, public-health, and health public-policy systems
- Health-care providers in formal and informal systems of care
- General public, patient groups, and those who help to shape their views and/or represent their interests, including the media, educators, nongovernmental organizations, and the voluntary sector
- The private sector, including venture capital firms, manufacturers, and distributors

CIHR (2004) stated that the process of KT includes knowledge dissemination, communication, technology transfer, ethical context, knowledge management, knowledge utilization, two-way exchange between researchers and those who apply knowledge, implementation research, technology assessment, synthesis of results with the global context, and development of consensus guidelines. Therefore, KT appears to be a larger construct that encompasses most previously existing concepts related to moving knowledge to use. It is the newest conceptual development that seems to be more comprehensive, more sophisticated, and highly embedded in the actual contexts in which the knowledge applications will eventually occur.

Overall, the characteristics of KT can be summarized in a nonranked order as follows:

- KT includes all steps between the creation of new knowledge and its application.
- KT needs multidirectional communications.
- KT is an interactive process.
- KT requires ongoing collaborations among relevant parties.
- KT includes multiple activities.
- KT is a nonlinear process.
- KT emphasizes the use of research-generated knowledge (that may be used in conjunction with other types of knowledge).

- KT involves diverse knowledge-user groups.
- KT is user- and context-specific.
- KT is impact-oriented.
- KT is an interdisciplinary process.

## **Knowledge Translation and Evidence-Based Practice**

*Knowledge translation* (KT) is a term increasingly used in health-care fields to represent a process of moving what we learned through research to the actual applications of such knowledge in a variety of practice settings and circumstances. In rehabilitation, the interest in KT (and other concepts about moving research-based knowledge into practice) appears to coincide with the growing engagement in the evidence-based practice (EBP) approach, in which practitioners make practice decisions based on the integration of the research evidence with clinical expertise and the patient's unique values and circumstances (Straus, Richardson, Glasziou, & Haynes, 2005). Despite a strong endorsement for EBP in rehabilitation and other health-care fields, the use of research for practice continues to be lacking (e.g., Bennett et al., 2003; Meline & Paradiso, 2003; Metcalfe, Lewin, Wisher, Perry, Bannigan, & Moffett, 2001; Turner & Whitfield, 1997). This difficulty has led to increased awareness of the complexity of this process, quests to understand its mechanisms, and attempts to develop strategies that could increase its success.

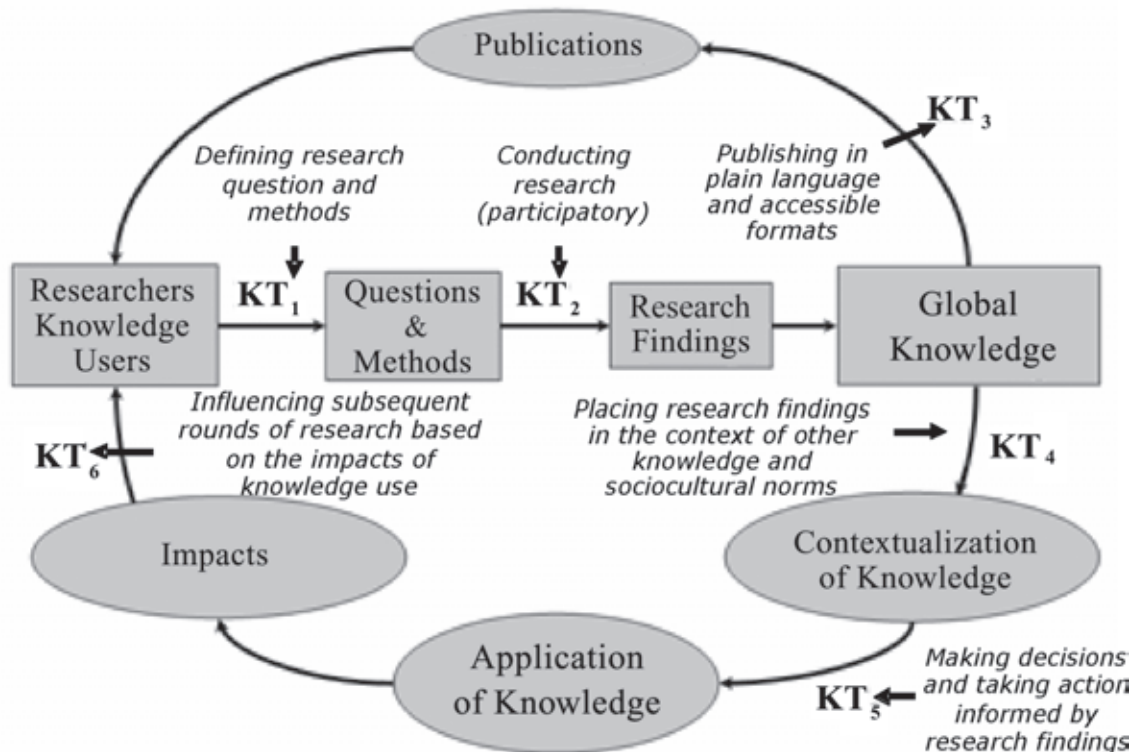
In past literature, scholars have had different takes on the interchangeable use of KT and other similarly focused terminologies. Some have used *KT* and other terms interchangeably (e.g., Jacobson, Butterill, & Goering, 2003), whereas others have attempted to tease out the differences between KT and other terms (e.g., Johnson, 2005; Kerner, 2006). That debate lies outside the scope of this paper and will not be discussed here. According to the CIHR's framework, KT encompasses other related concepts that come before it, and the discussion in this paper will follow that theme, treating related concepts as parts of KT.

# Knowledge Translation Models

## CIHR Model of Knowledge Translation

CIHR (2005) proposed a global KT model, based on a research cycle, that could be used as a conceptual guide for the overall KT process. CIHR identified six opportunities within the research cycle at which the interactions, communications, and partnerships that will help facilitate KT could occur. Those opportunities are the following:

- **KT1:** Defining research questions and methodologies
- **KT2:** Conducting research (as in the case of participatory research)
- **KT3:** Publishing research findings in plain language and accessible formats
- **KT4:** Placing research findings in the context of other knowledge and sociocultural norms
- **KT5:** Making decisions and taking action informed by research findings
- **KT6:** Influencing subsequent rounds of research based on the impacts of knowledge use



**Figure 1.** CIHR research cycle superimposed by the six opportunities to facilitate KT

(Source: Canadian Institutes of Health Research Knowledge Translation [KT] within the Research Cycle Chart. Ottawa: Canadian Institutes of Health Research, 2007. Reproduced with the permission of the Minister of Public Works and Government Services Canada, 2007).



Figure 1 on page 4 shows a graphical model in which the six opportunities listed here were superimposed on CIHR's depiction of the knowledge cycle.

## Other Models and Frameworks Applicable to Knowledge Translation

The CIHR's KT model offers a global picture of the overall KT process as integrated within the research knowledge production and application cycle. However, the use of other models and/or frameworks with more working details may be necessary to implement each part of the CIHR conceptual model successfully. Such details could be used to augment an understanding of the specific components, chronological stages, and contextual factors that must be taken into consideration to facilitate successful communications, interactions, partnerships, and desired outcomes during each of the KT opportunities. Selected comprehensive models that could be used to augment the CIHR's KT model are described in this section. An effective KT framework requires not only the environmental organizational view, but also the microperspective of an individual (Davis, 2005). Therefore, models and frameworks that represent an individual user's perspective, as well as those that address contextual factors, are included.

### *Interaction-Focused Framework*

**Understanding-User-Context Framework:** This framework for knowledge translation (Jacobson et al., 2003) was derived from a review of literature and the authors' experience. It provides practical guidelines that can be used by researchers and others to engage in the knowledge translation process by increasing their familiarity with and understanding of the intended user groups. Specifically, this framework can be used as a guide for establishing interactions required by the KT process illustrated in the CIHR's model.

The framework contains five domains that should be taken into consideration when establishing interactions with users:

1. The user group
2. The issue
3. The research
4. The researcher–user relationship
5. The dissemination strategies

Each domain includes a series of questions. The purpose of these questions is to provide a way to organize what the researcher already knows about the user group and knowledge translation, identify what is still unknown, and flag what is important to know. The following paragraphs and lists describe the foci and sample questions for each domain.

The *user group domain* focuses on understanding several aspects of the user group, such as the group's operational context, morphology, decision-making practices, access to information sources, attitudes towards research and researchers, and experiences with knowledge translation.

Sample questions for the user group domain are as follows:

- In what formal or informal structures is the user group embedded?
- What is the political climate surrounding the user group?
- What kinds of decisions does the user group make?
- What criteria does the user group use to make decisions?

The *issue domain* focuses on the characteristics and context of the issue intended to be resolved through the knowledge translation effort.

Sample questions for the issue domain are as follows:

- How does the user group currently deal with this issue?
- For which other groups is the issue salient?
- How much conflict surrounds the issue?
- Is it necessary to possess a particular expertise to understand this issue?

The *research domain* focuses on the research characteristics, the user group's orientations toward research, and the relevance, congruence, and compatibility of the research (at hand) to the user group.

Sample questions for the research domain are as follows:

- What research is available?
- What is the quality of the research?
- How relevant is the research to the user group?
- Does the research have implications that are incompatible with existing user-group expectations or priorities?

The *research–user relationship domain* focuses on the description of relationships between the researcher and the user group.

Sample questions for the research–user relationship domain are as follows:

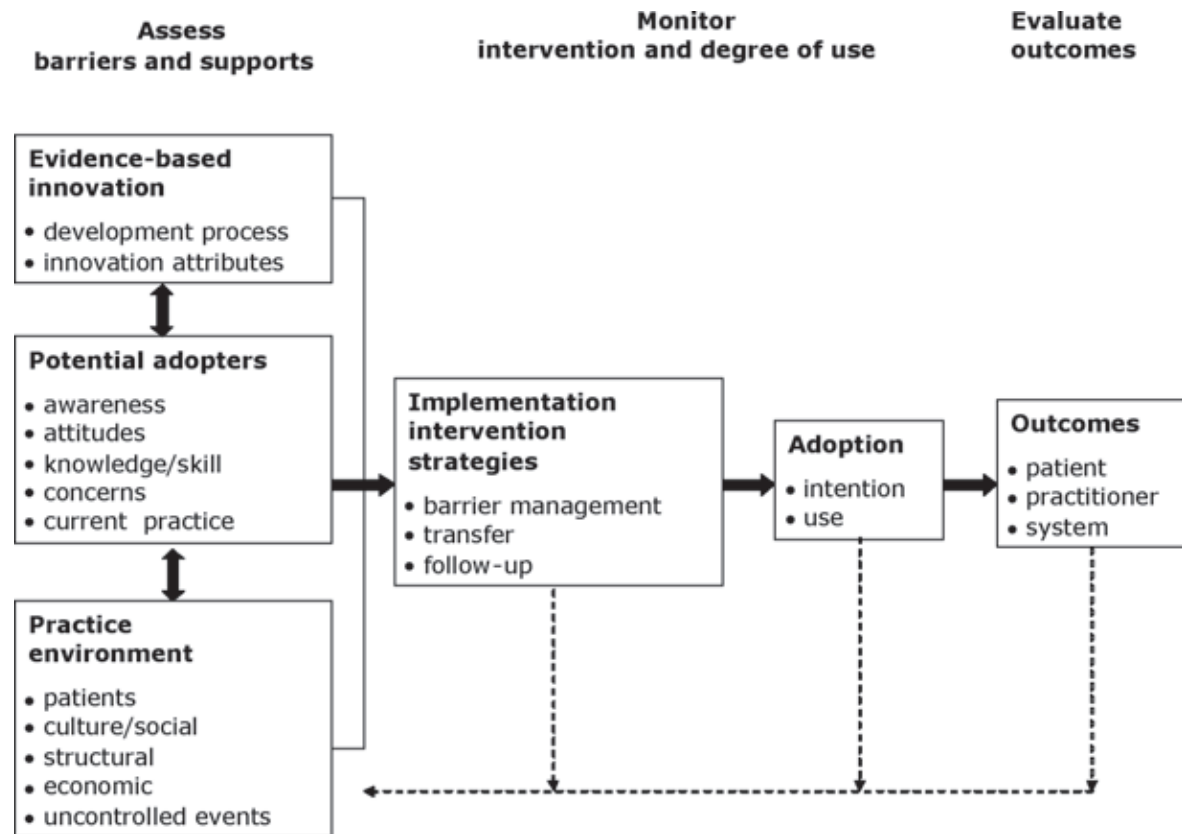
- How much trust and rapport exist between the researcher and the user group?
- Do the researcher and the user group have a history of working together?
- Will the researcher be interacting with the designated representative of the user group? Will that representative remain the same throughout the life of the project?
- How frequently will the researcher have contact with the user group?

The *dissemination strategies domain* focuses on practical strategies for disseminating the research knowledge.

Sample questions for the dissemination strategies domain are as follows:

- What is the most appropriate mode of interaction: written or oral, formal or informal?
- What level of detail will the user group want to see?
- How much information can the user group assimilate per interaction?
- Should the researcher pretest or invite feedback on the selected format from representatives of the user group before finalizing presentation plans?

As suggested by Jacobson et al. (2003), these questions may help raise awareness of the type of information about the user group that may be useful for the knowledge translation process. The scope in obtaining this information will depend on each knowledge translation circumstance. This framework offers a comprehensive approach to guide the interaction of knowledge creators and knowledge users. However, the focus of these interactions was on the implementation of existing knowledge (K4 and K5 in the CIHR's KT model). Additional frameworks that illuminate the mechanisms, considerations, and influencing factors of the interaction between the knowledge creators and the knowledge users through all steps in the process of knowledge translation are certainly needed.



**Figure 2.** The Ottawa Model of Research Use

(Reprinted with permission from *Canadian Journal of Nursing Research*, Vol. 36, Graham, I. D. & Logan, J., Innovations in knowledge transfer and continuity of care, pp. 89–103, copyright © 2004.

### **Context-Focused Models and Frameworks**

These selected models and frameworks can be used to understand the contextual factors that could play important roles in the success or failure of the knowledge translation effort and should be taken into consideration in all stages of the KT process.

**The Ottawa Model of Research Use:** The Ottawa Model of Research Use (OMRU) is an interactive model developed by Logan and Graham (1998). The feasibility and effectiveness of using the OMRU in actual practice contexts was supported by findings from a number of studies (Hogan & Logan, 2004; Logan, Harrison, Graham, Dunn, & Bissonnette, 1999; Stacey, Pomey, O’Conner, & Graham, 2006). The OMRU views research use as a dynamic process of interconnected decisions and actions by different individuals relating to each of the model elements (Logan & Graham, 1998). This model addresses the implementation of existing research knowledge (KT4 and KT5 in the CIHR’s KT model).

The model has gone through some revisions since its inception. The most recent version of the OMRU (Graham & Logan, 2004) includes six key elements:

1. Evidence-based innovation
2. Potential adopters
3. The practice environment

4. Implementation of interventions
5. Adoption of the innovation
6. Outcomes resulting from implementation of the innovation

The relationships among the six elements are illustrated in Figure 2 on page 7.

According to Graham and Logan (2004), the OMRU relies on the process of assessing, monitoring, and evaluating each element before, during, and after the decision to implement an innovation. Barrier assessments must be conducted on the innovation, the potential adopters, and the practice environment to identify factors that could hinder or support the uptake of the innovation. The implementation plan is then selected and tailored to overcome the barriers and enhance the supports identified. Introduction of the implementation plan is monitored to ensure that the potential adopters learn about the innovation and what is expected of them. The monitoring is ongoing to help determine whether any change in the current implementation or a new implementation plan is required. Finally, the implementation outcomes are evaluated to determine whether the innovation is producing the intended effect or any unintended consequences.

**The Knowledge-to-Action Process Framework:** Graham et al. (2006) proposed the knowledge-to-action (KTA) process conceptual framework that could be useful for facilitating the use of research knowledge by several stakeholders, such as practitioners, policymakers, patients, and the public. The KTA process has two components: (1) knowledge creation and (2) action. Each component contains several phases. The authors conceptualized the KTA process to be complex and dynamic, with no definite boundaries between the two components and among their phases. The phases of the action component may occur sequentially or simultaneously, and the knowledge-creation-component phases may also influence the action phases.

In the KTA process, knowledge is mainly conceptualized as empirically derived (research-based) knowledge; however, it encompasses other forms of knowing, such as experiential knowledge. The KTA framework also emphasizes the collaboration between the knowledge producers and knowledge users throughout the KTA process. The visual presentation of the KTA process is shown in Figure 3 on page 9.

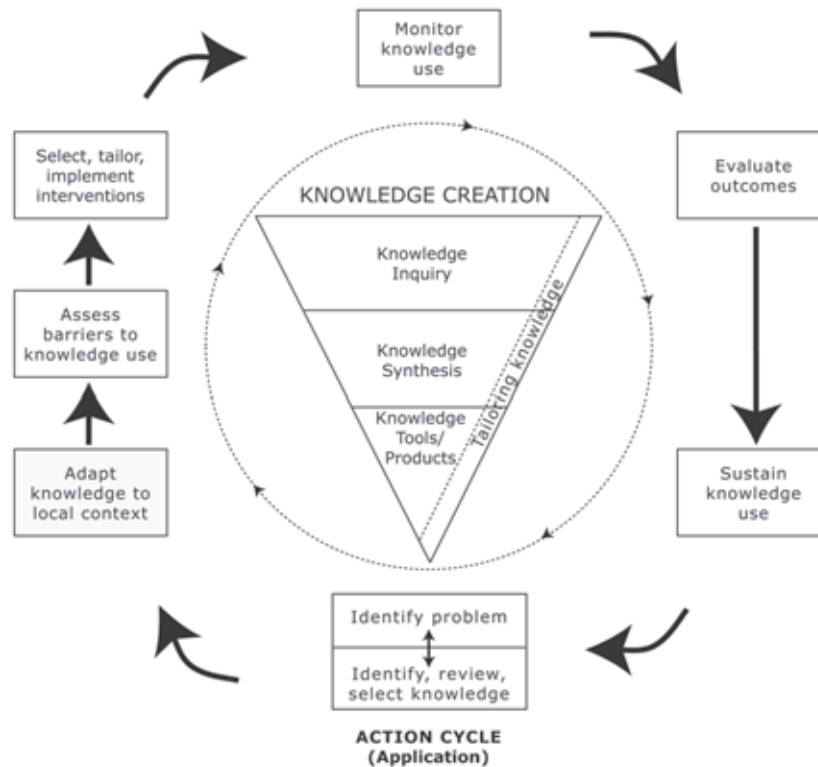
*Knowledge creation* consists of three phases: (1) knowledge inquiry, (2) knowledge synthesis, and (3) knowledge tools/products. Knowledge creation was conceptualized as an inverted funnel, with a vast number of knowledge pieces present in the knowledge inquiry process in the beginning. Those pieces are then reduced in number through knowledge syntheses and, finally, to an even a smaller number of tools or products to facilitate implementation of the knowledge. The authors stated that as knowledge moves through the funnel, it becomes more distilled and refined, and presumably becomes more useful to the stakeholders. The needs of potential knowledge users can be incorporated into each phase of knowledge creation, such as tailoring the research questions to address the problems identified by the users, customizing the message for different intended users, and customizing the method of dissemination to better reach them.

The action cycle represents the activities needed for knowledge application. Graham et al. (2006) conceptualized the action cycle as a dynamic process in which all phases in the cycle can influence one another and can also be influenced by the knowledge creation process. The action cycle often starts with an individual or group identifying the problem or issue, as well as the knowledge relevant to solving it. Included in this phase is the appraisal of the knowledge itself in terms of its validity and usefulness for the problem or issue at hand. The knowledge then is adapted to fit the local context. The next step is to assess the barriers and facilitators related to the knowledge to be adopted, the potential adopters, and the context or setting in which the knowledge is to be used. This information is then used to develop and execute the plan and strategies to facilitate and promote awareness and implementation of the knowledge. Once the

plan is developed and executed, the next stage is to monitor knowledge use or application according to types of knowledge use identified (conceptual use, involving changes in levels of knowledge, understanding, or attitudes; instrumental use, involving changes in behavior or practice; or strategic use, involving the manipulation of knowledge to attain specific power or profit goals). This step is necessary to determine the effectiveness of the strategies and plan so they can be adjusted or modified accordingly. During the KTA process, it is also necessary to evaluate the impact of using the knowledge to determine if such use has made a difference on desired outcomes for patients, practitioners, or the system. A plan also needs to be in place to sustain the use of the knowledge in changing environments as time passes.

As stated by Graham and colleagues (2006), the relationships between the action phases within the cycle are not unidirectional. Rather, each action phase can be influenced by the phase that precedes it and vice versa. For example, knowledge not being adopted and used as intended could indicate the need to review the plans and strategies again to improve the uptake of knowledge. The phases in the action process of the KTA are those also presented in the OMRU, as delineated in the previous section.

The KTA process framework presents a more comprehensive picture of KT than the OMRU because it incorporates the knowledge creation process. The framework also incorporates the need to adapt the knowledge to fit with the local context (which has also been indicated in the CIHR’s KT model) and the need to sustain knowledge use by anticipating changes and adapting accordingly. However, the KTA process framework does not provide additional details in the knowledge action process aside from what has already been outlined by the OMRU. Nevertheless, it is a comprehensive framework that begins to incorporate the full cycle of knowledge translation from knowledge creation through implementation and impact.



**Figure 3.** The Knowledge-to-Action Process

(Reprinted with permission from the *Journal of Continuing Education in the Health Professions*, Vol. 26, No. 1, Graham, I. D. et al., Lost in knowledge translation: Time for a map, pp. 13–24, copyright © 2006, John Wiley & Sons, Inc.)

**The Promoting Action on Research Implementation in Health Services Framework:** The Promoting Action on Research Implementation in Health Services (PARIHS) (Kitson, Harvey, & McCormack, 1998; Rycroft-Malone, 2004; Rycroft-Malone et al., 2002) is a conceptual model describing the implementation of research in practice. According to the model, a successful implementation of research into practice is a function of the interplay of three core elements: (1) the level and nature of the evidence to be used, (2) the context or environment in which the research is to be placed, and (3) the method by which the research implementation process is to be facilitated. These three elements have equal importance in determining the success of the research use. Each of the elements is positioned on a low-to-high continuum, and the model predicts that the most successful implementation occurs when all elements are on the high end of the continuum.

*Evidence* is defined as a combination of research, clinical experience, patient experience, and local data or information. For each type of evidence, there is a range of conditions from “low evidence” to “high evidence.” An example of high evidence would be that the research is valued as evidence, well conceived, and well conducted; the clinical experience is seen as a part of the decision; the patient experience is relevant; and the local data or information is evaluated and reflected on.

*Context* refers to the environment or setting in which people receive health-care services or the environment or setting in which the proposed change is to be implemented. Context can include physical environment in which the practice occurs; characteristics that are conducive to research utilization, such as operational boundaries, decision-making processes, patterns of power and authority, and resources; organizational culture; and evaluation for the purpose of monitoring and feedback. The PARIHS specifies three key themes under context as (1) culture, (2) leadership, and (3) evaluation. The low-to-high continuum was specified for each theme. A low context would be predictive of unsuccessful research utilization, and a high context would be predictive of successful utilization. An example of a high context would be a culture that values individual staff and clients, the leadership within effective teamwork, and the use of multiple methods of evaluation.

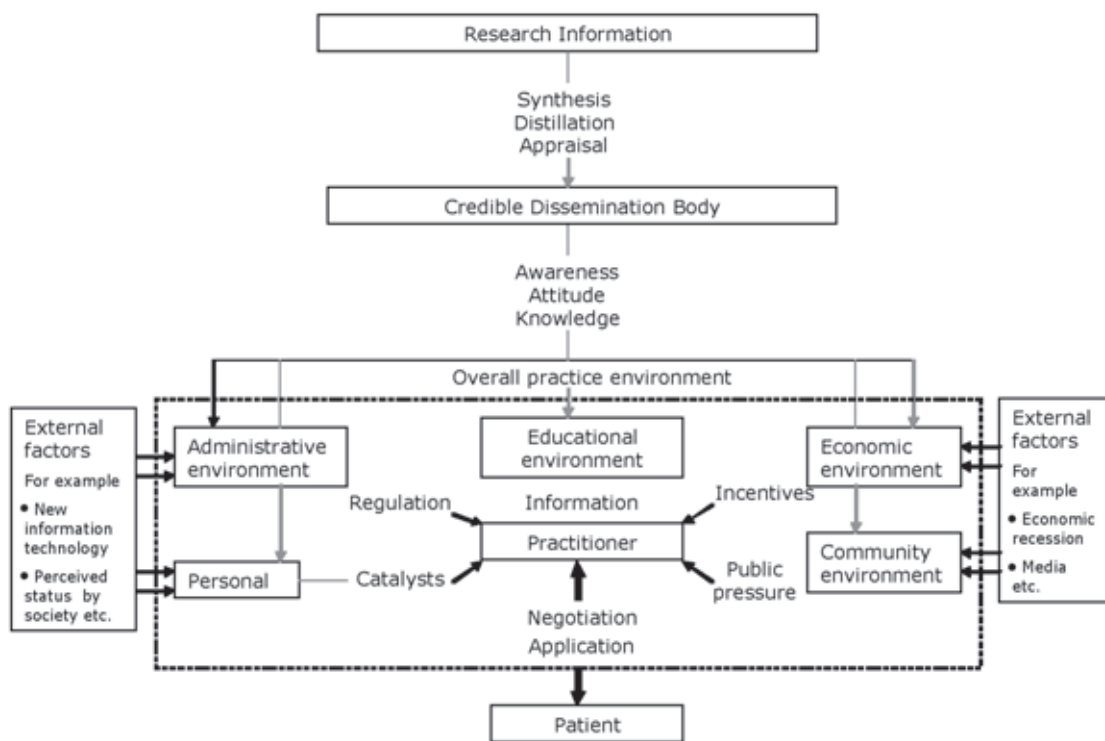
*Facilitation* is defined as a technique by which one person makes things easier for others. The framework authors believe that facilitators have a key role in helping individuals and teams understand what and how they need to change to apply evidence to practice. The role of a facilitator is an appointed one (rather than one arising from personal influence) that could be internal or external to the organization. The function of this role is about helping and enabling, as opposed to telling or persuading. It can encompass a broad spectrum of purposes, ranging from helping achieve a specific task to helping individuals and groups better understand themselves in terms of attributes that are important to achieve those tasks, such as attitudes, habits, skills, ways of thinking, and ways of working. According to the framework, there are three themes of facilitation: (1) purpose, (2) roles, and (3) skills and attributes. Same as the previous elements, each theme has dimensions of low and high. In PARIHS, high facilitation relates to the presence of appropriate facilitation depending on the needs of the situation.

The PARIHS framework is unique in that it identifies facilitation as one of the main elements in the research utilization process and provides much detail in determining the potential of success based on the prediction structure of the model. However, similar to most models reviewed so far, the emphasis is on the implementation component within the knowledge translation process. PARIHS does not discuss elements or factors related to the knowledge creation process, although creation is also an important part of knowledge translation.

Although the PARIHS model is highly complex and likely to be comprehensive in explaining factors and elements related to the use of research and practice, more demonstration of how the model could be applied in an actual practice environment is needed. The most updated version (Rycroft-Malone, 2004) is substantially more complex than the original (Kitson et al., 1998). All elements were revised based on

concept analysis of each element (evidence, context, facilitation) through extracting various dimensions of the elements from extensive literature to form a comprehensive definition and scope. Although doing so has undoubtedly increased the level of complexity of the model, it is not certain how that would affect the actual use of the model as a general framework to guide research utilization in everyday practice settings.

**The Coordinated Implementation Model:** Lomas (1993) proposed a model of research implementation that outlines the overall practice environment to capture schematically the competing factors of influence to the implementation process. According to the author, this model demonstrates some of the additional and largely unexploited routes through which research information could influence clinical practice. The factors of influence to the implementation process were illustrated in the model diagram in Figure 4.



**Figure 4.** The Coordinated Implementation Model

(Reprinted from *The Milbank Quarterly*, Vol. 71, Lomas, J., Retailing research: Increasing the role of evidence in clinical services for childbirth, pg. 439–475, copyright © 1993, with permission from Blackwell Publishing)

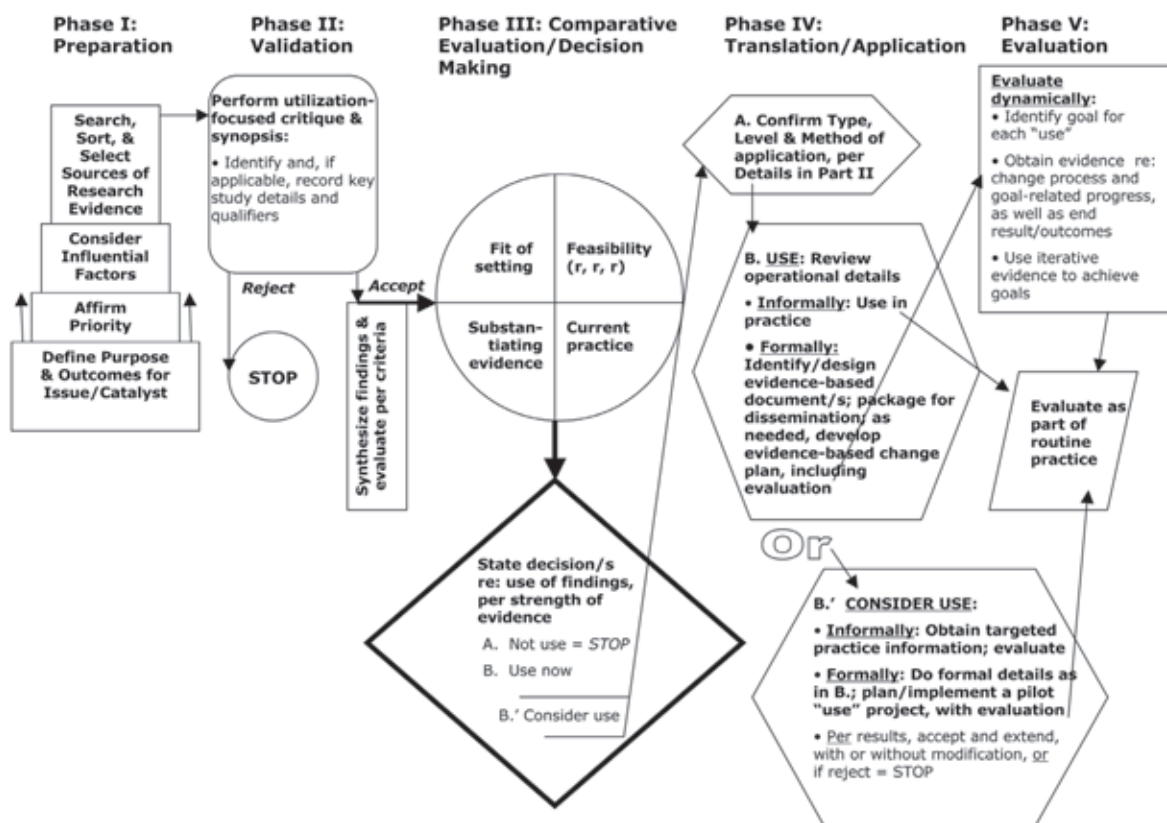
As discussed by Lomas (1993), the approaches used to transfer research knowledge into practice must take into account the views, activities, and available implementation instruments of at least four potential groups. Those include community interest groups, administrators, public policymakers, and clinical policymakers. Although the influences on the use of research from these groups (public pressure, regulation, economic incentives, education, and social influence) are exerted through different venues, they form a system in which, when they work together, the sum of their effects is greater than their parts. This model holds that patients, either as individuals or groups, can also strongly influence practitioners' decisions.

This model helps increase awareness of factors that should be taken into consideration in the implementation effort within the knowledge translation process. Having similar models that outline the

contextual factors that could influence the knowledge translation process in other steps would also be extremely helpful and add more to the understanding of the process.

### Individual-Focused Models

**The Stetler Model of Research Utilization:** The Stetler Model of Research Utilization is the practitioner-oriented model, expected to be used by individual practitioners as a procedural and conceptual guide for the application of research in practice. The model was first developed as the Stetler/Marram Model of Research Utilization (Stetler & Marram, 1976) and later revised and renamed the Stetler Model of Research Utilization (Stetler, 1994, 2001). The latest version of this model consists of two parts. The first part is the graphic model containing five phases of research utilization. The second part contains clarifying information and options for each phase. The graphic model is illustrated in Figure 5.



**Figure 5.** The Stetler Model of Research Utilization

(Reprinted from *Nursing Outlook*, Vol. 49, Stetler, C. B., Updating the Stetler model of research utilization to facilitate evidence-based practice, pg. 272–279, copyright © 2001, with permission from Elsevier)

The Stetler model was developed as a prescriptive approach designed to facilitate safe and effective use of research findings (Stetler, 2001). The model is based on six basic assumptions:

1. The formal organization may or may not be involved in an individual's utilization of research.
2. Utilization may be instrumental, conceptual, and/or symbolic.
3. Other types of evidence and/or non-research-related information are likely to be combined with research findings to facilitate decision making or problem solving.



4. Internal and external factors can influence an individual's or group's view and use of evidence.
5. Research and evaluation provide us with probabilistic information, not absolutes.
6. Lack of knowledge and skills pertaining to research utilization and evidence-based practice can inhibit appropriate and effective use.

The updated model directs users to be conscious of the types of research evidence and suggests that users seek already published systematic reviews whenever possible instead of using primary studies. The following paragraphs provide descriptions of activities within each of the five phases in the graphic model shown in Figure 5 (Stetler, 1994, 2001).

**Phase I** focuses on the purpose, context, and sources of research evidence. The practitioner identifies potential issues or problems and verifies their priority; decides whether to involve others; considers other influential internal and external factors, such as beliefs, resources, or time lines; seeks evidence in the form of systematic reviews; and selects research sources with conceptual fit.

**Phase II** focuses on the validation of findings and includes activities such as critiquing a systematic review, rating the quality of each evidence source, and determining the clinical significance of the evidence. The evaluation is utilization-focused, and the decision is made whether to accept or reject the evidence (rather than using the traditional critique to determine simply whether the evidence is weak or strong). If there is no evidence or the evidence is insufficient, the process will be terminated when the evidence is rejected. Otherwise, the evidence is accepted and the practitioner progresses to Phase III.

**Phase III** focuses on the four criteria used together as a gestalt to determine whether it is desirable to use the validated evidence in the practice setting. *Substantiating evidence* is meant to recognize the potential value of both research and additional non-research-based information as a supplement. *Fit of setting* refers to how similar the characteristics of the sample and study environment are to the population and setting of the practitioner. *Feasibility* entails the evaluation of risk factors, need for resources, and readiness of others involved ("r, r, r," as stated in the graphic model shown in Figure 5). *Current practice* entails a comparison between the current practice and the new practice (that may be introduced) to determine whether it will be worthwhile to change the practice. A decision is then made whether to "use," "consider use," or "not use" the evidence considered.

**Phase IV** focuses on the evidence implementation process, beginning with the confirmation of *type of use* (conceptual, instrumental, symbolic), *method of use* (informal/formal, direct/indirect), and *level of use* (individual, group, organization). Next, the operational details are specified as to who should do what, when, and how. In this phase, a decision is made regarding whether to use or to consider the use of the evidence.

**Phase V** focuses on the evaluation of the use, with two separate processes to evaluate the case of "use" and the case of "consider use" as decided in Phase IV. The evaluation of the "consider use" option requires pilot testing to enable further evaluation of the feasibility of the change in practice. Pilot data are then used to decide whether the evidence will be formally used. In the case of a "use" decision, the implementation process will be formally evaluated.

This model was originally developed for use with nurses. However, the same principles could conceivably apply readily to other practitioners, including in those in rehabilitation. The Stetler model is highly comprehensive and provides procedures to help guide practitioners through all steps in the research use process while taking into consideration the practical (utilization-focused) aspects of clinical decisions.

## Effectiveness of Knowledge Translation Strategies

Many strategies related to knowledge translation were reported in the literature. The majority of these strategies focused on the dissemination and implementation of existing knowledge. Only a few studies reported strategies involving knowledge creation. Those studies, however, mainly described the strategies that were used and their successes, but not the measurable outcomes of such strategies.

The evidence on the effectiveness of knowledge dissemination and implementation strategies came largely from studies on physicians, with a much smaller portion coming from other allied health professions, such as nursing, physician assistants, and other staff. In addition, the knowledge targeted for implementation in these studies was not all research-based. However, much can be learned about what might influence changes in providers' practice behavior. Ultimately, the translation of research knowledge into practice implies a need for change in providers' behavior to enable adoption and use of the new research-based knowledge.

### Overall Effectiveness of Implementation Strategies

A considerable number of studies are available in the area of implementation strategies' effectiveness, and several systematic reviews of those studies have been conducted. Also available are the overviews of systematic reviews.

Bero et al. (1998) conducted an overview of 18 systematic reviews, published between 1989 and 1995, to investigate the effectiveness of dissemination and implementation strategies of research findings. The systematic reviews were obtained from searches in MEDLINE records from 1966 to June 1995 (the Cochrane Library was also searched, but no relevant reviews were located). To be included, the reviews had to focus on interventions to improve professional performance, report explicit selection criteria, and measure changes in performance or outcome. The researchers found the following consistent themes from their review:

- Most of the reviews reported modest improvements in performance after interventions.
- Passive dissemination of information was generally ineffective in altering practices, no matter how important the issue or how valid the assessment methods.
- Multifaceted interventions, a combination of methods including two or more interventions, seemed to be more effective than single interventions.

Bero et al. (1998) also categorized three tiers of specific interventions based on their level of effectiveness in promoting behavioral change among health professionals: (1) consistently effective interventions, (2) interventions of variable effectiveness, (3) and interventions that have little or no effect. These levels of effectiveness are elaborated below:

- *Consistently effective interventions* included educational outreach visits for prescribing in North America; manual or computerized reminders; multifaceted interventions such as two or more approaches of audit and feedback, reminders, local census processing, or marketing; and interactive educational meetings.

- *Interventions of variable effectiveness* included audit and feedback, the use of local opinion leaders, local consensus processes, and patient-mediated interventions.
- *Interventions that have little or no effect* included educational materials and didactic educational meetings.

The authors concluded that the use of specific strategies to implement research-based recommendations seems necessary to promote practice changes and that more intensive efforts are generally more successful. The authors also indicated a need to conduct studies to evaluate two or more interventions in a specific setting to clarify the circumstances likely to modify the effectiveness of such interventions.

In an updated version of the Bero et al. overview (1998), Grimshaw et al. (2001) conducted an overview of 41 systematic reviews published between 1989 and 1998 to examine the effectiveness of intervention strategies in changing providers' behavior to improve quality of care. Similar inclusion criteria were used, although the searches for systematic reviews were expanded to include the Health Star database and feedback from the Cochrane Effective Practice and Organization of Care group's Listserv of potentially relevant published reviews that might have been omitted. The systematic reviews included in this overview were found to be widely dispersed across 27 different medical journals and covered a wide range of interventions.

Similar to the findings from the original overview (Bero et al., 1998), Grimshaw et al. (2001) found that, in general, passive approaches are ineffective and unlikely to result in behavior change (although they could be useful in raising awareness). Also, as previously reported, multifaceted interventions that targeted several barriers to change are more likely to be effective than single interventions. Specifically, the interventions of variable effectiveness included audit and feedback and use of local opinion leaders, whereas the interventions that were generally effective included educational outreach and reminders. However, most of the interventions were effective under some circumstances, and none were effective under all circumstances.

The researchers noted considerable overlap across the reviews in terms of original studies included, and they found that one reason for such overlap could be the lack of agreement within the research community on the theoretical or empirical framework for classifying interventions aimed at facilitating professional behavior change. In addition, although the findings indicated that multifaceted interventions are more likely to be successful, it is difficult to disentangle which components of such interventions led to success. Therefore, Grimshaw et al. (2001) suggested that more research is needed to facilitate a further understanding about the components contributing to the effectiveness of the multifaceted interventions.

Grol (2001) reported on experiences with more than 10 years of development and dissemination of clinical guidelines for family medicine in the Netherlands, arguably one of the most comprehensive programs for evidence-based guidelines development and implementation in the world. A stepwise approach was used for guidelines development and dissemination. First, a relevant topic was selected by an independent advisory board of practitioners. Second, researchers and practitioners worked together to develop guidelines that were later tested for feasibility and acceptability through a written survey and external reviewers who were specialized on the topic, and the guidelines were then revised. Next, the guidelines were presented to an independent scientific board for official approval. After approval, the final version of the guidelines was published in a scientific journal for family physicians. In addition to the formal publication, the dissemination activities included developing special educational programs and packages for each set of the guidelines and sending them to regional and local coordinators for continuing medical education and quality improvement. Support materials, such as summaries of the guidelines for

receptionists, leaflets, letters for patients, and consensus agreements with specialists' societies, were also developed and disseminated.

Several aspects of these experiences were empirically investigated, including knowledge and acceptance of the guidelines, the use of the guidelines, barriers to their implementation, and intervention effects. Grol (2001) concluded that the development of clinical guidelines is feasible and accepted by the target group when such development is owned and operated by the profession itself. Second, a comprehensive strategy to disseminate the guidelines through various channels appears to be very important. Third, a program to implement a guideline should be well designed, well prepared, and preferably pilot-tested for use.

Grimshaw et al. (2004) conducted a comprehensive systematic review of 235 original studies to evaluate the effectiveness and efficiency of guideline dissemination and implementation strategies. Literature searches were conducted in MEDLINE (1966–1998), Health Star (1975–1988), Cochrane Controlled Trial Register (4th ed., 1998), EMBASE (1980–1998), SIGLE (1980–1988), and the specialized register of the Cochrane Effective Practice and Organization of Care group. The studies included in this review employed randomized controlled trials, controlled clinical trials, controlled before-and-after studies, and interrupted time series methodologies. They also included medically qualified health-care professionals, used guideline dissemination and implementation strategies, and used objective measures of provider behavior and/or patient outcome.

The researchers found that the majority of interventions produced modest to moderate improvements in care, with a considerable variation both within and across interventions. Commonly evaluated single interventions were reminders, dissemination of educational materials, and audit and feedback. For multifaceted interventions, no relationship was found between the number of components in the interventions and the effects of such interventions. Fewer than one third of the 309 comparisons within the included studies reported economic data.

Grimshaw et al. (2004) concluded that there is an imperfect evidence base to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances. In addition, there is also a need to develop and validate a coherent theoretical framework of health-professional behaviors, organizational behaviors, and behavior change to better inform appropriate choices for dissemination and implementation strategies and to better estimate the efficiency of such strategies.

## **Effectiveness of Specific Implementation Strategies**

### ***Audit and Feedback***

To further investigate the features or contextual factors that determine the effectiveness of audit and feedback, Jamtvedt, Young, Kristoffersen, O'Brien, and Oxman (2006) conducted a systematic review to investigate the effects of audit and feedback on both professional practice and health outcomes using 118 randomized controlled trials (RCTs) published between 1977 and 2004. The original studies were located through the Cochrane Effective Practice and Organization of Care register for 2004, MEDLINE from January 1966 to April 2000, and the Research and Development Resource Base in Continuing Medical Education. The RCTs in this review included participants who were health-care professionals responsible for patient care; used audit and feedback as one of the interventions; and objectively measured provider performance in a health-care setting or measured health outcomes. *Audit and feedback* was defined as any summary of clinical performance of health care over a specified period of time, with information given in a written, electronic, or verbal format.

The findings showed that the effects of audit and feedback on compliance with the desired practice varied from negative effect to a very large positive effect, and the differences in effects were not found to relate to study quality. Some possible explanations offered by the authors for the differences included the level of baseline compliance of the targeted behavior, the intensity of audit and feedback, and the level of motivation of health professionals to change the targeted behavior (not assessed due to lack of sufficient data from original studies). The authors concluded that audit and feedback could be effective in improving professional practice, although the degree of effectiveness is likely to be greater in cases where the baseline adherence to recommended practice is low and the delivery intensity of audit and feedback is high. However, the results do not support mandatory use of audit and feedback as an intervention to change practice.

Recently, Hysong, Best, and Pugh (2006) used a purposeful sample of six Veterans Affairs Medical Centers to further investigate the impact of feedback's characteristics on its effectiveness, comparing facilities with high adherence to six clinical practice guidelines to those with low adherence. Data were obtained through individual and group interviews of all levels of staff at each facility, including facility leadership, middle management and support management, and outpatient clinic personnel. The researchers found four discernible characteristics that distinguished the high- and low-performing facilities: (1) the timeliness with which the providers received feedback, (2) the degree to which providers received feedback individually, (3) the punitive or nonpunitive nature of the feedback, and (4) the customization of feedback in ways that made it meaningful to individual providers. Based on these findings, the authors proposed a model of actionable feedback in which feedback should be provided in a timely fashion; feedback should be about the clinician's individual performance rather than aggregated performance at a clinic or facility level; feedback should be nonpunitive; and the individual should be engaged as an active participant in the process rather than be merely a passive recipient of information.

### ***Tailored Interventions***

Shaw et al. (2005) conducted a systematic review of 15 randomized controlled trials, published between 1983 and 2002, to assess the effectiveness of planning and delivery interventions tailored to address specific and prospectively identified barriers to changing professional practice and health outcomes. The pool of studies was retrieved from the Cochrane Collaboration Effective Practice and Organization of Care group's specialized register and pending files until the end of December 2002. Studies in this review were RCTs that included participants who were health-care professionals responsible for patient care; included at least one group that received an intervention tailored to address explicitly and prospectively identified barriers to change; either involved a comparison group that did not receive a tailored intervention or compared a tailored intervention addressing individual barriers with an intervention addressing both individual and social- or organizational-level barriers; and included objectively measured professional performance (excluding self-report). A *tailored intervention* was defined as an intervention chosen to overcome barriers identified before the design and delivery of the intervention. A meta-analysis method was used to synthesize subsets of the studies when possible.

The authors concluded that the effectiveness of tailored interventions is not conclusive and more rigorous trials are needed before the effectiveness of such an approach can be established. In addition, because of the small number of studies limited to a small number of organizational settings, the authors stated that it was not possible to determine whether interventions targeting both individual and organizational barriers are more effective than those targeting only individual barriers. Based on the review, the authors concluded that decisions about whether the tailored intervention approach is likely to be effective for specific problems should be made based on the knowledge of the problem in each setting and other practical considerations.

### ***Organizational Structures***

Foxcroft and Cole (2000) conducted a systematic review to determine the extent to which change in organizational structures would promote the implementation of high-quality research evidence in nursing. Literature searches were performed in the following databases: the Cochrane library, MEDLINE, EMBASE, CINAHL, SIGLE, HEALTHLINE, the National Research Register, the Nuffield Database of Health Outcomes, and the NIH Database up to August 2002 (the review was updated in 2003). Hand searches were performed in the periodicals *Journal of Advanced Nursing*, *Applied Nursing Research*, and *Journal of Nursing Administration* (to 1999). Reference lists of the articles obtained were also checked. In addition, experts in the field and relevant Internet groups were contacted for any other potential studies. To be included in this review, each study had to employ randomized controlled trial, controlled clinical trial, or interrupted time series research designs; include health-care organizations (where nurses practiced) as participants and measure and report nursing practice outcomes separately; evaluate an entire or identified component of organizational infrastructure aimed at promoting effective nursing interventions; and use objective measures of evidence-based practice.

Foxcroft and Cole (2000) found that no studies were sufficiently rigorous to be included in the formal systematic review, neither at that time nor when they updated the review in 2003. Therefore, they reported on seven studies that did not meet the design quality required but had evaluated organizational infrastructural interventions to establish the evidence baseline in this area. All of these studies were retrospective case reports. The researchers found that although positive results were reported, there was no offering of any substantive evidence to support the studies' conclusions. Therefore, no clear implication for practice can yet be drawn based on the findings of those studies.

### ***Interactive Strategies***

Vingillis et al. (2003) reported the use of knowledge translation strategies that integrated knowledge generation with knowledge diffusion and utilization. During the project's 3-year period, the researchers developed the initial research proposal in response to frustration expressed by local professionals. The researchers also built into the original research proposal a series of three colloquia of potential knowledge users, and they established an open-door policy so that interested parties could request meetings with the team. Vingillis et al. used a partnership culture model in which researchers and potential knowledge users develop a partnership of trust, respect, ownership, and common ground as the fundamental first step to successful knowledge dissemination and utilization. The strategies used by this group included viewing research as the means and not as the end, linking the university and research services to the community, using a participatory research approach, embracing transdisciplinary research and interactions, and using connectors to assist potential knowledge users in identifying knowledge needs and to assist researchers in translating knowledge to users. However, the effectiveness of these strategies in promoting knowledge translation was not reported.

### **Evidence in Rehabilitation**

The evidence to support or dispute the effectiveness of knowledge translation strategies in rehabilitation is very limited and available in the form of original studies only (as opposed to systematic reviews or overviews seen in medicine). Thomas, Cullum, McColl, Rousseau, and Steen (1999), in their searches of primary studies to conduct a systematic review to evaluate the effectiveness of practice guidelines in professions allied to medicine, could not locate such studies in rehabilitation. At present, the studies of knowledge translation strategies' effectiveness in rehabilitation continues to be scarce.

Wolfe, Stojcevic, Rudd, Warburton, and Beech (1997) investigated the uptake of stroke guidelines in a district of southern England using the 18-month audit process. The guidelines were developed through an interdisciplinary collaboration and included rehabilitation standards of services for physiotherapy, occupational therapy, and speech therapy. The guidelines were made available for participating hospitals, although no other specific strategies appeared to have been used to facilitate the adoption of the guidelines. The researchers found that, over the period of 18 months, only modest changes in practice occurred according to the guidelines, and the overall level of rehabilitation service remained low despite the significant increase in occupational therapy services within 72 hours of acute stroke episode. The researchers concluded that despite local development and feedback, adherence to guidelines was relatively poor, there was little improvement over time, and a considerable amount of unmet need continued to exist.

Heinemann et al. (2003) evaluated the effectiveness of a lecture-based educational program about post-stroke rehabilitation guidelines. The knowledge and referral practice questionnaire was used to assess changes in knowledge and practice of physicians and allied health professionals who provided services in acute care settings. The findings indicated no significant increase in knowledge or referrals at 6 months following the educational program. The researchers concluded that simply providing information about the guidelines did not result in an increase in knowledge and referrals.

Fritz, Delitto, and Erhard (2003) conducted a randomized clinical trial comparing the effectiveness of providing therapy based on a classification system matching patients to specific interventions with providing therapy based on the Agency for Health Research and Quality guidelines. At 4 weeks after treatment, the researchers found that the patients who received classification-based therapy showed greater improvement on the general health measure (SF-36) on the physical component score, greater satisfaction, and increased likelihood of returning to full-duty work status. At 1 year, however, there were no statistical differences between the groups in all outcomes.

Pennington et al. (2005) evaluated the effectiveness of two training strategies to promote the use of research evidence in speech and language therapy management of post-stroke dysphagia. The first strategy was the training on critical appraisal of published research papers and practice guidelines, and the second strategy was the same training plus additional training on management of change in clinical practice. The researchers found that, overall, there was no significant change in the adherence to clinical practice guidelines within 6 months of intervention. No other outcomes were measured.

Bekkering et al. (2005), using a cluster-randomized controlled trial, compared an active strategy for implementation of the Dutch guidelines for patients with low back pain with the standard passive method of dissemination of the same guidelines in 113 primary-care physical therapists who treated a total of 500 patients. The passive method group received the guidelines by mail, and the active method group received an additional active training strategy consisting of two sessions of education, group discussion, role-playing, feedback, and reminders. The outcomes were measured through self-reported patients' questionnaires on physical functioning, pain, sick leave, coping, and beliefs. The researchers found that physical functioning and pain in both groups improved substantially in the first 12 weeks but there were no significant differences between the two groups. At a follow-up at 12 months, there continued to be no difference between the two strategies. The researchers concluded that there was no additional benefit to applying active strategy to implement the physical therapy guidelines for patients with low back pain.

Because of the limited evidence, no conclusion or even pattern can be drawn from these studies at this time. The knowledge translation inquiry in rehabilitation appears to be in the beginning stage, and further development in this area is clearly needed. Although some information is available from other health-care fields, such as medicine and nursing, it is not certain how applicable those findings would be for rehabilitation, because of the conceivable difference in practice focus, culture, methods, and contexts.



## Measures of Knowledge Use

### Background Information

Backer (1993) defined *knowledge utilization* as “[including] a variety of interventions aimed at increasing the use of knowledge to solve human problems” (p. 217). Backer envisioned that knowledge utilization embraces a number of subtopics such as technology transfer, information dissemination and utilization, research utilization, innovation diffusion, sociology of knowledge, organizational change, policy research, and interpersonal and mass communication.

The use (application) of research knowledge is certainly the goal of knowledge translation. The expected outcome of such application/use would be a positive impact on the health and well-being of the intended beneficiaries (NIDRR, 2005). The inquiry related to the use (or lack thereof) of research knowledge has been the subject of interest of the multidisciplinary communities since the late 1960s (Paisley & Lunin, 1993). This interest has intensified in recent years, in parallel to increased recognition of the difficulties in moving research to be used in practice.

### Types of Knowledge Use

There are three main types of use: (1) instrumental use, (2) conceptual use, and (3) symbolic use. As described by Beyer (1997), *instrumental use* involves applying research results in specific and direct ways; *conceptual use* involves using research results for general enlightenment; and *symbolic use* involves using research results to legitimize and sustain predetermined positions. Instrumental use has been linked to the decision-making process, in which a direct, demonstrable instrumental use of research is meant to solve clearly predefined problems.

Estabrooks (1999) referred to *instrumental use* as a concrete application of research, in which research is translated into material in usable forms, such as a protocol that is used to make specific decisions. *Conceptual use*, according to Estabrooks, occurs when the research may change one’s thinking but not necessarily one’s particular action. In this type of use, the research helps inform and enlighten the decision maker. *Symbolic use*, in Estabrooks’ view, is the use of research as a political tool to legitimize opposition or practice.

The conceptual structure of research utilization was investigated empirically in a study with 600 registered nurses in western Canada (Estabrooks, 1999). Using Structural Equation Modeling for data analysis, Estabrooks demonstrated that the instrumental, conceptual, and symbolic research utilization influenced the overall research utilization, with more than 70% of the variance explained. The researcher also asserted that research utilization can be measured with relatively simple questions, as demonstrated by the questions used in this study, which measured each type of research utilization with only one question.

Emerging evidence shows that each type of use should be considered separately, as they may be associated with different predicting factors. In a survey of 833 government officials, Amara, Ouimet, and Landry (2004) found that, in general, the three types of research use simultaneously played a significant

role in government agencies and were commonly associated with the same set of factors. However, a small number of factors explained the increase of instrumental, conceptual, and symbolic utilization of research in different ways. Higher conceptual use was significantly associated with the qualitative research products and individuals with graduate studies. Higher instrumental use was significantly associated with research products that focused on advancement of scholarly knowledge and adaptation of research for the user's need. Finally, higher symbolic use was associated with the respondents from provincial government agencies (as opposed to those from the federal government agencies) and also the adaptation of research products to users' needs.

Milner, Estabrooks, and Humphrey (2005), in their survey of nurses in Alberta, Canada, also found that different factors predicted different types of research use. Factors such as having a degree in nursing, attitude, awareness, and involvement in research significantly predicted the instrumental research utilization. Having a degree in nursing also predicted the conceptual research utilization, whereas attitude and awareness did not. Localite communication, on the other hand, significantly predicted the conceptual research utilization but not instrumental research utilization. For symbolic research utilization, attitude, awareness, and involvement in research significantly predicted research use. Mass media were also found to significantly predict symbolic research use, though not other types of use. Certainly, more studies in this area are needed to further understand the subject.

These preliminary findings seem to indicate that it may be beneficial to take a precise, analytical approach when investigating knowledge use. To successfully facilitate the use of knowledge (as it is the focus of KT), it may be essential to predetermine specifically the type of use in which the knowledge user is likely to engage (or a specific use that would be the focus of that knowledge translation effort), consider specific factors that likely influence such use, derive appropriate knowledge translation strategies accordingly, and measure that specific type of use when evaluating the outcome.

### ***Considerations in Measuring Knowledge Use***

Early research assumed that utilization occurred when an entire set of recommendations was implemented in the form suggested by the researcher (Larsen, 1980). However, Larsen argued that knowledge can be modified, partially used, used in an alternative way, or justifiably not used at all. Complete adoption of knowledge is generally the exception and not the rule. As Larsen further stated, in some settings, knowledge may not be used if implemented in its original form but may work very well if changed to meet the user's circumstances. A recent example is an implementation study of Constraint-Induced Therapy (Sterr, Szameitat, Shen, & Freivogel, 2006), in which the treatment protocol (as previously developed in research) was locally tested and adapted to fit the needs, preferences, and logistics of the users in a local setting.

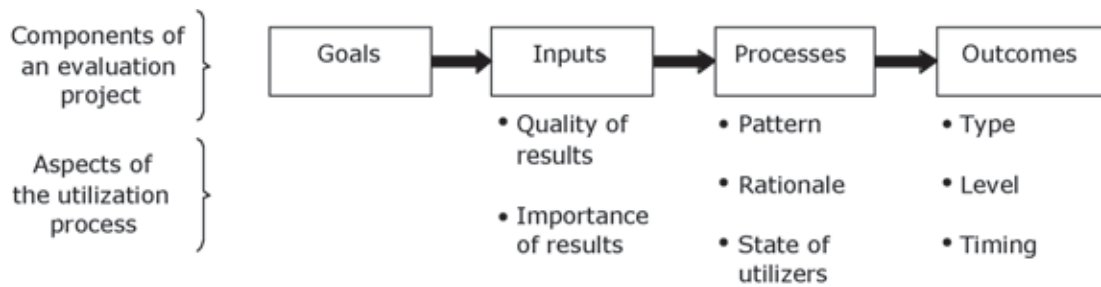
In addition, what constitutes an effective use is debatable. Often, the focus is on the use of research as it is intended. However, effective use can occur in ways that are not previously considered (SEDL, 2001). The time line in measuring use—whether it is retrospective or prospective—can also influence the results (Conner, 1981).

### ***Framework in Evaluating Knowledge Use***

Knowledge use is not a single discrete event occurring at one point in time. Rather, it is a process consisting of several events (Rich, 1991). Therefore, evaluating the use of knowledge can be complex and requires a multidimensional and systematic approach. Having a framework to guide the process when designing activities to evaluate the use of knowledge can be helpful.

An example of a comprehensive framework that can be used to guide the evaluation of knowledge use is that developed by Conner (1980). Conner proposed a conceptual model for research utilization evaluation, with the emphasis on four general aspects that are important for the evaluator to consider: (1) goals, (2) inputs, (3) processes, and (4) outcomes.

The model is represented by the visual scheme in Figure 6.



**Figure 6.** Conner's conceptual model for research utilization evaluation

(Source: *Handbook of Criminal Justice Evaluation* [M. W. Klein & K. S. Teilmann, Eds.], Conner, R. F., The evaluation of research utilization, pp. 629–653, copyright © 1980, reprinted with permission from Sage Publications)

According to Conner (1980), the first step of evaluating research utilization is to set up goals one would like to achieve as a result of the research-utilization effort. Without goals, it will be impossible to evaluate the success of such effort. The goals for utilization should be set up at the beginning of the research program. However, goal setting is perceived as a dynamic process in which goal changes can occur during the course of the research as better insight emerges. One of the main reasons for setting goals, according to Conner, is to know who will be the primary and secondary targets of the utilization effort. Once the target groups have been identified, they should be consulted at the outset of the research program to make sure that the information will be realistic for use by them and to learn of the type of information that would provide convincing evidence for them to use.

In this model, the primary inputs for a utilization effort are research findings. The research findings need to be evaluated in two aspects: quality and importance. Quality of the research findings relates to their sufficiently high validity and reliability, which could be verified by either consultation with other researchers or replication of the research in a similar setting. Determination of importance can also be obtained in several ways, such as the potential users' rating on the degree of importance; assessing socially significant implications; and assessing the clarity of recommendation for action—that is, whether it can be understood by the users. According to Conner (1980), other inputs should also be considered in addition to the research findings. The materials to be disseminated should be assessed for their appeal, clarity, and appropriateness for the target users. The people who will direct the utilization effort should be assessed for whether their skills and temperament would be suitable to conduct such an effort. As the model was later updated (Kirkhart & Conner, 1983), a consideration for resources—whether there are sufficient resources pertaining to the quality of materials or personnel involved in the planned change process—was added to the input component.

For the process component, Conner (1980) suggested that there is a need to monitor and document the course of dissemination and utilization efforts, particularly because the course could change from what was originally planned. Documenting the deviations from the plan will help in adjusting the evaluation to reflect the program that was actually implemented rather than one that was planned to be implemented.

The monitoring includes documenting who received the information to be utilized; their opinions of the information and their judgment of subsequent use of such information (pattern); their reasons for use or nonuse of the information (rationale); and the organizational arrangement and personal state and situation of the potential users (state of utilizers). The attitudes and capability of individuals adopting the innovation were later added to the process component of the model (Kirkhart & Conner, 1983).

The central question of this evaluation process is whether the results of the research are utilized. Conner (1980) indicated that evaluation of outcomes must occur for the type, level, and timing of the utilization process. This information can be determined in part by analyzing who has used the information (level of utilization), how the information was used (type of utilization), and the various time frames of utilization activities (timing of utilization). Outcomes assessment could focus on one of the two target groups: the actual targets (people who have been the direct target of utilization efforts) and the potential targets (people who are most relevant for utilization of the findings although they may not be the direct targets of the utilization efforts). The focus on potential targets is intended to address the issue of self-selection bias that could perceivably occur should the assessment focus on the actual targets, who tend to be more involved.

Conner (1980) concluded that evaluating research utilization has five benefits:

1. Determines the effectiveness of the utilization efforts using a critical review process
2. Increases recognition of the importance of dissemination-utilization process as a distinct activity rather than just being the last step in a research project
3. Increases attention to utilization goals and objectives, which will help in the development of utilization efforts
4. Provides more understanding of the process, including what may facilitate and/or hinder research utilization, which will aid in developing conceptual models of the utilization process that can be empirically tested
5. Increases the amount of interaction between researchers and users through a neutral third party (presumably the people who conduct the utilization efforts)

## **Methodologies and Focus of Measuring Knowledge Use**

Dunn (1983) conducted an 18-month project involving a review of existing literature to develop an inventory of concepts, procedures, and measures available for conducting empirical research on knowledge use. Dunn found that there were widely varied linguistic usages that made it difficult or impossible to compare, contrast, and evaluate essential variations in the concepts, methods, and measures in this area. However, three basic dimensions were found to underlie different concepts of knowledge use: (1) *composition*, a dimension that distinguishes between individual (for decision making) and collective (for enlightenment) uses of knowledge; (2) *expected effects*, a dimension that contrasts conceptual and instrumental use of knowledge; and (3) *scope*, a dimension that contrasts processes of use in terms of their generality (general use of knowledge) and specificity (e.g., use of specific recommendations of a program evaluation). As indicated by Dunn, the scope of use may also be viewed as a continuum ranging from general processes of being familiar with or aware of something to specific processes of being able to explain or perform some action.

More than 60 procedures used to study knowledge utilization were identified through this review and were categorized into three main methods of inquiry: (1) naturalistic observation; (2) content analysis; and (3) questionnaires and interviews. Within the questionnaires and interviews, there were three

categories of procedures: (1) relatively structured procedures; (2) semistructured procedures; and (3) relatively unstructured procedures. As reported by Dunn (1983), at least 30 different questionnaires and interviews or schedules were employed to study various aspects of knowledge use, and these were the most frequently used method of the studies included in this review. Naturalistic observation was rarely employed. Content analyses were employed with various kinds of documents, including research reports, case materials, and other records of experience.

Recently, Hakkennes and Green (2006) conducted a structured review of 228 original studies published in peer-reviewed journals to identify the outcome measures used to determine effectiveness of strategies aimed at improving development, dissemination, and implementation of clinical practice guidelines. Three types of data were collected from the included studies: (1) the measures used to assess the effectiveness of the intervention; (2) the methods used for such assessment; and (3) the reliability and validity of those outcome measures when reported.

Hakkennes and Green (2006) grouped the outcome measures into three main categories of measurement, at (1) patient level, (2) health practitioner level, and (3) organizational or process level. The outcome measures that focused on patient level were further categorized into those that measure the actual change in health status of the patient, such as mortality, quality of life, and actual symptom change, and those that use surrogate measures of the patient's change in health status, such as patient satisfaction, length of hospital stay, or number of health-care visits and hospitalizations. The outcome measures at the health practitioner level also followed the same pattern of either measuring actual change in health practice of the practitioner, such as their compliance (or noncompliance) with the implemented guidelines, or surrogate measures, such as measurement of the practitioner's knowledge or attitudes. For the organizational or process level, the focus was on measuring change in the health system, such as to cost, policy and procedures, and the time spent by the practitioner. As indicated by the authors, only a small number (20%) of the studies reported the reliability or validity of the outcome measures.

For studies included in the review (Hakkennes & Green, 2006), several methods were used to collect data, including medical record audit; computerized medical records audit; health practitioners survey, questionnaire, or interview; patient survey, questionnaire, or interview; computerized database; log books, department records, or registers; encounter charts, request slips, or diaries; and others (such as clinical examination, results of blood tests, and video- and audiotaping of consultations). The authors reported that approximately half of the included studies used a medical record audit to collect data for the outcomes. Overall, the measures of change in health practitioner behavior were the most common, followed by the measures that assess change at a patient level (either actual measures of change or surrogate measures of change), health practitioners' knowledge and attitudes, and changes at an organizational level.

### **Examples of Approaches in Measuring Knowledge Use**

Several approaches employed to measure knowledge use were reported in the literature. One approach is to measure users' discrete behaviors related to the use of research-based knowledge. Pelz and Horseley (1981) used survey questionnaire items (that were part of an 18-page questionnaire) to measure research utilization by nursing staff. Five items on the questionnaire directly measured research utilization activities, and the mean score of those five items was used as an index of research utilization. A response scale of 0, 1, 2–4, and 5 or more times in the past year was used for each activity. The Cronbach's alpha of this research utilization index (representing the internal consistency) was reported to be .87. The five research utilization activities are as follows:

1. Reviewing research literature to identify knowledge for use in practice
2. Evaluating research study to determine its value for practice
3. Transferring the research knowledge into useful practice activities
4. Planning for the implementation and evaluation of such practices
5. Discontinuing or rejecting practice activities because of the research knowledge learned

Vercoe and Hilton (1995), in a study investigating factors affecting acute-care nurses' use of research findings, measured both general use of research and use of specific research findings. For general use, nurses were asked to rate 10 statements using the scale of 1 = *not at all*, 2 = *sometimes*, 3 = *frequently*, and 4 = *always*. However, the actual statements were not reported. For use of specific research findings, nurses were asked to rate their use of 10 findings on a scale of 1 = *never*, 2 = *sometimes*, 3 = *always*, or, if the finding was inappropriate for their area of practice, *not applicable*. As reported by the authors, internal consistency of the items was .87. Content validity was tested through peer review.

A different approach is to view knowledge use as a chronological process. In this approach, each step within the process could be measured to gauge the progress on the knowledge use continuum, as opposed to just measuring whether the use of knowledge occurs at the end of the process. Using this approach, Hall, Loucks, Rutherford, and Newlove (1975) developed the Levels of Use Scale to measure levels of use of innovation. The scale addresses only the behavioral aspect of use and does not focus on other aspects of use, such as attitudinal, motivational, or affective.

The Levels of Use Scale consists of eight levels. Decision points were also provided to distinguish each level. The descriptions of those levels are as follows:

- **Level 0—Nonuse:** State in which the user has little or no knowledge of the innovation and no involvement with the innovation and is doing nothing toward becoming involved.
- **Level I—Orientation:** State in which the user has acquired or is acquiring information about the innovation and/or has explored or is exploring its value orientation and its demands on user and user system.
- **Level II—Preparation:** State in which the user is preparing for first use of the innovation.
- **Level III—Mechanical use:** State in which the user focuses most effort on the short-term, day-to-day use of the innovation, with little time for reflection. Changes in use are made more to meet the user needs than the client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
- **Level IV A—Routine:** Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.
- **Level IV B—Refinement:** State in which the user varies the use of the innovation to increase the impact on clients within the immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.
- **Level V—Integration:** State in which the user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
- **Level VI—Renewal:** State in which the user reevaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

As presented by Hall et al. (1975), each level of use of innovation is accompanied by seven categories to describe the range of behaviors within each level. The seven categories are (1) knowledge, (2) acquiring information, (3) sharing, (4) assessing, (5) planning, (6) status reporting, and (7) performing. For example, within Level I (orientation stage), each category was described as follows:

- **Category 1—Knowledge:** Knows general information about the innovation, such as origin, characteristics, and implementation requirements
- **Category 2—Acquiring information:** Seeks descriptive material about the innovation; seeks opinions and knowledge of others through discussions, visits, or workshops
- **Category 3—Sharing:** Discusses the innovation in general terms and/or exchanges descriptive information, materials, or ideas about the innovation and possible implications of its use
- **Category 4—Assessing:** Analyzes and compares materials, content, requirements for use, evaluation reports, potential outcomes, and strengths and weaknesses for the purpose of making a decision about use of the innovation
- **Category 5—Planning:** Plans to gather necessary information and resources as needed to make a decision for or against use of the innovation
- **Category 6—Status reporting:** Reports presently orienting self to what the innovation is and is not
- **Category 7—Performing:** Explores the innovation and requirements for its use by talking to others about it, reviewing descriptive information and sample materials, attending orientation sessions, and observing others using it

The psychometric properties of the Levels of Use Scale (Hall et al., 1975) were not reported. However, the scale is one of the most comprehensive in measuring use and could conceivably be quite sensitive in detecting small increments of progress in knowledge use. Particularly, the scale would be useful in evaluating steps taken toward implementation even when the full implementation has not yet occurred.

Larsen (1982) developed a utilization scale containing seven ranked stages of knowledge use and non-use. A piece of information (whether it be a research finding, an idea, a suggestion, or a recommendation) is assigned a rank value based on an ordinal scale outlined in the following list. No reliability or validity were reported.

1. **Considered and rejected:** Some discussion takes place, but the information is rejected.
2. **Nothing done:** No action, not even discussion, is taken.
3. **Under consideration:** Information has not been used but is being discussed and considered.
4. **Steps toward implementation:** Although information has not been used, the decision to do so has been made and initial planning steps have been taken.
5. **Partially implemented:** Certain features of information have been used, whereas others have been disregarded.
6. **Implemented as presented:** The information is used in the form in which it was originally presented.
7. **Implemented and adapted:** Information is modified or adapted to fit the local situation.

Brett (1987) developed the Nursing Practice Questionnaire (NPQ) to measure use of specific research findings. Brief descriptions of 14 innovations were provided in the questionnaire. Using Rogers' stages of innovation adoption (Rogers, 1983) as a guide, seven questions measuring the nurse's stage of innovation adoption were developed to be used with each of the 14 nursing practices. The seven questions, as later described by Michel and Sneed (1995), are listed here:

1. Have you read about this nursing practice?
2. Have you heard about this nursing practice?
3. Have you observed this practice in use?
4. Have you learned about this practice from any other source?
5. If appropriate to the practice setting, do you believe a nurse should use this nursing practice?
6. How often do you use this nursing practice?
7. Are you aware of any policies concerning this nursing practice in your workplace?

These questions address the four stages of innovation adoption identified in the Diffusion of Innovation framework: (1) knowledge (awareness), (2) persuasion, (3) decision, and (4) implementation (Rogers, 1983). Each question represents a specific stage of the innovation adoption:

- Questions 1 through 4 measure the level of *awareness* of the recommended practice. An answer of “yes” to at least one of these questions indicates involvement in the *awareness* stage and is scored 1.
- Question 5 measures the nurse’s attitude about the innovation. An affirmative response indicates a positive attitude about the innovation and is scored 1. A “no” or an “undecided” answer is scored 0. This question is designed to measure the *persuasion* stage of the innovation adoption.
- Question 6 assesses the nurse’s achievement of the *implementation* stage. Two levels of use of the innovation are measured: “sometimes,” which is scored 1; and “always,” which is scored 2.
- Question 7 measures the knowledge of institutional policies and/or procedures concerning the innovation. A range of scores is assigned for the extent of the dissemination of each research finding (innovation).

The points given for each stage (unaware = 0; aware = 1; persuasion = 1; used sometimes = 1; used always = 2) are totaled and averaged. The ranges of possible scores assigned to the various stages of adoption are as follows:

- Unaware = 0–0.49
- Aware = 0.5–1.49
- Persuasion = 1.5–2.49
- Used sometimes = 2.5–3.49
- Used always = 3.5–4.0

As reported by Brett (1987), the test–retest reliability using a 1-week interval was  $r = .83$ . The overall internal consistency (Cronbach’s alpha) was .95, whereas the coefficients of the individual innovation scales ranged from .68 to .95. Content validity was assumed because the 14 innovations were derived from published nursing research reports using specific criteria. The NPQ, in both its original form and in a modified form, was used in a number of studies (Berta, 1995; Brett, 1987, 1989; Coyle & Sokop, 1990; Michel & Sneed, 1995; Rodgers, 2000).

Also following the stages-of-use approach, Landry, Amara, and Lamari (2001) measured the use of social science research with a scale derived from the Knott and Wildavsky (1980) stages of knowledge utilization. However, this scale measures knowledge utilization from the perspective of the knowledge producers (who were university researchers) rather than of the knowledge users. A question was posed to the respondents as to what had become of their research of the last 5 years. They then were asked to respond to six statements representing the six stages of knowledge utilization using a five-point scale of 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *usually*, and 5 = *always*. No psychometric properties were reported. The six stages are listed here:



1. I transmitted my research results to the practitioners and professionals concerned (*transmission*).
2. My research reports were read and understood by the practitioners and professionals concerned (*cognition*).
3. My work has been cited as a reference in the reports, studies, and strategies of action elaborated by practitioners and professionals (*reference*).
4. Efforts were made to adopt the results of my research by practitioners and professionals (*effort*).
5. My research results influenced the choices and decisions of practitioners and professionals (*influence*).
6. My results gave rise to applications and extension by the practitioners and professionals concerned (*application*).

A similar scale was developed to measure knowledge utilization as reported by policymakers (Landry, Lamari, & Amara, 2003). The items representing the six stages of knowledge utilization are listed as follows. No psychometric properties were reported.

1. I received the university research pertinent to my work.
2. I read and understood the university research that I received.
3. I participated in meetings for discussion and popularization of the aforementioned university research.
4. I cited university research studies as references in my own professional reports or documents.
5. I made efforts to favor the use of university research results.
6. University research results influenced decisions in my administrative unit.

Another approach is to measure not only the behavioral aspect of the knowledge user, but also other aspects related to knowledge use. Anderson, Ciarlo, and Brodie (1980) used a structured interview method to measure knowledge utilization in the behavioral, cognitive, and affective dimensions. The behavioral aspect was measured by examining reported changes in the activities, practices, or policies that resulted from the researchers' feedback based on their program evaluation for the participating organization. The researchers used two questions, one open-ended and one recommendation-cued, to gather information for behavior change. In the open-ended question, they asked the respondents to describe specific instances of any activities undertaken related to the issues being evaluated. In the recommendation-cued question, they read each respondent a list of the recommendations from their evaluation research and then asked the respondent to cite specific instances of activities relevant to the recommendations. Information was then extracted and coded by category of utilization derived by the research team. The authors stated that after each set of interviews was coded, a measure of the interrater reliability of the coding was computed. However, the reliability results were not reported. The coding was nominal in nature, and the evaluation of knowledge use was descriptive rather than statistical.

To measure the cognitive aspect, the researchers compared the rating of the respondents' beliefs about various aspects of the issue they were studying. Those themes were extracted from the coding of the pre-intervention interviews. The participants were asked to rate their agreement with each of the themes earlier in the project and at 1-month and 6-month intervals after the completion of their intervention. In addition to the original themes obtained from the pre-intervention interviews, a list of "data themes," or statements based on the actual data analysis, was added. In some cases, as stated by the authors, an original theme may also become a data theme. For data themes not originally generated in the pre-intervention interview, the researchers examined whether the postevaluation views of the panel were in agreement or in conflict with those themes.

For the affective aspect, respondents were asked to rate their concern about the problem or issue and their satisfaction with the team's solutions. The timing and rating comparisons were the same as the methods outlined in the cognitive change measurement.

Using a similar orientation, Champion and Leach (1989) developed a scale to measure nurses' research utilization in their study to determine variables related to research utilization in nursing. Four sets of items were measured: (1) attitude, (2) availability, (3) support, and (4) research utilization. The attitude items measured feelings about incorporating research into practice. The availability items measured the opportunity a nurse had to access research findings in his or her institution. The support items measured the degree to which a nurse's administrative leaders and professional colleagues encouraged research utilization. The research utilization items measured the degree to which the nurse felt he or she incorporated findings into practice. The respondents were asked to rate each item using a Likert scale ranging from *strongly agree* (= 5) to *strongly disagree* (= 1). The questionnaire consists of 38 items, with 21 items measuring attitude, 7 measuring availability, 8 measuring support, and 10 measuring use. Examples of items representing each of the four aspects are provided below:

**Attitude:**

- I would change my practice based on research findings.
- I want to base my practice on research.
- Using research helps me meet my goal as a nurse.

**Availability:**

- I have access to research findings where I work.
- I have access to research findings on my floor.
- I have time to read about research while I am on duty.

**Use:**

- I base my practice on research.
- My nursing care decisions are based on research.
- I do not use research in my day-to-day practice.

**Support:**

- Nurses in my work area.
- Unit director (Head Nurse).
- Chairman.

As reported by the authors, the content validity was judged by experts. Internal consistency as measured by Cronbach's alpha ranged from .84 to .94.

Another possible approach in measuring research use is to separately measure each type of use, including conceptual, instrumental, and symbolic use. As discussed earlier, preliminary evidence (Amara, Ouimet, & Landry, 2004; Milner, Estabrooks, & Humphrey, 2005) has shown that each type of use may be uniquely influenced by different factors. Therefore, it seems logical to measure each type of use separately. Estabrooks (1999) developed a measurement scale using four questions to measure overall research utilization, direct research utilization (instrumental use), indirect research utilization (conceptual use), and persuasive research utilization (symbolic use).

The overall-research-utilization question was “Overall, in the past year, how often have you used research in some aspect of your nursing practice?” The question was asked four times throughout the questionnaire. Each time, the question was preceded by the definition of *overall research utilization* as “The use of any kind of research findings (nursing and non-nursing) in any aspect of your work as a registered nurse. Do not count as research things you learned in nursing school where you did your basic nursing training.”

The direct-research-utilization question was “Overall, in the past year, how often have you used research findings in this direct way in some aspect of your nursing practice?” This question was preceded by a definition of *direct research utilization* as “The use of any kind of research findings (nursing and non-nursing) where you directly use the findings in giving patient care and/or client interventions. Do not count as research things you learned in your basic training.” Examples of direct research utilization were provided immediately following the definition.

The indirect-research-utilization question was “Overall, in the past year, how often have you used research findings in this nondirect way in some aspect of your nursing practice?” Similar to the previous two areas, the question was preceded by the definition of *indirect research utilization* as “The use of any kind of research findings (nursing and non-nursing) to change your thinking or your opinions about how to approach certain patient care or client situations. Do not count as research things you learned in your basic training.” Examples were also provided.

The persuasive-research-utilization question was “Overall, in the past year, how often have you used research findings in this persuasive way?” The question was preceded by the definition of *persuasive research utilization* as “The use of research findings (nursing and non-nursing) to persuade others, who are usually in decision-making positions, to make changes in conditions, policies, or practices relevant to nurses, patients/clients, and/or the health of individuals or groups. Do not count as research things you learned in your basic training.” As for the other areas, examples were provided.

The response choices for each question included the scale of 1 = *never*, 2 = *on one or two shifts*, 3 = (unlabeled), 4 = (unlabeled), 5 = *on about half of the shifts*, 6 = (unlabeled), 7 = *nearly every shift*, and 8 = *do not know*. This measure was used in other studies (Estabrooks, Chong, & Birdsell, 2003; Milner et al., 2005) with slight modifications in administrative methods, scale, and wording of the questions.

Amara et al. (2004), in an approach similar to that of Estabrooks’ measurement of research utilization, developed questions that they included in a survey instrument to distinguish the degree of policymakers’ instrumental use, conceptual use, and symbolic use of university research. The *instrumental use* was described as “The use of university research led to concrete action in my field of work.” The *conceptual use* was described as “The use of university research served to shed light on situations and problems in my field of work.” The *symbolic use* was described as “The use of university research served to confirm choices already made in my field of work.” These questions were part of a larger questionnaire. The participants were asked to indicate the level of importance of each type of utilization using the Likert-type scale of 0 = *does not apply and does not know*, 1 = *negligible*, 2 = *somewhat negligible*, 3 = *moderately important*, 4 = *very important*, and 5 = *decisive*.

Focusing on the product of research use rather than on users’ behavior, Hanney, Gonzalez-Block, Buxton, and Kogan (2003) proposed a draft scale to measure research utilization in policymaking by directly examining the policy of interest in four areas:

1. Consistency of policy with research findings
2. Degree of influence of research on policy agenda setting
3. Degree of influence of research on policy formulation
4. Degree of influence of research on policy implementation

The first area, consistency of policy with research findings, concerns the agreement between the policy and the body of international research. The policy would be examined, using documentary analysis, on its consistency with research findings by determining the level of agreement between the policy and the findings of the research.

The second area, degree of influence of research on policy agenda setting, relates to the extent that research helps in getting the issue onto policymakers' agendas, such as by showing the existence of a problem, pointing to actions to be taken and having those actions turned into policy, or enlightening policymakers on the importance of the issue. This information would be obtained via interviews, documentary analysis, and questionnaires to determine degree of influence of research findings on the policy agenda setting.

The third area, degree of influence of research on policy formulation, concerns the actual influence that the research had during the policy formulating process. The actual influence, as indicated by Hanney et al. (2003), includes not only the direct use of research findings to develop the policy content, but also other possible impacts, such as the gradual development of insights, theories, concepts, and perspectives in the enlightenment mode (conceptual use). The degree of influence of research on the policy content, either for instrumental impact or enlightenment, would be determined primarily via interviews but also through survey and documentary data.

The fourth area, degree of influence of research on policy implementation, concerns the use of research in policy implementation, either to determine appropriate implementation strategies or to secure support for the policy in terms of financial resources, political commitment, and public opinion. Information in this area will come from interviews and documentary analysis.

For each area, the ranking scale of *considerable*, *moderate*, *limited*, or *no indication* is used to measure the degree of research utilization in the four areas indicated above.

---

## Epilogue

As evidenced in this review, knowledge translation (KT) is a complex and multifaceted construct that requires a consideration of a multitude of dimensions together to form a comprehensive picture. It should be noted that the literature included in this review came mostly from disciplines other than rehabilitation. Although the information from such literature could provide some understanding of KT in general, its direct applicability to KT in rehabilitation is not known. For instance, the degree of similarity between the context of policymaking, of which a substantial amount of information contributes to the body of the literature in this area, and the context of everyday practice in rehabilitation is not clear. Can it be assumed that the same influencing factors exist and play similar roles in both environments? Are the types of knowledge use similar in both contexts? Do practitioners and policymakers make the same kind of decisions? It is certainly important to create a body of empirical knowledge that is directly relevant and applicable to rehabilitation. Future questions may include the following: What types of use occur in practice settings, and how prevalent are they? Are the determinants for each type of use the same? What are the common predicting factors that transcend contexts, and what are the unique factors related to specific contexts? What is the relative importance of each of these contextual factors in predicting research use?

## References

- Amara, N., Ouimet, M., & Landry, R. (2004). New evidence on instrumental, conceptual, and symbolic utilization of university research in government agencies. *Science Communication, 26*, 75–106.
- Anderson, C. D., Ciarlo, J. A., & Brodie, S. F. (1980). Measuring evaluation-induced change in mental health programs. In J. A. Ciarlo (Ed.), *Utilizing evaluation: Concepts and measurement techniques* (pp. 97–123.). Beverly Hills, CA: Sage.
- Backer, T. E. (1993). Information alchemy: Transforming information through knowledge utilization. *Journal of the American Society for Information Science, 44*, 217–221.
- Bekkering, G. E., van Tulder, M. W., Hendriks, E. J. M., Koopmanschap, M. A., Knol, D. L., Bouter, L. M., et al. (2005). Implementation of clinical guidelines on physical therapy for patients with low back pain: Randomized trial comparing patient outcomes after a standard and active implementation strategy. *Physical Therapy, 85*, 544–555.
- Bennett, S., Tooth, L., McKenna, K., Rodger, S., Strong, J., Ziviani, J., et al. (2003). Perceptions of evidence based practice: A survey of Australian occupational therapists. *Australian Occupational Therapy Journal, 50*, 13–22.
- Bero, L. A., Grilli, R., Grimshaw, J. M., Harvey, E., Oxman, A. D., & Thomson, M. A. (1998). Closing the gap between research and practice: An overview of systematic reviews of interventions to promote the implementation of research findings. *British Medical Journal, 317*, 465–468.
- Berta, K. M. (1995). Information seeking, research utilization, and barriers to research utilization of pediatric nurse educators. *Journal of Professional Nursing, 11*, 49–57.
- Beyer, J. M. (1997). Research utilization: Bridging the gap between communities. *Journal of Management Inquiry, 6*, 17–22.
- Brett, J. L. L. (1987). Use of nursing practice research findings. *Nursing Research, 36*, 344–349.
- Brett, J. L. L. (1989). Organizational integrative mechanisms and adoption of innovations by nurses. *Nursing Research, 38*, 105–110.
- Canadian Institutes of Health Research (2004). *Knowledge translation strategy 2004–2009: Innovation in action*. Retrieved September 9, 2006, from <http://www.cihr-irsc.gc.ca/e/26574.html>
- Canadian Institutes of Health Research (2005). *About knowledge translation*. Retrieved September 9, 2006, from <http://www.cihr-irsc.gc.ca/e/29418.html>
- Champion, V. L., & Leach, A. (1989). Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing, 14*, 705–710.

- Conner, R. F. (1980). The evaluation of research utilization. In M. W. Klein & K. S. Teilmann (Eds.), *Handbook of Criminal Justice Evaluation* (pp. 629–653). Beverly Hills, CA: Sage.
- Conner, R. F. (1981). Measuring evaluation utilization: A critique for different techniques. In J. A. Ciarlo (Ed.), *Utilizing evaluation: Concepts and measurement techniques* (pp. 59–75). Beverly Hills, CA: Sage.
- Coyle, L. A., & Sokop, A. G. (1990). Innovation adoption behavior among nurses. *Nursing Research, 39*, 176–180.
- Davis, D. (2005). Quality, patient safety and the implementation of best evidence: Provinces in the country of knowledge translation [Special issue]. *Healthcare Quarterly, 8*, 128–131.
- Dunn, W. N. (1983). Measuring knowledge use. *Knowledge: Creation, Diffusion, Utilization, 5*, 120–133.
- Estabrooks, C. A. (1999). The conceptual structure of research utilization. *Research in Nursing & Health, 22*, 203–216.
- Estabrooks, C. A., Chong, H., & Birdsell, J. (2003). *The Alberta nurses survey: Utilization of health research results in medical practice*. Faculty of nursing, University of Alberta, Edmonton, Alberta, Canada.
- Foxcroft, D. R., & Cole, N. (2000). Organizational infrastructures to promote evidence-based nursing practice (Review). *Cochrane Database of Systematic Reviews, 3*, Art. No.: CD 002212. DOI: 10.1002/14651858.CD002212.
- Fritz, J. M., Delitto, A., & Erhard, R. E. (2003). Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain. *Spine, 28*, 1363–1372.
- Graham, I. D., & Logan, J. (2004). Innovations in knowledge transfer and continuity of care. *Canadian Journal of Nursing Research, 36*, 89–103.
- Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., et al. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13–24.
- Graham, K., & Logan, J. (2004). Using the Ottawa Model of Research Use to implement a skin care program. *Journal of Nursing Care Quality, 19*, 18–24.
- Grimshaw, J. M., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L. A., et al. (2001). Changing provider behavior: An overview of systematic reviews of interventions. *Medical Care, 39*(8, Suppl. 2), II-2–II-25.
- Grimshaw, J. M., Thomas, R. E., MacLennan, G., Fraser, C., Ramsey, C. R., Vale, L., et al. (2004). Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technology Assessment, 8*(6). Retrieved March 7, 2007, from <http://www.hta.ac.uk/fullmono/mon806.pdf>
- Grol, R. (2001). Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical Care, 39*(8, Suppl. 2), II-46–II-54.
- Hakkennes, S., & Green, S. (2006). Measures for processing practice change in medical practitioners [Electronic version]. *Implementation Science, 1*(29). Retrieved December 20, 2006, from <http://www.implementationscience.com/content/1/1/29>
- Hall, G. E., Loucks, S. F., Rutherford, W. L., & Newlove, B. W. (1975). Levels of use of the innovation: A framework for analyzing innovation adoption. *Journal of Teacher Education, 26*, 52–56.

- Hanney, S. R., Gonzalez-Block, M. A., Buxton, M. J., & Kogan, M. (2003). The utilization of health research in policymaking: Concepts, examples and methods of assessment [Electronic version]. *Health Research Policy and Systems, 1*(2). Retrieved December 21, 2006, from <http://www.health-policy-systems.com/content/1/1/2>
- Heinemann, A. W., Roth, E. J., Rychlik, K., Pe, K., King, C., & Clumpner, J. (2003). The impact of stroke practice guidelines on knowledge and practice patterns of acute-care health professionals. *Journal of Evaluation in Clinical Practice, 9*, 203–212.
- Hogan, D. L., & Logan, J. (2004). The Ottawa Model of Research Use: A guide to clinical innovation in the NICU. *Clinical Nurse Specialist, 18*, 255–261.
- Hysong, S. J., Best, R. G., & Pugh, J. A. (2006). Audit and feedback and clinical practice guideline adherence: Making feedback actionable. *Implementation Science, 1*(9). DOI: 10.1186/1748-5908-1-9. Retrieved December 1, 2006, from <http://www.implementationscience.com/content/1/1/9>
- Jacobson, N., Butterill, D., & Goering, P. (2003). Development of a framework for knowledge translation: Understanding user context. *Journal of Health Services Research & Policy, 8*, 94–99.
- Jamtvedt, G., Young, G. M., Kristoffersen, D. T., O'Brien, M. A., & Oxman, A. D. (2006). Audit and feedback: Effects on professional practice and healthcare outcomes (review). *Cochrane Database of Systematic Reviews, 2*. Art. No.: CD000259. DOI: 10.1002/14651858.CD000259.pub2.
- Johnson, L. S. (2005). From knowledge transfer to knowledge translation: Applying research to practice. *OT Now (July/August)*, 11–14.
- Kerner, J. F. (2006). Dullest translation versus knowledge integration: A “funder’s” prospective. *The Journal of Continuing Education in the Health Professions, 26*, 72–80.
- Kirkhart, K., & Conner, R. F. (1983). Evaluating and maintaining planned change. In E. M. Glaser, H. H. Abelson, & K. N. Garrison (Eds.), *Putting knowledge to use: Facilitating the diffusion of knowledge and the implementation of planned change*. San Francisco: Jossey-Bass.
- Kitson, A., Harvey, G., & McCormack, B. (1998). Enabling the implementation of evidence-based practice: A conceptual framework. *Quality in Health Care, 7*, 149–158.
- Knott, J., & Wildavsky, A. (1980). If dissemination is the solution, what is the problem? *Knowledge: Creation, Diffusion, Utilization, 1*, 537–578.
- Knowledge Translation Program, Faculty of Medicine, University of Toronto (2004). *About knowledge translation: Definition*. Retrieved January 8, 2006, from <http://www.ktp.utoronto.ca/whatisktp/definition/>
- Landry, R., Amara, N., & Lamari, M. (2001). Climbing the ladder of research utilization: Evidence from social science research. *Science Communication, 22*, 396–422.
- Landry, R., Lamari, M., & Amara, N. (2003). The extent and determinants of the utilization of the university research in government agencies. *Public Administration Review, 63*, 192–204.
- Larsen, J. K. (1980). Knowledge utilization: What is it? *Knowledge: Creation, Diffusion, Utilization, 1*, 421–442.



- Larsen, J. K. (1982). *Information utilization and non-utilization* (Report No. AIR-64200-72300-79100-84300-FR). Palo Alto, CA: American Institutes for Research in the Behavioral Sciences. (ERIC Document Reproduction Service No. ED227430).
- Logan, J., & Graham, I. D. (1998). Toward a comprehensive interdisciplinary model of health care research use. *Science Communication, 20*, 227–246.
- Logan, J., Harrison, M. B., Graham, I. D., Dunn, K., & Bissonnette, J. (1999). Evidence-based pressure-ulcer practice: The Ottawa Model of Research Use. *Canadian Journal of Nursing Research, 31*, 37–52.
- Lomas, J. (1993). Retailing research: Increasing the role of evidence in clinical services for childbirth. *The Milbank Quarterly, 71*, 439–475.
- Meline, T., & Paradiso, T. (2003). Evidence-based practice in schools: Evaluating research and reducing barriers. *Language, Speech & Hearing Services in Schools, 34*, 273–283.
- Metcalfe, C., Lewin, R., Wisher, S., Perry, S., Bannigan, K., & Moffett, J. K. (2001). Barriers to implementing the evidence based in for NHS therapies. *Physiotherapy, 11*, 433–441.
- Michel, Y., & Sneed, N. V. (1995). Dissemination and use of research findings in nursing practice. *Journal of Professional Nursing, 11*, 306–311.
- Milner, F. M., Estabrooks, C. A., & Humphrey, C. (2005). Clinical nurse educators as agents for change: Increasing research utilization. *International Journal of Nursing Studies, 42*, 899–914.
- National Center for the Dissemination of Disability Research. (2005). What is Knowledge Translation? *Focus: Technical Brief*, No. 10. Austin, TX: Southwest Educational Development Laboratory. Retrieved (March 7, 2007) from <http://www.ncddr.org/kt/products/focus/focus10/>
- National Institute on Disability and Rehabilitation Research (2005). *Long-range plan for fiscal years 2005–2009*. Retrieved September 23, 2006, from <http://www.ed.gov/legislation/FedRegister/other/2006-1/021506d.pdf>
- Paisley, W., & Lunin, L. F. (1993). Introduction and overview. *Journal of the American Society for Information Science, 44*, 215–216.
- Pelz, D. C., & Horseley, J. A. (1981). Measuring utilization of nursing research. In J. A. Ciarlo (Ed.), *Utilizing evaluation: Concepts and measurement techniques* (pp. 125–149). Beverly Hills, CA: Sage.
- Pennington, L., Roddam, H., Burton, C., Russell, I., Godfrey, C., & Russell, D. (2005). Promoting research use in speech and language therapy: A cluster randomized controlled trial to compare the clinical effectiveness and costs of two training strategies. *Clinical Rehabilitation, 19*, 387–397.
- Rich, R. F. (1991). Knowledge creation, diffusion, and utilization: Perspectives of the founding editor of Knowledge. *Knowledge: Creation, Diffusion, Utilization, 12*, 319–337.
- Rodgers, S. E. (2000). A study of the utilization of research in practice and the influence of education. *Nurse Education Today, 20*, 279–287.
- Rogers, E. (1983). *Diffusion of Innovations* (3rd ed.). New York: The Free Press.
- Rycroft-Malone, J. (2004). The PARIHS framework: A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality, 19*, 297–304.

- Rycroft-Malone, J., Kitson, A., Harvey, G., McCormack, B., Seers, K., Titchen, A., et al. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care, 11*, 174–180.
- Shaw, B., Cheater, F., Baker, R., Gillies, C., Hearnshaw, H., Flottorp, S., et al. (2005). Tailored interventions to overcome identified barriers to change: Effects on professional practice and healthcare outcomes (Review). *Cochrane Database of Systematic Reviews, 3*, Art. No. CD 005470. DOI: 10.1002/14651858.CD 005470.
- Southwest Educational Development Laboratory (2001). *Utilization measurement: Focusing on the “U” in “D & U.”* Austin, TX: Southwest Educational Development Laboratory. (ERIC Document Reproduction Service No. ED457620).
- Stacey, D., Pomey, M-P, O’Conner, A. M., & Graham, I. D. (2006). Adoption and sustainability of decision support for patients facing health decisions: An implementation case study in nursing. *Implementation Science, 1*(17), DOI:10.1186/1748-5908-1-17. Retrieved July 30, 2007, from <http://implementationscience.com/content/1/1/17>
- Sterr, A., Szameitat, A., Shen, S., & Freivogel, S. (2006). Application of the CIT concept in the clinical environment. *Cognitive & Behavioral Neurology, 19*, 48–54.
- Stetler, C. (1994). Refinement of the Stetler/Marram model for application of research findings to practice. *Nursing Outlook, 42*, 15–25.
- Stetler, C. B. (2001). Updating the Stetler model of research utilization to facilitate evidence-based practice. *Nursing Outlook, 49*, 272–278.
- Stetler, C. B., & Marram, G. (1976). Evaluating research findings for applicability in practice. *Nursing Outlook, 24*, 559–563.
- Straus, S. E., Richardson, W. S., Glasziou, P., & Haynes, R. B. (2005). *Evidence based medicine: How to practice and teach EBM* (3rd ed.). Philadelphia: Elsevier–Churchill Livingstone.
- Thomas, L., Cullum, N., McColl, E., Rousseau, J., & Steen, N. (1999). Guidelines in professions allied to medicine (Review). *Cochrane Database of Systematic Reviews, 1*, Art. No. CD 000349. DOI: 10.1002/146518528.CD 000349.
- Turner, P., & Whitfield, T. W. A. (1997). Physiotherapists’ use of evidence based practice: A cross-national study. *Physiotherapy Research International, 2*, 17–29.
- Vercoe, C., & Hilton, A. (1995). Factors affecting acute-care nurses’ use of research findings. *Canadian Journal of Nursing Research, 27*(4), 51–71.
- Vingillis, E., Hartford, K., Schrecker, T., Mitchell, B., Lent, B., & Bishop, J. (2003). Integrating knowledge generation with knowledge diffusion and utilization. *Canadian Journal of Public Health, 94*, 468–471.
- Wolfe, D. A., Stojcevic, N., Rudd, A. G., Warburton, F., & Beech, R. (1997). The uptake and costs of guidelines for stroke in a district of southern England. *Journal of Epidemiology and Community Health, 51*, 520–525.
- World Health Organization (2005). *Bridging the “Know–Do” gap: Meeting on knowledge translation in global health*. Retrieved September 25, 2006, from [http://www.who.int/kms/WHO\\_EIP\\_KMS\\_2006\\_2.pdf](http://www.who.int/kms/WHO_EIP_KMS_2006_2.pdf)

## About the author



Dr. Pimjai Sudsawad, at the time of this manuscript preparation, was an assistant professor at the University of Wisconsin-Madison. Her main research area was knowledge translation in the context of evidence-based rehabilitation. Specific interests included barriers to and facilitators of the use of research evidence for rehabilitation practice, research methodology that could increase the usability of research evidence for practice, and rehabilitation researchers' readiness to adopt such methodology for their research.

Available online in alternate electronic formats at  
[www.ncddr.org/kt/products/ktintro/](http://www.ncddr.org/kt/products/ktintro/)

**The National Center for the  
Dissemination of Disability Research**

---

at the Southwest Educational Development Laboratory

