DEVELOPING A TOOL TO MEASURE KNOWLEDGE EXCHANGE OUTCOMES

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Abstract: This article describes the process of developing measures to assess knowledge exchange outcomes using the dissemination of a best practices in type 2 diabetes document as a specific example. A best practices model consists of knowledge synthesis, knowledge exchange (dissemination/adoption), and evaluation stages. Best practices are required at each stage. An extensive literature review found no previous knowledge syntheses of concrete tools and models for evaluating dissemination or exchange strategies. This project developed a practical and usable tool to measure the reach and uptake of disseminated innovations. The instrument itself facilitates an opportunity for knowledge exchange to occur between producers and adopters. At this point the tool has a strong theoretical basis. Initial pilot-testing has begun; however, the accumulation of evidence of validity and reliability is only in the planning stages. The instrument described here can be adapted to other areas of population health and evaluation research.

Résumé :   Cet article décrit le processus de développement de mesures pour l'évaluation de résultats de l'échange de connaissances. Ce processus sera décrit en utilisant comme exemple spécifique un document sur la diffusion des meilleures pratiques pour le diabète de type 2. Un modèle des meilleures pratiques comprend la synthèse de connaissances, l'échange de connaissances (diffusion ou adoption) ainsi que des étapes d'évaluation. Les meilleures pratiques sont nécessaires à toutes les étapes. Un examen approfondi de la littérature n'a permis d'identifier aucune synthèse de connaissances d'outils concrets ou de modèles pour l'évaluation de stratégies de diffusion ou d'échange. Dans ce projet, un outil pratique et utilisable a été développé pour mesurer la portée et la compréhension des innovations diffusées. L'instrument comme tel facilite l'échange de connaissances entre les producteurs et les utilisateurs. À l'heure actuelle, l'outil présente des appuis théoriques solides. Les expérimentations initiales sont amorcées, cependant les tests de validité et de fiabilité sont encore à l'étape de planifi-

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cation. L'instrument décrit peut être adapté à d'autres domaines d'évaluation et de recherche sur la santé des populations.

███████　　A three-phase project related to *Best Practices in Type 2 Diabetes Prevention* was conducted for Health Canada, beginning in 2002. In Phase 1, a systematic review of literature and a nominated practices scan identified interventions for the primary prevention of type 2 diabetes (Hanning, Manske, Skinner, McGrath, & Heipel, 2004; Hanning, Skinner, et al., 2004). These interventions were evaluated using effectiveness and plausibility criteria to suggest which could be considered "best" or "promising" practices. They were then documented in detail and ready to be disseminated. In Phase 2, Dubois, Wilkerson, and Hall (2003) developed a dissemination plan and framework for the practices. One limitation of the Phase 2 work was that it did not describe measurement tools for assessing the knowledge exchanged following dissemination. This article represents Phase 3, which follows systematic search methodology to identify literature to support the development of a tool to assess the reach and uptake of the dissemination of the *Best Practices in Type 2 Diabetes Prevention* project. It describes:

- a search for literature that conceptualizes dissemination/diffusion and adoption of health interventions
- a search for approaches for measuring knowledge exchange in the health field
- a search for methods of measuring and/or evaluating the usage of disseminated health information
- development of a usable tool to assess outcomes of knowledge exchange for best practices

In this article, dissemination of the *Best Practices in Type 2 Diabetes Prevention* project is used as an example in which the knowledge exchange tool could be applied. However, the tool described here is not exclusive to the area of type 2 diabetes prevention. Many areas of population health and evaluation research may find this to be a valuable tool for measuring the outcomes of their dissemination strategies and provide an opportunity for interaction (i.e., exchange) between researchers and users.

BEST (BETTER) PRACTICES

The area of Best Practices (BP) (also called Better Practices — see, e.g., Moyer, Maule, Cameron, & Manske, 2002; Program Training and

Consultation Centre, 2005) attempts to close the research–practice gap by developing a system for assessing and evaluating community-based practices to determine their effectiveness in certain contexts. It also provides a foundation for knowledge synthesis (creating a clearer understanding of what we know) and knowledge exchange (KE) by supporting the use of the recommended practices. The BP field has evolved because of a crucial barrier between science and practice: a lack of appropriate methods to measure the effectiveness of community programs (Cameron, Jolin, Walker, McDermott, & Gough, 2001).

The idea of "best practices" in health promotion has evolved over the past decade. Numerous groups have attempted to clarify the evidence-based or BP movement by constructing definitions, frameworks for evaluation, and guidelines for developing a best practice (Cameron et al., 2001; Centers for Disease Control and Prevention, 2003; Centre for Substance Abuse Prevention, 2003; Dubois et al., 2003; Green, 2001; Kahan & Goodstadt, 2001; Nova Scotia Group, 2002). Each group has developed a model that defines what qualifies as evidence and evaluates that evidence with different emphases. Each has done so to provide guidance to health promotion and population health practitioners who are being pushed for greater accountability to adopt BP interventions.

THE EVALUATION OF COMMUNITY PROGRAMS

While large-scale, multi-centre research interventions often receive thorough evaluations to determine their effectiveness, the practices they evaluate may not be easily adopted by or even appropriate for health promotion practitioners (Green & Glasgow, 2006). Some of the difficulty in identifying and determining which interventions can be considered best practice is the lack of appropriate evaluation of small community-driven grassroots initiatives. Although these interventions are often the most plausible and practical for public health practitioners to adopt, it is unclear whether a given program meets another key criterion of BP, effectiveness. The development of assessment criteria for these initiatives can facilitate the selection of BPs that are plausible and practical for health promoters to adopt.

Phase 1 of the *Best Practices in Type 2 Diabetes Prevention* project addressed the need for appropriate methods to measure effectiveness in population health. This phase resulted in 16 best and 71 promising practices for chronic disease prevention (Heart Health Resource

Centre, 2006). Phase 2 of the full project recommended a plan to get the practices disseminated and used (Heart Health Resource Centre, 2005).

KNOWLEDGE EXCHANGE

Research literature uses various terms (e.g., diffusion, dissemination, knowledge exchange, knowledge transfer, knowledge translation, knowledge utilization, etc.) to describe similar processes (Garcia, 2006; Graham et al., 2006). For consistency this article uses the term KE to describe these concepts. A number of the terms appear unidirectional, and the term KE is preferred as it implies a two-way dialogue for information exchange (Garcia, 2006; Gravois Lee & Garvin, 2003).

Appropriate and effective dissemination is one strategy often considered to facilitate a link between science and practice (Cameron, Brown, & Best, 1996). Another key factor to encourage knowledge diffusion and utilization is for researchers to acknowledge and involve end users. Early and ongoing collaboration with potential knowledge users has been shown to enhance research utilization (Vingilis et al., 2003). An existing relationship between academia and practitioner can better support knowledge translation and thus successful diffusion of knowledge (Nutbeam, 1996). Rosenfield (2000) differentiates between information and usable knowledge and suggests there is a need for the development of a "consumer mindset" by researchers. Jacobson, Butterill, and Goering (2003) echo this recommendation and claim that knowledge translation requires an understanding of user context.

Lavis, Robertson, Woodside, McLeod, and Abelson (2003) differentiate producer-push, user-pull, and exchange models of knowledge transfer for getting knowledge used. Exchange models emphasize interactive, mutually respectful, collaborative approaches driven jointly by researchers and practitioners (including policy makers). An exchange model fits most closely with the framework developed by Dubois et al. (2003) for Phase 2 of this project.

A key question is how to measure the extent of KE that has occurred, so that exchange efforts can be improved. We can gain precision by examining different levels of outcome of KE processes. For example, Rogers (1995) defines five stages in the exchange (diffusion) process: awareness, interest, evaluation, trial, and adoption. To simplify, for

presentation sake, we can condense these components into two stages: *reach* and *uptake*. *Reach* is an important component because, without exposure to materials, no further knowledge use can occur. *Uptake* reflects behavioural efforts to use the materials. This article reports on Phase 3, which uses reach and uptake as proxy measures for KE. The goal was to search for quantitative models or scales that could be drawn upon in the development of a tool to measure outcomes of KE, specifically reach and use. A number of researchers in this field identify uptake and use as indicators for knowledge exchange and research utilization (Dobbins, Ciliska, Cockerill, Barnsley, & DiCenso, 2002; Dobbins, Cockerill, & Barnsley, 2001; Knott & Wildavsky, 1980; Landry, Lamari, & Amara, 2001a, 2001b, 2003). The uptake tool questions developed during Phase 3 of this project include the use of innovations as well as other components along the continuum of KE outcomes. Reach was included in the tool because it is the first step before uptake and use can occur. Reach alone is not a reflection of KE, but innovations must be disseminated and "reach" target users for uptake and utilization to be possible. The "exchange" occurs during the interaction between knowledge producers and knowledge users toward joint actions (Davies, Nutley, & Walters, 2005).

METHOD

Development of the proposed tool began with a systematic search for published, unpublished, and grey literature related to measuring outcomes of efforts for KE (i.e., knowledge use). An annotated bibliography of relevant literature was generated. This facilitated the author's ability to conceptualize measurement in the context of KE. Several key articles and reports were chosen for their applicability to developing a tool to measure KE. The measurement models in these sources were compared for overlapping concepts. Key ideas emerged and were adapted to design specific questions and scales to assess reach and uptake following KE efforts of BP documents.

Because the knowledge exchange domain covers many contexts, it was decided to explore sources within and beyond those typically used in systematic literature reviews in health. Therefore, to conduct a thorough investigation, four different search strategies were used. Initially a search of peer-reviewed, published literature was performed using eight database search engines (CINAHL, Communication Studies, ERIC, MEDLINE (via PubMed), PsychINFO, Social Services Abstracts, Sociological Abstracts, and Web of Science). All searches were restricted to published articles from 1970 to

December 2004 in English-language journals. Search strings of many combinations were created using the following key words: *knowledge*, *exchange*, *evaluat**, *measure**, *disseminat**, *diffusion*, *knowledge exchange*, *knowledge translation*, *knowledge transfer*, *model*, *process*, *outcome*, *program*, *intervention*, *adoption*, *reach*, and *uptake*. The terms *health* and *diabetes* were used to focus the results. Then a table of contents search of 12 accessible electronic journals was conducted. These journals had the potential to yield informative articles due to their titles, which included the terms *knowledge*, *evaluation*, or *measurement*. Journals that frequently emerged from the database search and were accessible electronically were also included. Third, an Internet-based search engine (Google) was used to access grey literature using the same keyword search strings as the database search. The last strategy included a review of the reference lists from articles retrieved.

Articles and resources were retrieved if they fit the following inclusion criteria:

- addressed at least one outcome of KE (dissemination/diffusion, adoption, reach, uptake, utilization, transfer, translation)
- either pertained specifically to KE within health or could be adapted to the health domain.

The inclusion criteria remained very broad so that a variety of resources could be considered in the creation of the tool.

RESULTS

The database search yielded 4,023 hits (duplicates removed), of which 413 titles were selected for further review. Abstracts corresponding to these titles were read and 103 papers fitting the selection criteria were then retrieved. Nine relevant articles (not overlapping with the database search) were retained from the table of contents search. The Internet search led to 6 unpublished and 2 published documents. The review of reference lists provided 12 additional publications, the majority being articles prior to 1980.

Similar to the findings of Dubois et al. (2003), the four search strategies located numerous models and strategies for effective dissemination. A wealth of information on knowledge utilization was also retrieved. However, the goal of this search was to find specific tools

and literature relevant to a sub-component of dissemination, that is, how to measure outcomes of KE efforts. Although the 130 resources retrieved fit the inclusion criteria and were peripherally related to KE outcomes, very few of the articles identified dealt specifically with the measurement of KE outcomes and none of the papers displayed actual measurement tools. Much of the literature that exists on measuring knowledge use was published between 1975 and 1983 (Dunn, 1983). More recently, research has been conducted on research utilization (Dobbins et al., 2001, 2002; Estabrooks, 1999; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Landry et al., 2001a, 2001b, 2003) and evaluating team knowledge (Castka, 2003; Cooke, Kiekel, Salas, & Stout, 2003; Mohammed & Dumville, 2001).

DEVELOPMENT OF A TOOL TO MEASURE OUTCOMES OF KNOWLEDGE EXCHANGE

Measuring Reach

The dissemination report and framework by Dubois et al. (2003) is a valuable tool for organizations that are interested in disseminating BP material for population health. Although developed with type 2 diabetes prevention in mind, the framework can be used to guide dissemination within a wide variety of public health areas. The purpose of the Dubois project was to develop a dissemination framework to support the uptake or use of the BP material available to practitioners in heart health in Ontario. The framework was developed following a literature review, key informant interviews (experts in dissemination and diabetes), and practitioner interviews (diabetes prevention practitioners). A draft framework was piloted and additional feedback was received from knowledge developers, knowledge brokers, and adopters. The final dissemination framework and dissemination report by Dubois et al. (2003) has guided the development of the proposed tool for measuring reach. Reach can be quantified as the number of intended users who were aware of the project, giving them the opportunity to adopt it. Thus, it is important to identify who the end users are and what distribution points they contact to become aware of and access resources. Dubois and colleagues (2003) concluded their report with a list of recommended actions for dissemination of the BP resource. One of these actions was to disseminate the resource through various distribution points. These particular distribution points (expanded in Table 1) were selected based on their ability to reach target users/adopters of the resource. They were chosen by key informants (end users) interviewed by Dubois. Thus, for the specific

example of the *Best Practices in Type 2 Diabetes Prevention* document, the process for evaluating its diffusion or "reach" following dissemination could be conducted as follows:

1. Identify target users of the best practices

After dissemination has occurred, obtain lists of potential users (practitioners) to act as key informants and contact a sample of them via e-mail, telephone, and mail to complete the uptake questions (Appendix A). Answering "yes" to question 1, "I am aware of the document" (in this case, *Best Practices in Type 2 Diabetes Prevention*), indicates the dissemination effort has reached the intended user. The respondent could then continue on with the uptake questionnaire to determine their use of the BPs.

2. Identify distribution points for the best practices to reach users

Huge potential exists for reaching target adopters and beyond this population by dissemination through commonly accessed distribution sites. Distribution points could be considered intermediaries for potential end users, and Table 1 is an example of the range of possible distribution points for examining reach. After dissemination has occurred, relevant distribution points can be scanned to see if the *Best Practices* document is listed in their organization as a resource. Examining reach in this way determines whether key distribution points have been captured. Distribution points included people, networks, listservs, websites, databases, and coordinating bodies and therefore will need to be contacted using a variety of methods. These methods may include phone calls to people involved, accessing listservs, websites, and databases.

Measuring Uptake

Development of the uptake tool began by summarizing potentially relevant literature into an annotated bibliography. This was an effective way to gain a better understanding of the literature content. This exercise assisted in grasping the ideas central to evaluation, measurement, and, most importantly, in specific reference to KE. Several key articles and reports were chosen for their applicability to the development of a tool to measure KE, as they exhibited specific scales that could be adapted into a framework. Articles were reviewed to identify the knowledge outcomes considered and how various authors' conceptualization of KE outcomes mapped onto each other.

Table 1
Examples of Distribution Points to be Considered for the Diabetes Best Practices Document

Type of Source(s)		Specific Organization	Acronym	Website
Website	Resource centres across Canada	Canadian Diabetes Association	CDA	www.diabetes.ca
Website		Chronic Disease Prevention Alliance	CDPAC	www.cdpac.ca
Website		Canadian Health Network	CHN	www.canadian-health-network.ca
Website	Listserv	Nutrition Resource Centre	NRC	www.nutritionrc.ca
Website	Listserv	Activitalk		www.active2010.ca
Listserv		Ontario Health Promotion Email-Bulletin Feature	OHPE Bulletin	www.ohpe.ca
Listserv	Database	Lifestyle Information Network	LIN	www.lin.ca
Database		G7/G8 Heart Health		www.med.mun.ca/g8hearthealth
Coordinating Committee		For Diabetes Strategy		n/a
Other		Dietitians of Canada	DC	www.dietitians.ca
Other		Registered diabetes educators		n/a
Other		Banting and Best DC Institute	BBDC	www.bbdc.org
Other		Provincial Chronic Disease Prevention partnerships		e.g., www.opha.on.ca/projects/ocdpa.html
Other		Alberta Centre for Active Living		www.centre4activeliving.ca

Note. Expanded from Dubois, Wilkerson, and Hall (2003).

Five key resources (Hall, George, & Rutherford, 1979; Hall, Loucks, Rutherford, & Newlove, 1975; Johnson, 1980; Larson, 1982; Pelz & Horsley, 1981) contained measurement models that, while differing in terminology, significantly overlapped in the concepts measured. These resources consisted of scales and indices described by Dunn (1983). A figure of the selected scales was created in order to compare their indices to each other (Figure 1). A thematic analysis of the components of each scale determined that the index that corresponded to most of the categories in the other scales was the Level of Use (LoU) Scale (Hall et al., 1975). In Figure 1, themes corresponding to each other are indicated by connecting lines. This scale also had the most

comprehensive chart with detailed notes for each level. Key ideas emerged and were adapted to design a specific set of questions to assess uptake and knowledge exchanged after the dissemination of BP documents (Appendix A).

The uptake tool was constructed with a combination of the stages from the Seven Standards of Utilization (Knott & Wildavsky, 1980) and the categories of the LoU Scale (Hall et al., 1975), and designed as a questionnaire with questions similar to those used by Landry et al. (2001a, 2001b) and Estabrooks (1999). Sections of questions in the uptake tool were guided by the seven categories of knowledge utilization from Knott and Wildavsky (1980) (Table 2).

Table 2
Stages/Standards of Knowledge Utilization

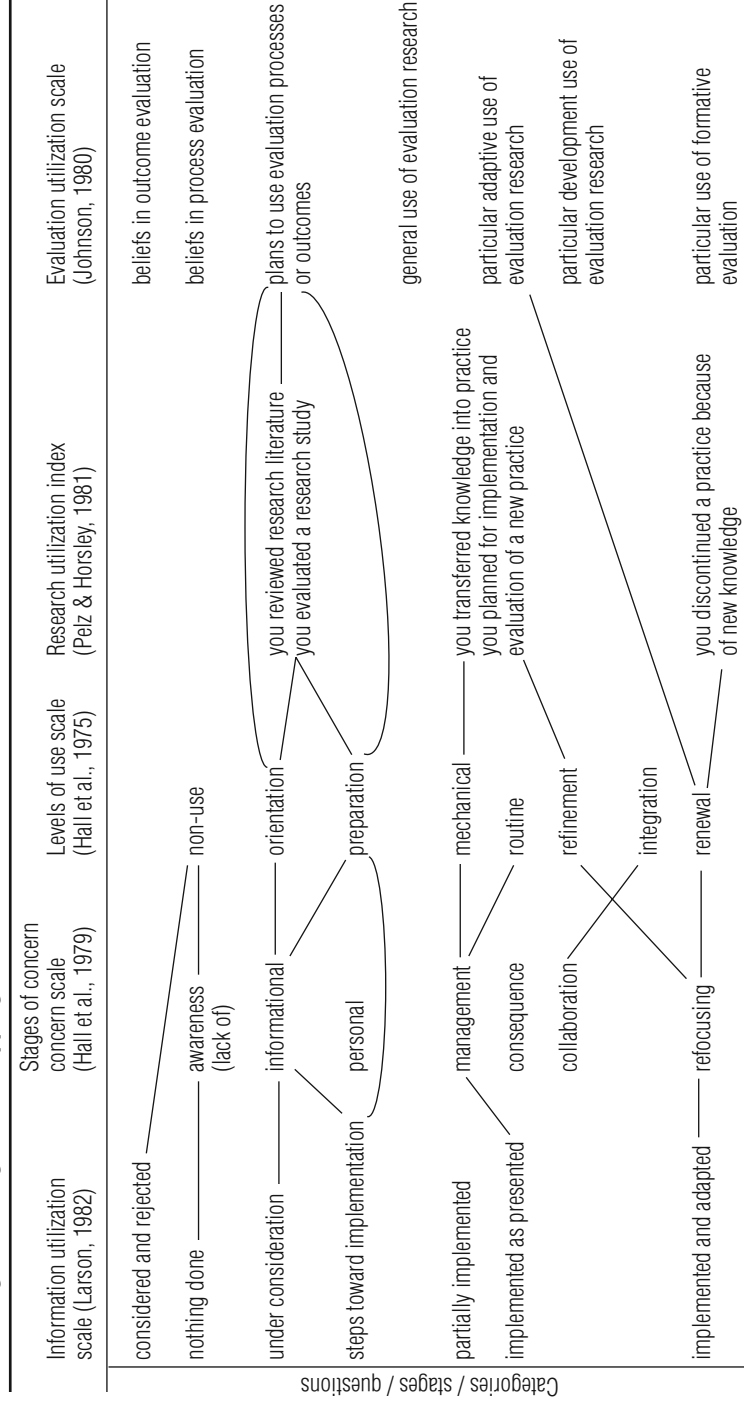| Stage	Category	Description
1	Reception	Receiving information/information[a] is within reach
2	Cognition	Read, digest, and understand information
3	Discussion	Altering frames of reference to the new information
4	Reference	Information influences action/adoption of information
5	Adoption	Influences outcomes and results/effort to favour information
6	Implementation	Adopted information becomes practice
7	Impact	Tangible benefits of information

Note. Summarized from Knott and Wildavsky (1980).
[a]The term "information" could be substituted by project, program, intervention, innovation, practice, policy, research, knowledge, document, evaluation, etc.

Knowledge uptake is strongly related to the context within which it is delivered (Davies et al., 2005), and it is critical to capture reasons behind the non-adoption of a disseminated innovation, especially if the practitioner was aware of and had access to it. Therefore, questions were added for deliberate non-use (or non-adoption) in Section 2 and were guided by Dobbins et al. (2002).

Landry et al. (2001a, 2001b) adapted the Knott and Wildavsky (1980) standards into six stages and used them to measure the extent of utilization of university research in public administration. They developed a series of questions that corresponded to each stage and requested answers using a Likert scale (1 = "never," 2 = "rarely," 3 = "sometimes," 4 = "usually," 5 = "always"). Likert scales are often used to measure opinions, beliefs, and attitudes (DeVellis, 2003). A Likert scale was not chosen for this tool for a number of reasons: the tool was

Figure 1
Measuring Knowledge Use: Mapping of Selective Scales and Indices

Information utilization scale (Larson, 1982)	Stages of concern concern scale (Hall et al., 1979)	Levels of use scale (Hall et al., 1975)	Research utilization index (Pelz & Horsley, 1981)	Evaluation utilization scale (Johnson, 1980)
considered and rejected				beliefs in outcome evaluation
nothing done	awareness (lack of)	non-use		beliefs in process evaluation
under consideration	informational	orientation	you reviewed research literature	plans to use evaluation processes or outcomes
steps toward implementation	personal	preparation	you evaluated a research study	
				general use of evaluation research
partially implemented	management	mechanical	you transferred knowledge into practice	
implemented as presented	consequence	routine	you planned for implementation and evaluation of a new practice	particular adaptive use of evaluation research
	collaboration	refinement		particular development use of evaluation research
	integration			
implemented and adapted	refocusing	renewal	you discontinued a practice because of new knowledge	particular use of formative evaluation

Categories / stages / questions

not intended to measure opinions, beliefs, or attitudes; respondents may not be able to discriminate meaningfully between a range of 5 and 6 response options (DeVellis, 2003); Likert-style response options did not follow logically as answers to many of the questions; and a primarily binary scale reduces the burden placed on the respondents (DeVellis, 2003). The uptake tool outcomes and levels of use (Table 3) were based on the LoU Scale by Hall et al. (1975). The LoU dimension intends to describe behaviours of innovation users and does not focus on attitudinal, motivational, or other affective characteristics of the user (Hall et al., 1975), thus further supporting binary response options instead of a Likert scale.

UTILIZING THE TOOL

Using the proposed tool should not require a lot of planning by the group interested in measuring the utilization of their BPs. Initial planning would entail identifying target users (as key informants) and distribution points, and determining a reasonable time frame from the time of dissemination.

It is expected that reach will be determined first, and then the uptake questionnaire can be used as an extension of the measurement of reach. When using the uptake questionnaire, the term "document" can be substituted by project, program, intervention, innovation, practice, research, knowledge, information, evaluation, policy, and so on.

Outcomes

The reach and uptake tools are primarily descriptive measures of outcomes. Reach is measured and described in two parts. First, after a list of target users has been generated, a random sample could be contacted to calculate a percentage of target users that are aware of the document (or innovation, program, etc.). Second, the number and type of distribution points captured can be described and compared to a list of relevant distribution points that were to be used for dissemination. It is beneficial to collect information on the type of users aware of the document and the type of distribution points that were captured, because this can inform future dissemination efforts.

The uptake tool intends to capture the thought process and actions of the user as well as provide valuable feedback for the disseminator. Thus, it is not informative to have a numerical score. Previous

experience will inform users' current practices, and they will integrate their existing knowledge as they adopt and implement new innovations. This will alter their progressive responses while completing the uptake questions and affect their level of uptake.

After questionnaires for uptake have been completed, the level of use for each individual user can be determined (Table 3). The levels are determined based on the responses to the uptake questions.

Interpreting the level of use or knowledge exchanged is not necessarily meant to be a continuous measure with a definitive endpoint (i.e., a Guttman-type scale). For example, in Table 3, *refinement* is not

Table 3
Uptake Outcomes and Levels of Use (LoU)

Scale point definitions: Levels of use of the innovation	Relationship to questions: Determining level
NON-USE: State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved	End here if No to Q 2, 5 or ended at Q 9
Decision Point A: Takes action to learn more detailed information about the innovation	
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 upon user and user system	Yes or Maybe or Sometimes/Often to any of Q 5, 6, 7, 8, 10, 11, 12 End here if No to Q 8
Decision Point B: Makes a decision to use the innovation by establishing a time to begin	
PREPARATION: State in which the user is preparing for first use of the innovation	Fully/Partially to Q 26 Yes to Q 27 End here if Not at all/Not sure to Q 25 and 26
Decision Point C: Begins first use of the innovation	
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 user needs than 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.	Yes to any of Q 25, 32, 33, 34 End here if No to all of Q 32, 33, 34, 36
Decision Point D-1: A routine pattern of use is established	
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.	Yes to Q 36 End here if No to Q 37

Table 3 (continued)

Decision Point D-2: Changes use of the innovation based on formal or informal evaluation in order to increase client outcomes

REFINEMENT: State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.	Yes to Q 37 End here if No to Q 38 and 39

Decision Point E: Initiates changes in use of innovation based on input of and in coordination with what colleagues are doing

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.	Yes to Q 38 or 39 End here if No to Q 40

Decision Point F: Begins exploring alternatives to or major modifications of the innovation presently in use

RENEWAL: State in which the user evaluates 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.	Yes to Q 40

Note. Definitions of levels of use and decision points are from Hall et al. (1975).

necessary for *integration* to occur. If practitioners are satisfied with a practice that they have adopted and have found to be effective, there is no motivation to change the intervention, and this does not prohibit the potential for collaboration and integration of the innovation with other organizations. Likewise, *renewal* (the last level) may not be the goal following adoption, as the innovation is likely already evaluated and does not require major modifications. However, an increased LoU or knowledge uptake occurs as a user moves toward higher levels and potentially passes through decision points (Table 3). The user does not need to complete consecutive levels before moving higher up on the scale, but can skip over a level. Skipping levels may be an indication of a user's previous knowledge and experience. Along with the completion of the uptake questions, it is important to gather qualitative information from the user. This will provide context for the uptake of the innovation. The final question in Section 1 allows for this dialogue to occur. In most cases, the goal of the disseminator will be for the user to reach the levels of *routine*, *refinement*, and *integration*. The outcome for Section 2 is a level of *non-use* and provides feedback on deliberate non-use of an innovation. This information is valuable for disseminators to consider in their future work when tailoring their innovations to end users.

DISCUSSION

As the title of this article suggests, this tool is in the development stage. This article describes details of the process used during tool development, in particular the theoretical basis on which the tool is based. While the tool appears to have face validity, the main limitation is that reliability and validity testing have not yet been conducted. Implications for use of the tool in practice are cautioned until further evidence is available.

Initial pilot-testing of the uptake tool has begun, and it appears to have a strong practical application. As part of a larger research study, the uptake tool has been adapted and used to facilitate and study the KE processes intended to enhance evidence-informed practice in public health. Thus far, it has been used to interview 20 Ontario health unit practitioners who received data and reports on smoking and physical activity in secondary school students in their region (E. Bonin, personal communication, September 29, 2006). The knowledge broker conducting these interviews has found the tool to be quick and easy to use (e.g., it takes about 10 minutes to conduct a phone interview). The knowledge broker made minor suggestions to improve the readability of the questions, and these have been incorporated. The KE research study demonstrates that the tool can be adapted to domains outside of BP documents, even toward measuring KE processes when the disseminated product is data.

Canada's premier health research funding agency has impact on health as part of its parliamentary mandate. Similarly, policy makers and practitioners are looking to be good stewards of resources. Satisfactory systems for KE are critical to meet these goals. Unfortunately, the system lacks adequate practical measurement of outcomes. KE measurement may be underdeveloped due to the lack of clarity in quantifying knowledge and poor tangibility of knowledge outcomes. Both the reach and uptake components of the proposed tool are based on theory in the published and grey literature, which gives the tool some credibility even though its utility has not yet been assessed. Measuring knowledge utilization (and exchange) requires the examination of a process of several events including (a) information pick-up, (b) information processing, and (c) information application (Rich, 1997). This tool attempts to capture that process in addition to collecting information on the reasons why a document or practice may not be adopted. Specifically, this tool can facilitate efforts of measuring the extent to which BPs have reached and are used by practitioners.

However, the tool is not exclusive to BPs and is valuable for many areas of population health and evaluation. Potential users of this tool include evaluators, researchers, policy and program decision-makers, as well as any person, group, or organization wanting to facilitate and measure KE processes. One of the important contributions of this tool is that when it is implemented, the tool creates an opportunity for knowledge to be exchanged. The uptake tool itself initiates or continues a connection between the end user of the innovation and the developer and/or disseminator of the innovation.

Future validation efforts are required to move this tool forward from the development stage. Qualitative data should be gathered to validate the tool, and steps outlined by DeVellis (2003) on scale development should be followed. Initially, several experts in the field of knowledge exchange should review the tool for content validity, and items determined to be ambiguous should be revised or removed. The tool should then be administered to a sample of participants selected from two groups: (a) intended users of the reach and uptake tools, and (b) target adopters/non-adopters who might be completing the uptake questions. Item responses from these two groups should be evaluated using factor analysis. Concurrent validity could be tested by collecting semi-structured qualitative data and analyzing the results to assess consistency of individual responses to the tool. Validation of this tool will add to its current utility as a quick, easy to implement, and theoretically grounded measure of KE outcomes.

The key contribution of this article is the synthesis of evidence on KE into a practical and usable questionnaire that works toward filling the gap on measuring KE outcomes. The significant value of this tool is that it engages both the producer and the user, from both sides of the KE equation, to exchange knowledge with each other.

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Appendix A
Uptake Questions: Questions for the Dissemination of Best Practices

SECTION 1
Awareness (I know the document exists)

    1   **Are you aware of the BP document**?
        YES (go to question 3)
        NO (go to question 2)

    2   **Would you like to learn more about this document?**
        YES (discontinue questions and distribute information)
        NO (discontinue questions)

Reception (I have a copy of the document OR know how to access the document)

    3   **Have you received a copy of the document?**
        YES (go to question 6)
        NO (go to question 4)

    4   **Did you retrieve a copy of the document on your own?**
        YES (go to question 6)
        NO (go to question 5)

    5   **Do you plan to access the document some time in the future?**
        YES
        MAYBE
        NO (discontinue questions)
        DON'T KNOW

    6   **Even before reading it, did you think the document might be useful?**
        YES
        MAYBE
        NO
        DON'T KNOW

Cognition (read, digest, and understand the document)

    7   **Have you read the document?**
        FULLY (go to question 10)
        PARTIALLY (go to question 10)
        NOT AT ALL (go to question 8)

    8   **Do you plan to read the document?**
        YES (go to question 13)
        MAYBE (go to question 13)
        NO (go to question 9)

    9   **Do you have the intention of reading the document in the future?**
        YES (discontinue questions)
        NO (discontinue questions)

    10   **Was the material in the document presented in a way you could understand?**
        YES
        NO

11   Did you understand the material presented in the document?
YES
NO
DON'T KNOW

12   Have you thought about the contents of the document since you read it?
NEVER
RARELY
SOMETIMES
OFTEN

Discussion (altering frames of reference to the new information)

13   Have you made other colleague(s) aware of this document?
YES
NO
DON'T KNOW

14   Have you discussed the document with colleagues within your organization?
YES (go to question 16)
NO (go to question 15)

15   Do you plan to discuss the document with colleagues within your organization?
YES
MAYBE
NO

16   Have you discussed the document with colleague(s) outside of your organization?
YES (go to question 18)
NO (go to question 17)

17   Do you plan to discuss the document with colleague(s) outside of your organization?
YES
MAYBE
NO

18   Have you sought the opinion(s) of other(s) who have used this document (e.g., through discussions, visits, or workshops)?
YES
NO

Reference (document influences action/adoption of information)

19   Have you cited this document in your own reports or documents?
YES (go to question 21)
NO (go to question 20)

20   Do you plan to cite this document in your own reports?
YES
MAYBE
NO
DON'T KNOW

21   Has this document introduced you to a new idea/way of thinking for a currently used practice (i.e., not a practice adopted from the document)?
YES
NO

22   Has this document changed your beliefs about a particular approach to practice?
YES
NO

Effort (efforts made to favour information)

23 Have you favoured the results in this document over other document(s)/sources of information?
YES
NO

24 Have you favoured using this document over other document(s)/sources of information?
YES
NO

Adoption (document influences adoption of a practice/practice adopted from document)

25 Have you adopted a practice outlined in the document?
FULLY (go to question 28)
PARTIALLY (go to question 28)
NOT AT ALL (go to question 26)

26 Do you plan to adopt a practice outlined in the document?
FULLY (go to question 27)
PARTIALLY (go to question 27)
NOT AT ALL (discontinue questions)
NOT SURE (discontinue questions)

If answered NOT AT ALL or NOT SURE to Question 26 proceed to Section 2.

27 Do you know when you will begin to use the practice you plan to adopt?
YES (discontinue questions)
NO (discontinue questions)

28 a) Was the practice you adopted a Best Practice (as defined by the document/ source)?
YES (go to question 30)
NO (go to question 29)
b) Was the practice you adopted a Promising Practice (as defined by the document/ source)?
YES
NO

29 Have you stopped a non-recommended practice?
YES
NO
NOT APPLICABLE

30 Have you combined together the components of more than one practice?
YES
NO

Implementation (adopted information becomes practice)

31 Overall, in the past 1 (6, 12, 18) month(s), how fully have you used a practice recommended in the document?
NOT AT ALL
A LITTLE
A LOT
A LOT, BUT ADAPTED FROM THE ORIGINAL

32 Have you employed short-term strategies for using this practice?
YES
NO

33 Do you know the short-term effects (outcomes) from using this practice?
YES
NO

34 **Do you spend your time managing the activities of the practice?**
YES
NO
35 **Do you know the long-term requirements to using this practice?**
YES
NO
36 **Has using this practice become routine (i.e., practice runs smoothly with minimal management problems)?**
YES
NO
37 **Have you varied your use (i.e., made modifications) of the practice to increase its impact on your target population?**
YES
NO
38 **Have you collaborated with colleagues and/or other organizations targeting the same population to implement this practice?**
YES (go to question 40)
NO (go to question 39)
39 **Do you plan to collaborate with colleagues and/or other organizations targeting the same population to implement this practice?**
YES
MAYBE
NO
40 **Have you explored other practices that could be used in combination with, or in place of, the current practice to improve effectiveness?**
YES
NO

Impact

41 **Has this practice made an impact on your target population?**
YES
MAYBE
NO
DON'T KNOW
42 **Has your use of this document changed a current practice or routine in your work?**
YES
MAYBE
NO
DON'T KNOW
43 **Have you encouraged a colleague(s) to adopt this practice?**
YES
NO
44 **Have you persuaded a colleague(s) to adopt this practice?**
YES
NO

Additional Comments
Are there any additional comments you would like to make about the document or practice?
(Your comments do not need to be related to an adopted or implemented practice.)

SECTION 2: Deliberate Non-use
This section only applies to answers NOT AT ALL or NOT SURE to Question 26.
x   Please indicate ALL of the following reasons why you chose not to adopt this new source of information/document/practice/intervention/innovation.

Innovation Characteristics

Relative Advantage

I have an equivalent program already in place

The innovation was not perceived to be better than the current program

The innovation did not show any economic advantage from adopting it

The innovation was more time-consuming and required more effort than the current program

Compatibility

The innovation was not consistent with the current values of my program or organization

The innovation did not meet the needs of my program or organization

Complexity

The innovation was too difficult to understand

The innovation was too difficult to implement or use

Trialability

The innovation could not be implemented on a small scale to determine its advantages or disadvantages

I have not heard of any other organization(s) related to mine that have adopted this innovation

Observability

I have not seen this innovation successfully implemented

Organizational Characteristics

Size and Resources

My organization is too small or too large to adopt this innovation

My organization does not have enough personnel resources (staff) to adopt this innovation

My organization does not have enough financial resources to adopt this innovation

Location

My organization was not in an appropriate location to adopt or implement this innovation

Hierarchy

I do not have enough decision-making authority in my position to decide to adopt this innovation

I was not able to prove to my supervisor that this was an important innovation to adopt

Formalization

This innovation did not follow the rules and procedures of my organization

There was not enough research evidence that this innovation would be effective or successful

Environmental Characteristics

There is not enough collaboration or potential for networking with other organizations to be able to adopt and implement this innovation

Individual Characteristics

This innovation did not seem relevant to my practice

It is not an appropriate time to be adopting this innovation

This innovation does not coincide with my values or beliefs about what is effective

I have insufficient time to adopt and implement a new innovation

Other

Other reasons not mentioned above have resulted in non-adoption of this innovation

These other reasons are:

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