Toward a Conceptual Knowledge Management Framework in Health

by Francis Lau, PhD

Abstract

This paper describes a conceptual organizing scheme for managing knowledge within the health setting. First, a brief review of the notions of knowledge and knowledge management is provided. This is followed by a detailed depiction of our proposed knowledge management framework, which focuses on the concepts of production, use, and refinement of three specific knowledge sources-policy, evidence, and experience. These concepts are operationalized through a set of knowledge management methods and tools tailored for the health setting. We include two case studies around knowledge translation on parent-child relations and virtual networks in community health research to illustrate how this knowledge management framework can be operationalized within specific contexts and the issues involved. We conclude with the lessons learned and implications.

Introduction

Knowledge

Davenport and Prusak define knowledge as a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.[1] In organizations, knowledge often becomes embedded in documents, repositories, and organizational routines, practices, and norms. In their seminal work on knowledge creation, Nonaka and coworkers propose a theory of organizational knowledge creation based on a never-ending spiral of tacit and explicit knowledge conversion through socialization, externalization, combination, and internalization.[2,3] While explicit knowledge is often precise and can be formally articulated in organizations, tacit knowledge is the know how within individuals that is much harder to express, except through experience.[4] Supporting this latter point is also the notion that the act of knowing is a social construct of translation and making sense of one's information, experiences, and insights within a given context.[5,6]

Knowledge Management

From a practical standpoint, organizations need to know what, how, why, where, and when to use their knowledge in order to be successful. They also need to view knowledge management (KM) as a strategic way of integrating the organizational know how, processes, and learning.[7,8] Davenport et al. have examined 31 KM projects in 24 companies and summarize what made them successful.[9]

1. linkage to economic performance and industry value
2. existing technical and organizational infrastructure
3. standard but flexible form of knowledge structure
4. knowledge-friendly culture
5. clear purpose and language among staff
6. change in motivational practices
7. multiple channels of knowledge transfer
8. senior management support

The four common types of KM projects noted are to build knowledge repositories, improve knowledge access and use, enhance knowledge environment, and manage knowledge as an asset.[10] Current KM research issues include refining a

knowledge vocabulary, taking into account its organizational and cultural contexts, identifying ways of managing and measuring knowledge acquisition, refinement, and use, and nurturing knowledge creation through communities of practice as part of organizational learning.[11-14]

Knowledge-based Healthcare

In our view, the notions of KM are not well established in the health setting. A recent scan of the health literature revealed few KM-related articles, many of which are on theoretical aspects of understanding professional knowledge such as nursing, or on technical representation of expert knowledge in medicine (see, for example, Fox and Silverman[15,16]). The 2002 Knowledge Roundtable in health, held at Queen's University in Canada, reported successful examples of KM practices in health settings that include critical care pathways, care planning, evidence-based decision making, and virtual health networks.[17] The roundtable also identified unresolved challenges such as the need for user participation, information technology (IT) investment, and organizational structures and cultures that support KM.

These findings led us to believe that an opportunity exists to apply business KM concepts to create a healthcare delivery system that is strategic, proactive, and knowledge intensive. This paper describes a conceptual KM framework that comprises a set of KM concepts, methods, and tools for the health setting. We include two case studies around knowledge translation on parent-child relations and a virtual network in community health research to illustrate how this framework can be operationalized in specific contexts and the issues involved. We conclude with lessons learned and implications.

A Proposed Knowledge Management Framework

Assumptions

Our framework provides an initial conceptualization of KM for the health setting. First, we define knowledge as information combined with experience, context, interpretation, and reflection. The knowledge source may be explicit or tacit depending on where it is located (for example, policy document versus individual expert). KM, then, is the systematic approach to translating between the explicit and tacit forms of this knowledge in a given context. While we believe one can manipulate knowledge as discrete objects, we also recognize that the act of "knowing" is a socially constructed sense-making endeavor that requires ongoing dialogue, coordination, and collaboration among policymakers, practitioners, and researchers to be effective and sustainable.

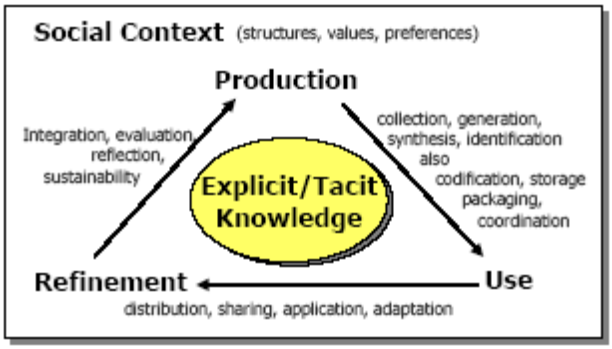
Knowledge Management Concepts

We have established a common vocabulary to describe this KM framework to foster a shared understanding. The three knowledge sources of particular interest are policy synthesis, research findings, and local practices, referred to by the Canadian Health Services Research Foundation as policy, evidence, and experience, respectively.[18] The core concepts within this framework are knowledge production, use, and refinement, situated within a complex and evolving social context. As such, these concepts are interrelated, iterative, dynamic, and layered with multiple meanings and interpretations. This conceptual framework is shown in Figure 1. Note that each core KM concept can be expanded into following subconcepts.

- **Knowledge production** has two parts: creation of knowledge through collection, generation, synthesis, and identification; and organization through codification, storage, packaging, and coordination.

- **Knowledge use** consists of distribution, sharing, application, and integration.
- **Knowledge refinement** consists of evaluation, reflection, adaptation, and sustainability.
- **Social context** refers to the underlying structures, values, and preferences of individuals and organizations.

Figure 1: A Conceptual Knowledge Management Framework in Health



Knowledge Production

Knowledge production refers to different means of creating and organizing policy, evidence, and experience. The creation of such knowledge in particular settings from policy syntheses, research findings, and local practices involves these subconcepts.

- **Collection** of local experience around specific clinical cases and health services/programs that reflect practice norms, organizational forms, and values/preferences in a particular health setting.
- **Generation** of new understandings of relationships between specific factors, processes, and outcomes from primary research and policy development such as a randomized trial or case study in a particular health setting.
- **Synthesis** of available research findings, policy advice, and local experiences in specific areas of health through a critical review process such as systematic review.
- **Identification** of individuals, groups, and organizations as resources with expertise or experience in specific areas of health who are willing to share their tacit knowledge.

As policy, evidence, and experience are being created, some formal means of organizing this knowledge is required. Depending on whether the knowledge is explicit or tacit, it may be stored in repositories as artifacts or acknowledged as intellectual resources for consultation. The subconcepts for organizing policy, evidence, and experience are:

- **Codification** of knowledge using appropriate nomenclature for its description, classification, and indexing (examples include the use of Systematized Nomenclature of Medicine or SNOMED to codify practice experiences, structured abstracts for scientific literature, and policy synthesis briefs for options analysis);
- **Storage** of knowledge in computer-based repositories to allow its retrieval, updating, monitoring, and archiving;
- **Packaging** of knowledge with different levels/types of content details and delivery modalities targeted at specific groups of policymakers, practitioners, and researchers; and
- **Coordination** of intellectual resources on such details as their expertise, experience, location, and availability.

Knowledge Use

Knowledge use refers to the manner by which policymakers, practitioners, and researchers use policy, evidence, and experience as knowledge within the local setting. As such, this knowledge not only needs to be disseminated to the intended audience, it must be translated and even modified to suit local circumstances such as geographical, value, and cultural differences. The subconcepts for knowledge use are:

- **Distribution** of knowledge through different modalities such as newsletters, bulletins, policy briefs, and Web-based resources to targeted audiences;
- **Sharing** of knowledge through interpersonal communications and dialogues via such forums as workshops;
- **Application** of the knowledge within a local setting as new policies, guidelines, or practice routines; and
- **Adaptation** of the knowledge to suit local circumstances such as values, cultures, and norms for implementation in a specific health setting.

Knowledge Refinement

Knowledge refinement refers to ways in which policy, evidence, and experience as knowledge sources are institutionalized with organizations over time as part of routine practices in a taken-for-granted fashion. The means of knowledge refinement are:

- **Integration** of knowledge with or without adaptations as part of existing work processes and practice norms in a taken-for-granted fashion within the local setting;
- **Evaluation** of a specific knowledge source using different structure, process, and outcome/output measures such as quality of knowledge produced, extent of its use in a given setting, and effect on the organization and its staff;
- **Reflection** on the knowledge source through subjective interpretations by policymakers, practitioners, and researchers (examples include personal experiences and lessons learned from those involved with producing and using the knowledge in a given setting); and
- **Sustainability** of the KM approach by ensuring that policymakers, practitioners, and researchers are committed to ongoing production, use, and refinement of the knowledge sources within the local setting.

Social Context

Social context is the production, use, and refinement of policy, evidence, and experience as knowledge take place in a complex and changing context that renders these concepts unique and difficult to replicate. This evolving context is influenced by social structures, value systems, and personal choices as outlined below:

- **Structures** provide the organization, rules, and processes that make up the social environment where policymakers, practitioners, and researchers reside and operate.
- **Values** are personal viewpoints, morals, and standards used by policymakers, practitioners, and researchers as guiding principles for their beliefs and actions.
- **Preferences** are choices and priorities set by policymakers, practitioners, and researchers on a wide range of health issues based on their belief systems and needs.

Knowledge Management Methods and Tools

The KM concepts are operationalized through a collection of methods and tools adapted from other disciplines and approaches to deal specifically with policy, evidence, and experience in the health setting.

KM Methods

Knowledge management methods are drawn from other disciplines and approaches including systematic literature review, evidence-based decision making, organizational sense making, group and relational development, knowledge creation, information system evaluation, and reflective practitioners. These methods are grouped according to whether they deal with new or existing knowledge sources, or by the individuals involved:

- **Consensus-based critical review** is focused on the production of existing knowledge. It includes synthesis of evidence and policy through critical appraisal of literature, collection of local practice experience, and packaging of this knowledge for distribution to the target audience.
- **Collaborative knowledge building** deals with the generation of new policy, evidence, and experience as original knowledge through primary research with stakeholder participation. It also covers codification, storage, packaging, and distribution of this new knowledge.
- **Group sense making** involves deliberation, negotiation, and decision making by researchers, practitioners, and policymakers around the application, adaptation, integration, and evaluation of specific new or existing knowledge in local settings.
- **Work group development** involves the identification and coordination of communities of practice in specific settings to engage in collaborative knowledge work. Such group methods as facilitation, decision making, consensus building, and relational development are adapted as KM methods that emphasize sharing and reflection of policy, evidence, and experience as tacit knowledge.

KM Tools

The KM methods are implemented with a collection of manual and automated tools to support the KM processes. Examples of KM tools developed by the authors and others under different online environments follow:

- **Knowledge translation tools** are used to synthesize and package knowledge resources, such as scientific literature, into systematic reviews and policy briefs. An example is the Web-based software the authors have developed for consensus-based critical review of existing policy, evidence, and experience from ShirWin Knowledge and Learning Systems in Alberta, Canada. This Web-based tool has a set of entry and query forms for quality assessment of literature, collection of local practices, and evaluation and reflections of this knowledge.
- **Knowledge mapping tools** are used to organize, represent, and store concepts and their relationships. Examples are knowledge representation and diagramming tools, such as Protégé 2000 and MS-Visio. Protégé 2000 is a product developed by the medical informatics Department at Stanford University. Both products codify and store new concepts and their relationships as ontology maps, Health Level-7 (HL7) messages, and guideline interchange format (GLIF)-based guidelines.
- **Group collaboration tools** refers to groupware that supports interactions of groups in organizations to exchange information, share ideas, support peers, and collaborate on projects. Examples include such groupware as Web4M for Web conferencing and MeetingWorks for brainstorming, voting, and decision-making.
- **Online knowledge repositories** allow new and existing policy, evidence, and experience to be codified and stored as Web-based knowledge resources. Also included are metadata schema and knowledge maps for navigating through the knowledge repositories, and audit trails for logging of activities.

Two Illustrative Cases

Case 1: Knowledge Translation in Parent-Child Relations

Background

We recently completed a 20-month study funded by the Canadian Population Health Initiative to apply the KM framework to produce, use, and refine available evidence around a health issue of relevance to five managers from the Child Youth and Family Program of the Central Vancouver Island Health Region in British Columbia. Our original research question was whether program managers would use the knowledge produced through this KM approach in their decision-making. During initial meetings these managers expressed interest in parenting education interventions for parents of young children (birth to three years) to strengthen parent-child relationships. Through negotiation, the refined question became whether program managers would use the parenting education knowledge produced through this KM approach in their public health programs on early childhood development. Because the study was only funded for 20 months, we realized it would be difficult to show immediate effects because of the significant time and effort required to implement public health programs within the region. Nevertheless, the managers believed this KM study could assist them in the planning of local parenting education programs.

Methods

The methods employed to produce, use, and refine parenting education knowledge consisted of systematic literature review with follow-up of selected authors and instruments on their current status; packaging of this evidence as detailed or summary research reports, structured abstracts, and executive briefs; and distribution of this evidence as new knowledge resources through the Web repository and in hard-copy formats. The managers took part in refining the research question and literature search process, critiquing and refining the evidence synthesized by the researchers, and exploring ways to adapt the evidence for local application. To study the KM process, we collected data from interviews with the managers, field notes from team meetings, and transcripts of discussions from conducting the systematic review. An independent consultant also conducted a formative and summative evaluation with the managers.

Results

The knowledge production process to gather literature, undertake systematic reviews, and follow up on instruments and programs required more time than anticipated. For example, it took more than six months for the researchers and managers to reach a mutual understanding on the question and terms on parenting education and parent-child relations. Out of 450

publications, the systematic review identified 17 primary and three review articles that were considered relevant. The reported studies ranged from randomized trials to cohort pilots but were mostly considered weak to moderate in quality rating because of small samples, confounders, and intervention inconsistencies. The review showed that no single measure of parent-child interaction is valid, reliable, and practical for ongoing use in evaluation of parenting education programs across cultures and socioeconomic groups. The follow up of literature did identify a number of universal parenting education programs and instruments for measuring parent-child relations worth pursuing and adapting by the managers for local implementation.

Effects

The managers commented that the study helped them clarify their thinking as a team, define what they were trying to do, put it into research terms, identify their information needs, and think about how they could make the time and transition to apply the knowledge in their practices. The external evaluation revealed that the managers felt the project was worthwhile and were committed to continuing the collaboration with the researchers. The managers did spend time thinking about and exploring possible next steps for using the knowledge generated through the study to make changes in their programs. The challenges identified were in trying to communicate their needs to the researchers, narrowing the focus topic, understanding what the study was about, and their role. Because of time constraints, the potential use and usefulness of the knowledge produced has not yet been fully assessed. The managers stressed the importance of keeping the knowledge resources current so they would be of value over time. Thus far, our effort to seek further funding to conduct stakeholder buy-in workshops on the knowledge produced has been unsuccessful. However, we did recently obtain funds from the Human Early Learning Partnership Program to refine the KM tools with an emphasis on critical appraisal, follow-up, and knowledge translation.

Case 2: Virtual Networks for Community Health Research

Background

In the mid 1990s the Alberta Heritage Foundation for Medical Research (AHFMR) began to grapple with the problem of low uptake of health research knowledge in practice settings.[19] Part of this problem was due to the lack of receptor capacity in the field that could translate research knowledge in ways that can be used in decision-making. In 1996 AHFMR partnered with the Regional Health Authorities, the Universities of Alberta and Calgary, and the Alberta Ministry of Health to train practitioners in applied health research and the use of evidence in decision-making through an innovative research training program called SEARCH. The purpose of this program was "to increase the capacity throughout Alberta to acquire, aggregate, interpret and apply health information in individual, regional and provincial health decisions and programs, and to facilitate more effective management of the health system."[20]

Methods

The original program was delivered over two years, with two residential learning modules of two to three weeks each, coupled with ongoing virtual learning and individual and collaborative projects through the Internet. Each trainee was given a laptop computer with groupware and Internet access to organize their knowledge resources, communicate with each other, collaborate on projects, and contribute to a Web-based experience repository. The participants were evaluated by the researchers at every three, six, and 12-month interval. The data collected include program documents, interviews, meeting notes, computer usage statistics, online surveys, conference postings, and course feedback. The latest curriculum is organized into seven residential modules of five to seven days each, with three learning themes around creating, choosing, and using evidence.

Results

To date, more than 75 health practitioners have enrolled in this program and learned to how to conduct relevant research using evidence to apply in decision making within their workplaces. A key component of this program has been the formation of a community of practice among mentors, trainees, experts, and stakeholder organizations throughout the province in the form of a virtual network. This has allowed participants with various backgrounds, roles, and expertise to be identified and coordinated in ways that allow the sharing and reflection of their tacit knowledge across settings in a sustainable manner. More than 50 individual and 10 group projects on different health issues relevant to the regions have been completed and presented; several

projects have been published in peer-reviewed journals; and some participants were successful in obtaining external research grants.

Effects

The SEARCH program has been evaluated on an ongoing basis by AHFMR. Some of the reported effects at the local level include: (1) 70 percent of participants continued to be active in research four years after completing the program; (2) many have moved into more senior positions with greater research responsibilities; and (3) through the participants some regions have become active in province and nationwide initiatives such as the national health indicators and the provincial minimum data sets.[21] Current evaluation efforts are focused on change impacts at the health systems level. Another indication of the success of this program is that the Canadian Health Services Research Foundation recently adapted the SEARCH model for its newly established national health research training program for senior decision makers in the health system, the Executive Training in Research Application, which started in the fall of 2004.

Discussion

This section discusses the lessons learned and implications of the proposed KM framework. The two illustrative cases describe the processes, results, and effects of employing the KM framework as an organizing scheme to manage policy, evidence, and experience as three distinct knowledge sources in the health setting. While the emphasis of the knowledge translation case is on the production and use of explicit knowledge, the virtual network is focused primarily on the sharing of tacit knowledge among a community of practice. Although the effect of parenting education knowledge on parent-child relations in the knowledge transfer case is yet to be seen, the case does highlight the issues and challenges involved when implementing the KM framework in practice. The four key lessons learned thus far are that:

- **Interplay of tacit and explicit knowledge** is an integral part of managing knowledge in the health setting; online knowledge repositories can only be as good as the willingness of individuals within the organization to externalize, combine, socialize, and internalize that knowledge as part of their routine work practices.
- **Purpose, focus, and scope** are essential when defining a KM initiative within the organization and communicating its importance, relevance, and effects to management and staff, who need to be convinced of the value of KM in the organization at a practical level in order to devote the resources needed to make the initiative successful.
- **Generalization versus contextualization** of knowledge is an important dichotomy, as the notion of generalizability from scientific studies as evidence by researchers is opposite from policymaker and practitioner needs to make sense of this evidence by applying and adapting it in ways consistent with the local social context.
- **Facilitation and knowledge brokering** are necessary "translation" mechanisms by which knowledge in the form of policy, evidence, and experience can be shared, applied, adapted, and integrated in the health setting. Yet these mechanisms are highly resource intensive and must produce tangible outputs/outcomes in order to demonstrate measurable benefits.

Research and practice implications must also be considered. In terms of research, while the KM concepts, methods, and tools within this framework provide specific approaches by which policy, evidence, and experience as knowledge can be produced, used, and refined, more empirical work is needed to determine the ways and extent to which this KM framework can be adopted in other health domains and settings. For practice implications, health organizations wishing to adopt this framework will need to devise the appropriate strategy, process, and resources to ensure these KM concepts, methods, and tools can be deployed in sustainable ways with measurable effects. Also of importance is the level of organizational readiness, which determines the degree of change that can be introduced at a given time.

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