

Toward a Comprehensive Interdisciplinary Model of Health Care Research Use

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Numerous health care disciplines have noted that insufficient research evidence is used in clinical practice. This situation denies optimal care to patients and potentially increases system costs. A practical theoretical framework for policymakers intent on promoting an evidence-based approach to the transfer and use of research findings in clinical practice settings is presented. The Ottawa Model of Research Use (OMRU) has a comprehensive interdisciplinary focus and consists of six key elements: the practice environment, potential adopters of the evidence, the evidence-based innovation, research transfer strategies, the evidence adoption, and health-related and other outcomes. Model elements and the interactive relationships among them are described.

Toward a Comprehensive Interdisciplinary Model of Health Care Research Use

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Research utilization has been defined as “a process directed toward transfer of specific research-based knowledge into practice through the systematic use of a series of activities” (Horsley et al. 1983, 100-101). Although

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scholarly interest in diffusion of medical and other innovations has existed in the social sciences for many years, in the health sciences, theory and research on the adoption and use of research evidence is a relatively new field of inquiry.

Several models with diverse perspectives have been proposed to facilitate the transfer of research into clinical practice. Some attempt to provide an overview of the process from a particular frame, for example, the individual or the organization (Stetler 1994; Titler et al. 1994). Others are aimed at providing a heuristic for use during parts of the process (Browman et al. 1995; Titler et al. 1994). Several models simply describe efforts to implement findings into practice (Lomas 1993; White, Leske, and Percy 1995).

While all of these models offer valuable insights into the process of research use, they have limitations. They identify many key elements of research transfer but few adopt a holistic approach that considers all aspects of the process of research use and its impact on health outcomes. Also, few of the existing models provide a parsimonious view of the major elements in research use that can be helpful to organizational and clinical policymakers for selecting research use strategies and for determining the resources needed to support these strategies. Most are intended for use by one professional discipline despite the fact that new organizational structures emphasize interdisciplinary teamwork and that systematic reviews of the evidence and evidence-based clinical guidelines are increasingly interdisciplinary (Bond 1995; Lewis 1995; Robinson 1994).

The Ottawa Model of Research Use

Aware of the lack of practical models to promote research use, we began assembling diverse aspects of the process of research use into a simple and useful framework, which we call the Ottawa Model of Research Use (OMRU). We created the OMRU framework to be used by policymakers seeking to increase the use of health research by practitioners, as well as by researchers interested in studying the process by which research becomes integrated into practice. The elements of the model are supported by evidence where available. The elements are primarily drawn from the literature relating to research utilization, the diffusion of innovations, physician behavior change, and the development and implementation of practice guidelines.

The OMRU was refined through discussions with participants in workshops we conducted for the Ontario Health Care Evaluation Network (Graham and Logan 1995, 1996a), conference presentations and clinical education rounds (Graham and Logan 1996b; Harrison, Logan, and Graham 1997;

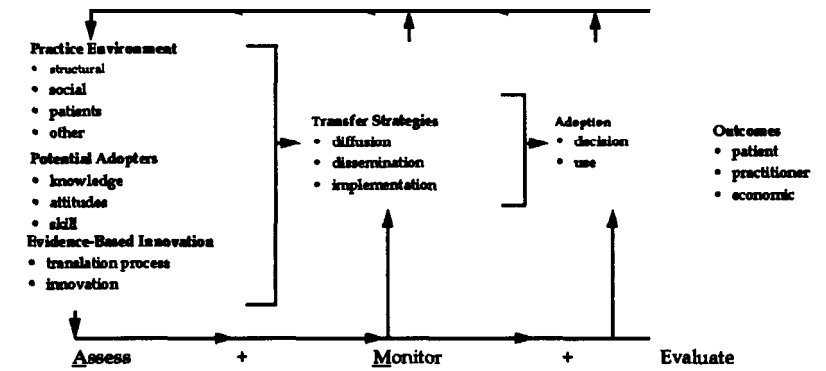


Figure 1: The Ottawa Model of Health Care Research Use

Logan and Graham 1996a, 1996b, 1997). Impetus for developing the model derived not only from our intellectual curiosity about research use but also from our desire to support the multifaceted work on research transfer taking place academically and clinically at the University of Ottawa and the Clinical Epidemiology Unit of the Ottawa Civic Hospital Loeb Research Institute. For instance, the Ottawa Ankle and Knee Rules are excellent examples of attempts to assist clinicians with evidence-based diagnostic decision making (Stiell et al. 1993, 1994, 1996; Stiell, Greenberg, et al. 1995; Stiell, Wells, et al. 1995). The Ottawa Health Decision Center, also part of the Loeb Research Institute, is a leader in developing evidence-based decision aids for patients and is increasingly focusing on research transfer strategies.

The OMRU consists of six key elements that are connected to each other through the process of evaluation (Figure 1). These elements address what we believe to be the central components in the research use process: the practice environment, potential adopters, the evidence-based innovation, strategies for transferring the evidence into practice, the use of the evidence, and health-related and other outcomes of the process. We are using the term innovation to refer to research evidence that is new to the potential adopter, even though the evidence may have been available for some time (Rogers 1995). Evidence-based innovations may be evidence that some treatment or practice

is beneficial and should be used, or evidence that some current treatment or practice is not beneficial and should be abandoned or used more selectively.

The OMRU can be classified as an interactive model of research use (Weiss 1979). It views research use as a dynamic process of interconnected decisions and actions by different individuals relating to each of the model elements. The process decisions take place over time and in an order that depends on the specific state of each element within a given context. Although presented as a linear diagram, the nature of the process should not be interpreted as unidirectional. All of the model elements influence and are influenced by each other. The dynamic interaction and interplay between the elements of the model distinguish this model from sequential stage models, which assume that the progression of research into practice occurs in an orderly, linear, and rational way (Buxton and Hanney 1996).

As patients and their health outcomes should be the primary focus of evidence-based practice, one assumption underlying the OMRU is that patients may play a key role in all aspects of the process and therefore must be considered within each model element. Another is that both the general and health care external environments will affect all aspects of the process.

Assess, Monitor, and Evaluate

Integral to the OMRU is the systematic assessment, monitoring, and evaluation (**AME**) of the state of each model element prior to, during, and following any research transfer efforts. The **AME** data serve four functions: (1) to identify potential barriers and supports to research use related to the practice environment, potential adopters, and the evidence-based innovation; (2) to provide direction for selecting and tailoring transfer strategies to overcome the identified barriers and enhance the supports; (3) to track the progress of the transfer effort; and (4) to evaluate the actual use of the evidence-based innovation and its impact on outcomes of interest.

The selection of methods to be used to conduct the **AME** will vary depending on whether the purpose is to assess, to monitor, or to evaluate. Although there is a paucity of validated instruments designed specifically for these efforts, various qualitative and quantitative methods might be used to undertake the **AME** (see Table 1).

Green et al.'s (1980) PRECEDE model suggests conducting a diagnosis of the predisposing, enabling, and reinforcing factors and then addressing those that will promote patient behavioral change. Although useful, this model does not provide any specific direction regarding which issues might be more

TABLE 1
Methods of Assessing, Monitoring, and Evaluating

| <i>Types of Methods</i> | <i>Focus of Evaluation and Monitoring</i> | | |
|-----------------------------|-------------------------------------------|----------------|-----------------|
| | <i>Background</i> | <i>Process</i> | <i>outcomes</i> |
| Observation | X | X | |
| Interviews | X | X | |
| Focus groups | X | X | |
| Surveys/statistics | X | | X |
| Utilization data | X | | X |
| Cost-effectiveness analysis | | X | X |

important to consider when attempting to promote the use of research and would be more complex to implement than the **AME**.

Elements of the OMRU

From the literature, barriers and supports to research use can arise from three distinct sources: the practice environment, potential adopters, and the evidence-based innovation. The first step in using the model as a guide is to assess these elements for barriers and supports.

Practice Environment

The environment exerts a powerful set of influences on practitioners, researchers, and policymakers (Lomas 1994). These influences can encourage or discourage the process of research transfer and use (Funk et al. 1991, 1995; Haynes 1993; Walczak et al. 1994). Sometimes these opposing influences are exerted simultaneously. This element of the model directs attention to identifying, describing, and assessing such influences within the practice environment. These factors may be broadly categorized as structural, social, patient, and other situation-specific factors.

Within the practice setting, structural *factors* such as the settings' decision-making structure; rules, regulations, and official policies; physical structure; workload; available resources and supplies; and the system of incentives are all factors that have been shown to influence research use (Battista 1992; Battista and Mickalide 1990; Elmslie 1994; Elson and Connelly 1995; Funk et al. 1995; Graham 1997; Greco and Eisenberg 1993; Greer 1977, 1988; Grol 1992; Lomas 1994; Nolan et al. 1994; Rogers 1995; Stoberingh, Janknegt, and Wijnands 1993).

Social *factors* include such things as the politics and personalities involved, the presence of local champions or advocates of the evidence-based innovation, and the culture and belief systems operating within the setting (Brown, Shye, and McFarland 1995; Conroy and Shannon 1995; Fineberg 1985; Graham 1997; Greer 1988; Groll 1993; Kirchoff et al. 1993; Klein et al. 1995; Mittman, Tonesk, and Jacobson 1992; Weiss 1977, 1979).

Patients are often the source for the questions and problems identified by clinicians or policymakers that trigger the demand for evidence-based practice (Browman et al. 1995; Titler et al. 1994; Wise and Billi 1995). Depending on the type of evidence-based innovation, patients can encourage or discourage their adoption by practitioners. Patient influence or pressure may stimulate practitioner adoption of evidence, while patients' inability or unwillingness to comply with evidence-based recommendations may discourage practitioners from applying the evidence (Brook 1995; Graham 1997).

Depending on the specific setting, there may also be *other salient aspects* of the practice environment that policymakers may need to discover and assess for their potential as barriers or supports. For physicians, the *medico-legal* climate may be one such factor that may have considerable impact on the adoption of evidence-based innovations. While assessing the practice environment for barriers and supports to research use, policymakers must consider also another set of factors related to potential adopters of the evidence-based innovation.

Potential Adopters

Patients, clinicians, and other policymakers in the system are all potential adopters of research. The OMRU directs policymakers to identify all potential adopters or target audiences to whom they intend to direct the evidence and to define and describe them in terms of their attitudes, knowledge, motivation for adopting the evidence, skills, and current practices.

The interests of potential adopters of evidence vary according to who they are. For example, policymakers use societal or organizational priorities as the context in which they understand research (Weiss 1980). Clinicians are similarly influenced by considerations other than research findings. For this reason, the OMRU emphasizes the need to view the proposed change from the potential adopters' perspective and to identify and understand all the scientific and extrascientific considerations that may influence adoption of the evidence (Eveland 1986; Greer cited in Kaegi 1991). All the information collected on the potential adopters can be used to create a profile of adopters focusing on potential barriers and supports to research use.

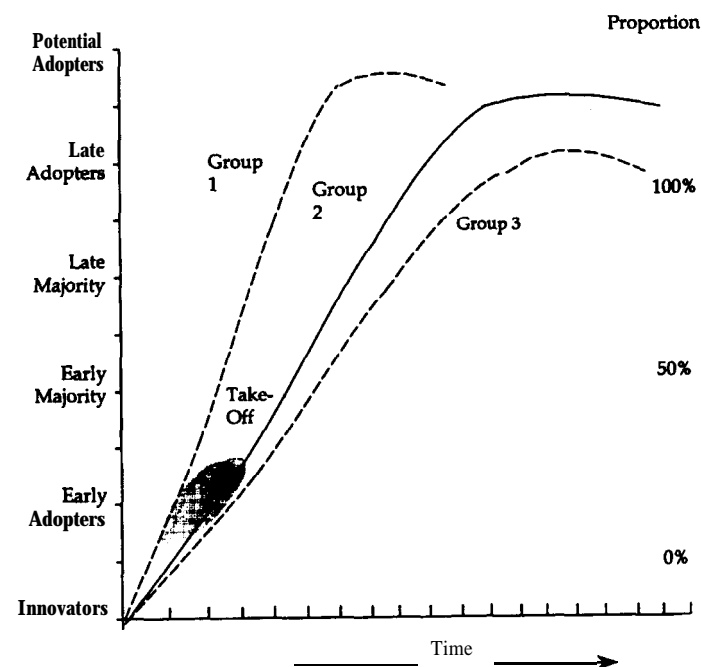


Figure 2: Rate of Adoption by Different Groups Based on Attitudes toward an Innovation

Evidence-Based Innovation

This model element focuses attention on potential adopters' perceptions of the attributes or characteristics of both the process by which research evidence was translated into some evidence-based innovation (e.g., the process by which a practice guideline was developed) and the innovation itself (e.g., the actual guideline). The OMRU directs policymakers to consider how perceptions of the attributes of the innovation may affect potential adopters' decisions about adoption. This is to be done by identifying the attributes likely to be viewed positively or negatively and tailoring transfer strategies appropriately.

The rationale for this model element is that attributes of an innovation interact with potential adopters. Mostly outside of health care, different diffusion patterns have been shown to exist for innovations with different

attributes (Rogers 1995). The rate of diffusion (e.g., the diffusion S curve) varies **from** setting to setting in part because potential adopters differ in their perceptions of **the** attributes of the same innovation (Figure 2). If policymakers can minimize potential adopters' negative perceptions of the innovation and maximize their positive ones, then the adoption of the innovation should occur more quickly, with all things being equal.

Attributes of the translation process thought to positively influence adoption are credible developers and involvement of potential adopters in the process (Brown, Shye, and McFarland 1995; **Conroy** and Shannon 1995; Grol 1993). Furthermore, translation processes should be explicit and transparent, including a rigorous searching of the literature for evidence and incorporating objective methods to synthesize the evidence (Auston, Cahn, and Selden 1994; Hayward and Laupacis 1993; Shiffman and Greenes 1994).

Largely in fields outside of health care, attributes of innovations shown to be consistently and positively related to adoption include the innovation being considered compatible with the current way of doing things, the innovation seen to be more advantageous than current practice (relative advantage), and **the** innovation not considered difficult to do (low complexity) (Tomatzky and Klein 1982). Within medicine, there is some evidence demonstrating that physician compliance with clinical practice guidelines is greater for guidelines that are not difficult to do (low complexity) and easy to try out before making a final decision to go on using it (high trialability) (**Grilli** and Lomas 1994).

Other attributes seldom considered that might be expected to influence adoption of health care innovations are the **risk:benefit** ratio for patients of implementing the innovation, ethical considerations, and the format and style of the innovation (being perceived as user-friendly and attractive) (Brown, Shye, and McFarland 1995). In addition, potential adopters may perceive that conflicting evidence or practice guidelines exist. In this situation policymakers can assist potential adopters by making explicit the priorities set for available resources. By understanding potential adopters' perceptions of the innovation, both positive and negative, policymakers are better positioned to respond proactively to these perceptions with appropriate transfer strategies.

One potentially useful heuristic for conducting the barriers assessment is **the** "innovation decision process" proposed by Rogers (1995). The innovation decision process is broken down into five stages potential adopters may go through as they decide to adopt an innovation. The stages in this process are knowledge (awareness of the innovation), persuasion (development of positive attitudes toward the innovation), decision (a cognitive decision to adopt **the** innovation), implementation (use of the innovation), and confirmation (continued use of the innovation).

Although the evidence for the innovation decision process in health professions is extremely limited (**Brett** 1987; **Digan**, Tillgre, and Michielutte 1994; **Pathman** et al. 1996), conceptualization of the process of research use in stages may assist policymakers to identify different barriers and supports depending on the stage. Furthermore, it may be necessary to emphasize different strategies at different times as the research use process evolves and more of the cohort of potential adopters move along the research use decision continuum from the early stages of awareness to the later stages of use and ongoing use.

Once policymakers have assessed the practice environment, potential adopters, and the evidence-based innovation and determined the potential barriers and supports related to each of these elements, the next step is to use all the information collected to efficiently select and tailor research transfer strategies to overcome identified barriers and enhance the existing supports.

Research Transfer Strategies

This model element represents the strategies for getting evidence-based innovations to potential adopters and encouraging them to use these strategies. These strategies range from passive unplanned efforts (diffusion, e.g., publication of research findings or practice guidelines in a journal or putting them on the World Wide Web), to targeting and tailoring the evidence and **the** message for a particular audience (dissemination, e.g., direct mailing), to systematic efforts to encourage adoption of the evidence (implementation, e.g., academic detailing, continuing health education) (Lomas 1993).

Transfer strategies have included such things as provision of educational materials; social marketing, for example, the use of posters and other forms of advertising; educational activities such as continuing health education conferences and workshops, individual or group instruction, outreach or academic detailing; the use of opinion leaders and educational influentials; audit and feedback individually or as a group; reminder systems; patient influence and patient-mediated strategies; and the use of incentives and sanctions (Lomas and Haynes 1988; Lomas et al. 1991). Evidence suggests that strategies **that** work for one discipline may not be effective with others (Hodnett et al. 1996).

Evidence of the effectiveness of various transfer strategies is fairly limited at present although this body of literature is growing. There are some systematic reviews that have examined **the** effect of continuing medical education strategies on changing physician performance (Davis et al. 1995), continuing nursing education on nursing practice (**Waddell** 1995), interventions on

improving professional practice (Oxman et al. 1995), computer-based clinical decision support systems on clinical performance (Johnston et al. 1994), feedback of information on clinical practice (Mugford, Banfield, and O'Hanlon 1991), single and combined implementation strategies in primary care (Wensing and Grol 1994), and implementation strategies on practice guideline use and impact (Grimshaw et al. 1995). It should be noted that while all of the research synthesized in these reviews related to changing practitioner behavior, the focus of much of the original research in the reviews did not consider whether the rationale for the behavior change was evidence based, a crucial detail.

To date, the evidence from the systematic reviews suggests that all implementation strategies work at least some of the time but that none work all of the time. Multiple strategies appear more effective than single ones. Strategies that are nearer to the end users and integrated into the process of care delivery are more likely to be effective. Even the most complex transfer strategies have at best a 20 percent to 50 percent effect in changing behavior (Oxman et al. 1995). The effect of transfer strategies is greater on the process of care than on health outcomes, although the latter effect has been much less often evaluated.

The OMRU helps explain these findings by suggesting that the most efficient approach to implementation of research evidence probably rests with tailoring the transfer strategies to the salient barriers and supports found within the particular setting (see Table 2). The greater use of multiple strategies then has likely resulted from policymakers, consciously or unconsciously, simultaneously targeting barriers inherent in the practice environment and related to the potential adopters and evidence-based innovation. The more barriers addressed by the transfer strategies, the greater the use of the evidence-based innovation. In Figure 3, we have combined the work of Rogers (1995) and Lomas (1993) to provide an example of how the OMRU can be used to help tailor research transfer strategies to stages of the innovation decision process.

Research Adoption and Use

Adoption is making full use of an innovation as the best course of action available (Rogers 1995) and represents behavioral change (using the evidence-based innovation). Determining the extent to which the innovation is used is the only way policymakers can assess the success of the transfer strategies employed. By monitoring the adoption process, they can determine whether the innovation is being used as it was intended, whether it has been

TABLE 2
Examples of Tailoring Research Strategies to
Barriers and Supports of Research Use

| <i>Barriers/Supports</i> | <i>Transfer Strategy</i> |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Practice environments | |
| Structure | |
| Rules, regulations, policies | Create or modify directives |
| Available resources technology | Provide resources, provision, practice |
| Support | |
| workload | Operational tools |
| | Provide reminder systems |
| Social | |
| Politics, personalities | Diplomacy, negotiation, strategic alliances |
| Culture, belief system | Use social influence, opinion leaders, peer review |
| Patient | |
| Compliance | Patient education |
| Influence. | Patient-mediated strategies |
| Potential adopters | |
| Awareness | Publication |
| Attitudes | Dissemination, social marketing |
| Knowledge and skills | Opinion leaders, educational materials continuing medical education, continuing nursing education, outreach visits |
| Ongoing support | Audit + feedback |
| Evidence-based innovation | |
| Evidence, translation process | Use credible developers |
| | Incorporate end users |
| The innovations | Make it user-friendly |
| | Promote positive attributes (e.g. strength of evidence, beneficial results) |

adapted to local conditions and may no longer be used as intended, or whether it has been adopted and later abandoned. Because the process of research use is evolutionary and interactive, it is essential for policymakers to understand how the innovation has been adopted (or rejected) and how this may have changed over time. In so doing, policymakers are in a better position to modify existing transfer strategies or select new ones to maximize research transfer.

Outcomes

The final element of the model is outcomes, which represent the impact of using the evidence-based innovation. The consequences of research use may

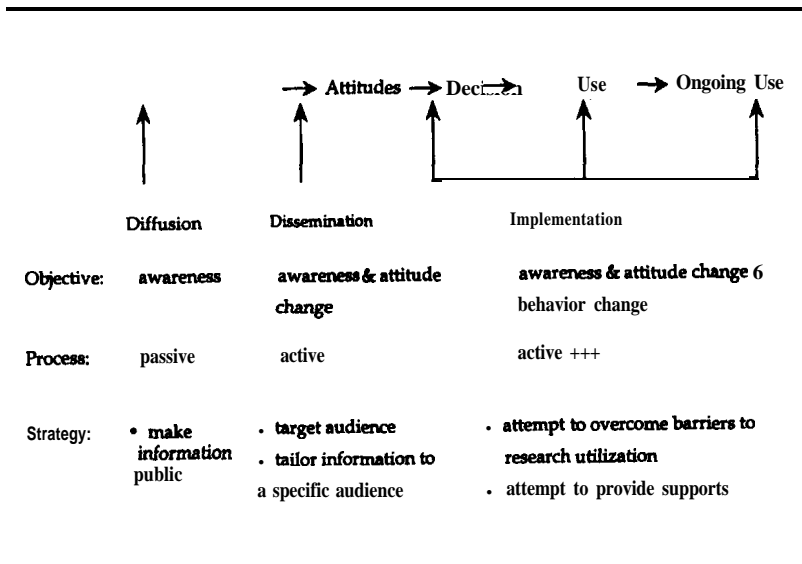


Figure 3: Examples of Research Transfer Strategies in Categories Adapted from Work by Rogers (1995) and Lomas (1993)

be desirable, direct, anticipated, or undesirable, indirect, and unanticipated (Greer 1988). Direct outcomes can relate to patients and their families, practitioners, and the system (economic outcomes) (Titler et al. 1994). An important assumption of the OMRU is that a primary objective of research use in health care is that it improves patient health outcomes. For this reason, the evaluation of the initial and ongoing effectiveness of the research use with respect to patient outcomes is needed (Basinski 1995; Davis and Taylor-Vaisey 1997). The necessity to monitor and evaluate the outcomes of research use is heightened by the unpredictability of the process of research use and the possibility of unanticipated outcomes, both positive and negative. It is only by evaluating the impact of evidence-based innovations that their true value can be determined.

Using the Model to Guide Research Use

While the OMRU was still evolving, it was used to guide a clinical project with the goal of implementing evidence-based practice related to pressure

ulcers across three health care agencies: tertiary care hospital, long-term care agency, and a community nursing agency (Logan et al. 1997). We first identified the goals and resources available to policymakers because this determined what research transfer strategies were possible and feasible to undertake in each setting. The clinical project was suitably funded by the Ontario Ministry of Health. We next undertook a “barriers assessment.” This involved “scanning” the model elements—practice environment, potential adopters, and evidence-based innovation—for potential barriers and supports to research use. Most of the information was collected through focus groups and interviews with key informants. All of the practice environments were laboring under limited resources and restructuring that had resulted in low staff morale and high stress for potential adopters. Supports included some previous work done on evidence-based practice guidelines by two of the three agencies, enthusiastic clinical leadership, and a common desire to improve practice.

Once the potential barriers and supports related to each of the model elements were identified, we used the information to select and tailor research transfer strategies to overcome identified barriers and enhance the existing supports. This project will soon enter the evaluation phase in which pre- and posttest quantitative data will be analyzed.

Table 3 presents a diagnostic schema that was developed along with our attempts to validate the OMRU with the evidence-based pressure ulcer project. In the table are some examples of transfer strategies that were offered to overcome specific barriers and to strengthen or provide support. **Policymakers** may use the diagnostic schema to record their findings and actions during the research transfer effort.

Conclusion

We have proposed a comprehensive interdisciplinary model of health care research use as a guide to promote implementation of research findings into health care practice. The OMRU can provide assistance to organizational policymakers from diverse disciplines who wish to ensure, or are charged with ensuring, evidence-based practice. The OMRU constructs are supported by evidence where available and indicate what key aspects to assess, to monitor, and to evaluate. The model is meant as a guide, not a recipe. The variables within each main element can be expected to differ within diverse settings over time. We propose that policy decision makers consider the model elements simultaneously.

TABLE 3
Assessment Monitoring and Evaluation Schema

| Research Use | EBI ^a Factors | | | | Practice Environment | | | |
|----------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------|----------------------------------------------|-----------------------------------------|-----------------------------------------|-------|--|
| | Potential Adopters | Product | Process | Structure | Social | Patients | Other | |
| Decision Process | | | | | | | | |
| Awareness of EBI | | | | | | | | |
| Barriers/supports | Unaware of project, evidence | Pressure ulcer guidelines used in prevalence studies in two agencies | AHCPR ^b with local adaptation | Decentralized decision making | Supportive leaders | Increasing numbers of high-risk elders | | |
| Transfer strategies | Presentations, reports, unit orientation sessions, logo, newsletters | | | | | | | |
| Outcomes | Most staff increase awareness | | | | | | | |
| Attitudes toward EBI | | | | | | | | |
| Barriers/supports | Lack skills to interpret evidence | Considered too complicated to use | Credible developers | Heavy workload | High stress, low morale | | | |
| Transfer strategies | Aware of importance | | Strong evidence | | | | | |
| Outcomes | Workshops on critical appraisal and clinical practice guidelines | Emphasize positive attributes, modify negative ones | Promote aspects of development process | | | | | |
| Outcomes | Positive attitudes developed, increase in product champions | | Ability to pilot | | | | | |
| Decision to use EBI | | | | | | | | |
| Barriers/supports | Not convinced by evidence | Not user-friendly | | Current policies counter to innovation | Another administrator opposed to change | Concern patients will object | | |
| Transfer strategies | Use opinion leaders and product champions to promote innovation, offer trial period | Modify product | Local input into development | Change policies | Negotiate, build alliances | Provide data showing patient acceptance | | |
| Outcomes | Agreement to develop common methodology for assessing pressure ulcers | | | Agency resources to support implementation | | | | |
| Use EBI | | | | | | | | |
| Barriers/support | Lack skills/competencies to carry out new innovation | | | Too busy to try innovation | | Need supporting technology | | |
| Transfer strategies | Workshops/one-on-one training | | | Reorganize scheduling | | Find resources | | |
| Outcomes | Common methodology for assessing pressure ulcers in three agencies | | | | | | | |
| Continued use of EBI | | | | | | | | |
| Barriers/supports | Not evaluated yet | | | Lack ongoing administrative support/workload | Constantly changing staff | | | |
| Transfer strategies | | | | Use electronic reminder system | Audit/feedback, peer influence | | | |
| Outcomes | | | | | | | | |

a. EBI = evidence-based innovation.

b. AHCPR = Agency for Health Care Policy and Research.

The OMRU has had some initial validation by our attempts to apply it in two clinical projects during its evolution. However, much research is needed to explicate the relationships between and among the model elements. In addition, reliable and valid tools to measure the elements are scant. There is much work needed here. Furthermore, there is insufficient evidence on each model element that is specific to health care. There is a need to assess the feasibility and usefulness of the model and to evaluate the model prospectively and to test its applicability in settings other than health care. This comprehensive interdisciplinary model provides a basis for future research into this topic.

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