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A Literature Review on Distance Knowledge Exchange in Healthcare Groups: What Can We Learn From the ICT Literature?

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Abstract As healthcare groups continue to communicate and collaborate at a distance on knowledge exchange activities, Information and Communication Technology (ICT) has come to play an increasingly important role in supporting such interactions. However, to date, the literature on knowledge exchange appears disconnected from that of ICT. Research on the effects of ICT on knowledge exchange activities is needed. The literature review explores the potential impacts ICTs can have on knowledge exchange groups, and especially, the social interaction process. A discussion of how ICTs could impact the social interaction process of knowledge exchange activities is made.

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Introduction

Information and communication technologies (ICT) such as e-mail, teleconferencing, video-conferencing, and web-conferencing plays a large role in supporting distant communication and collaboration between knowledge exchange groups. Little is known on the impacts ICTs may have on knowledge exchange activities, and especially, the social interaction process. The purpose of this paper is to review the literature on ICTs and explore the potential impacts ICTs may have on the knowledge exchange social interaction process. The literature review is organized as follows: (1) methods of the literature review are discussed; (2) knowledge exchange is defined; (3) knowledge exchange in healthcare groups is discussed; (4) knowledge exchange within health informatics is discussed; (5) the general impacts of ICTs on social interactions; and (6) the potential impacts of ICTs knowledge exchange social interactions are made.

Methods

The focus of the literature review was to gather evidence on the impacts of information and communication technologies on group social interaction norms. After reviewing the literature, we were able to determine several key words and terms that helped define our initial search. Using several different online databases and article

indexes between 2004 and 2006, we were able to gather a core of literature on the subject.

A broad search strategy was used covering separate electronic databases including Pubmed, ERIC, IEEE Xplore, and Academic Search Premier. Most of the articles were obtained through the University of Victoria Library's online catalog which allowed access to full-text articles. Search terms used were: social interaction norms, social interactions, information and communication technology, groupware, and group decision-support systems. Reference lists of relevant articles were also perused and articles that were deemed relevant were extracted and included in the review.

A second literature search was conducted between August 2006 and August 2009 to include the latest trends on the impacts of information and communication technologies on group social interaction norms. Pubmed, ERIC, IEEE Xplore, and Academic Search Premier were searched using the same terms used in the original search. A core list of review articles were included in the review as a result of the second search.

Defining knowledge exchange

Several terms are used in the literature to describe collaborative research efforts. In this paper, we use the term knowledge exchange. CHSRF 2008 [7] defines knowledge exchange as collaborative problem solving between researchers and decision-makers that happens through linkage and exchange. Linkage and exchange are processes embedded within knowledge exchange where researchers and decision-makers "are engaged in ongoing interaction, collaboration, and exchange of ideas" [7]. Therefore, knowledge exchange can be defined as a collaborative problem solving approach between decision-makers and researchers that happens through communication linkages and information exchanges.

In addition to these definitions, other researchers have proposed various models that provide explanations for use and non-use of research knowledge in the collaborative research process. For example, the two-communities model, also known as the interaction model, assumes that the amount of interaction (i.e., linkage and exchange) between researchers and decision-makers is a predictor of use or non-use of research knowledge by decision-makers [25]. This perspective on linkage and exchange assumes that several barriers exist between the research world and decision-making world. Only through increased communication linkages and information exchanges between decision-makers and researchers can research become more relevant and useful to the decision-making process. Studies have shown that such research partnerships can successfully support the implementation of effective interventions that are both of scientific and practical value [5]. Hence, the challenge is to close the cultural gap by creating linkages and exchanges between the two cultures where both decision-makers and researchers are involved in the research process [8].

The two-communities model explains why barriers between decision-makers and researchers exist. For example [11], suggests that researchers and decision-makers work on different timelines, use different languages, and respond differently to incentives. Leung (1992) [16] claims that a sense of distrust and antagonism permeates interactions between the two-communities.

Rich (1991) [24], however, provides a more comprehensive explanation of the barriers to linkage and exchange within policy decision-making. He classifies the two-communities barriers in considerable detail: (1) a general distrust and sense of antagonism between the two groups; (2) different reward systems (e.g., researchers are rewarded through publication and managers are rewarded by concrete policy results); (3) different communication styles (e.g., researchers use terms that amount to jargon); (4) different perspectives on time (e.g., while it may take years for researchers to provide this information, whereas decision-makers require information immediately); (5) different perspectives on research relevance (e.g., academic studies' results in their published form are not relevant to decision-making needs).

As previously noted, knowledge exchange researchers believe that increasing the interactions between decision-makers and researchers will lead to fewer barriers and an increased use of research results in the decision-making process [14]. These interactions can occur through (a) informal contacts with decision-makers and researchers; (b) researcher involvement in research, committees, seminars, and workshops organized by government agencies; (c) reports to government agencies [15]; and (d) the involvement of knowledge brokers to facilitate the knowledge translation process [14].

However, once a relationship between decision-makers and researchers has been established, maintaining such a relationship can be difficult. For instance, value or process conflict between the two groups may impede the relationship [2]. To reduce the effect of such problems, researchers have focused their attention on finding ways to build trust through: frequent e-mail and face-to-face interactions; group sense making sessions; conflict resolution procedures; and procedural restructuring [27].

Even with positive working relationships, other external factors may cause the linkage and exchange process to fail. For example, research studies demonstrate that the linkage and exchange process tends to move slowly even when relationships between decision-makers and researchers are

positive [27]. A slow process can lead decision-makers to lose interest in the research process.

Nonetheless, the two-communities model has been widely used to explain how the knowledge exchange, and more specifically, the linkage and exchange process can be effectively implemented with researcher and decision-maker groups [21]. Studies in the healthcare domain continue to use the two-communities model to explain the failure or success of decision-maker and researcher inter-actions working within the context of knowledge exchange.

Knowledge exchange processes in health care

Traditionally, researchers have been the source of ideas that direct the research process, while users of research, such as policy decision-makers, have been receivers of research results [15]. This view of the research process assumes that decision-makers will search for research information in academic journals and use it to inform or guide policy decisions [17]. However, research studies alone may be insufficient to inform or guide policy decisions [15].

To make research results more relevant to decision-making needs, researchers and policy decision-makers are beginning to collaborate more often on research projects. Policy decision-makers are now included in the formulation of research questions, methods, and the publication of research results. Proponents claim that communication linkages and information exchanges between researchers and policy decision-makers during the research process make research results increasingly relevant to decision-making needs [17]. However, research process models have not accounted for policy decision-maker and researcher interaction during the research process.

Research process models remain focused on the researcher as the source of ideas and direction throughout the research process. For example, [3] described an adapted research process model that is generic and non-sequential. The authors demarcated eight research processes: (1) generating ideas; (2) conducting library research; (3) refining the research topic; (4) planning a research strategy; (5) specifying a research design; (6) collecting data; (7) analyzing data; and (8) publishing research results. Varke-visser et al. (2003) [33] proposed a specific research model for conducting health research and proposal development. The steps outlined in their model include (1) selecting, analyzing, and stating the research problem; (2) reviewing the literature; (3) formulating the research objectives; (4) outlining the research methodology; (5) describing the work plan; (6) budgeting; (7) planning for project admin-istration and utilization of results; and (8) providing a proposal summary. Booth et al. (2003) [4] described a simpler approach to the research process beginning with:

(1) understanding the problem; (2) developing a research question; (3) researching the problem; (4) answering the research question; and (5) applying the findings to solve the problem. None of these research process models includes consideration of decision-maker input in the process; as a result, opponents have criticized these traditional research approaches for not producing relevant research that can be used by decision-makers to solve real world problems [17].

Technology use in the research process: a health informatics perspective

The increasing demand for linkage and exchange between researchers and decision-makers underlies the need for the development of new tools to facilitate co-operation between these two groups. For years, researchers have used e-mail, telephone, video and web-conferencing, and group decision support systems to coordinate the communication required to promote research collaboration [26]. Some of the first research groups to use ICT for communication and collaboration were in the fields of physical oceanography, worm genomics, and space physics [32]. The field of health informatics includes two well-known research collabora-tives: HealNet and InterMed Collaboratory.

HealNet (1995–2002) was a national network of Cana-dian researchers from the health, social, and applied sciences whose primary aim was to improve the health of Canadians by making research knowledge available to healthcare decision-makers. The research network was composed of 20 universities, 31 private sector companies, five federal departments, 24 provincial departments, and 29 other organizations (HealNet 1999). However, a review of the annual reports on the HealNet website and a search on PubMed did not reveal any formal evaluation studies on the use of ICT in the linkage and exchange process between researchers and decision-makers collaborating in the network.

Patel et al. (1999) [23] and [28] have extensively evaluated the use of ICT in the InterMed Collaboratory. The InterMed Collaboratory (1994–1998) was a research collaboration involving five medical institutions in the United States and one in Canada with the objective of developing and sharing software system components and procedures to support the goals of three health informatics research projects. InterMed also had a second objective— to provide clinical applications, guidelines, and knowl-edge bases for clinical, administrative, and educational purposes. The studies by [23] and [28] focused on how researchers collaborated using various communication media, such as e-mail, teleconferencing, and face-to-face meetings. The authors did not discuss researcher decision-maker interactions.

As important as the work of Patel and colleagues has been for understanding how research groups collaborate using ICT within healthcare, a gap in the health informatics literature remains, that is, evaluating the effects of ICT on knowledge exchange, and especially, social interactions.

Effects of ICTs on social interactions

There is an insignificant amount of literature available discussing the impacts of ICTs on social interaction norms within knowledge exchange groups. In this section, a general overview of the impacts of ICTs on social interactions is made. The insignificant researcher points to an area of needed examination in order to better understand the impacts of ICTs on the social interaction dimension of group function working within the contect of knowledge exchange.

Of the researchers examining the effects of ICT on group processes, [37] were among the first to analyze group social interaction processes within groups using technology, and specifically, Group Decision Support System (GDSS) literature. In general, the group interaction process within GDSS supported groups has been studied from the point of view of how technology influences behaviour, which means that these studies focused on how group members interacted with each other and consciously or unconsciously influenced one another in the performance of group related decision-making tasks [13].

In a laboratory study, [37] specifically examined group influence behaviour and how members using different communication media (face-to-face and GDSS) influenced each other when working on group tasks. The authors divided influence behaviour into five categories: (1) initiation behaviour (which concerns initiating agendas); (2) goal-oriented behaviour (which concerns group goals); (3) integrative behaviour (which concerns the summary and integration of group contributions); (4) implementation behaviour (which concerns action leading to task completion); and (5) process behaviour (which concerns procedural movement of the group). These categories represented influence behaviour in group interaction processes and the use of influence among members in agenda setting, discussing group goals, summarizing opinion, attempting to implement action, and evaluating group processes generally. The subjects in the study consisted of undergraduate students working in GDSS and non-GDSS supported groups. The study's major findings showed no significant differences in influence behaviour between computer and non-computer supported groups. However, the authors learned that GDSS groups used more initiation influence statements (e.g., acting on an agenda item) and process type influence statements (e.g., providing direction to each other). The authors found another difference: GDSS groups used fewer goal oriented influence statements and integrative influence statements (i.e., summarizing and integrating group member discussions) than did face-to-face groups.

Building on the work of [13, 37] studied the effects of GDSS support and task type on social interactions. They designed a conceptual model derived from McGrath's Time Interaction Performance (TIP) theory, social psychology, and GDSS literature. Like [13, 37] studied group social interactions from a behaviour perspective. The participants in the study were undergraduate students working in GDSS or non-GDSS supported groups and were evaluated in a laboratory type environment. The authors examined two types of group interaction processes: informational influence (accepting information from other members as reality) and normative influences (desiring to conform to the expectations of other group members). The authors found that GDSS support affected group interaction processes by increasing information influence and decreasing normative influence. The authors also found that GDSS groups were less satisfied with the group social interaction process.

In a laboratory study, [29] examined the effects of ICT on social interactions, including communication efficiency, participation, interpersonal behaviour, and group choice. The investigators asked group members to reach consensus on career choice problems. The groups communicated either face-to-face or through an ICT medium. Research results demonstrated that when groups communicated using technology, group members made fewer remarks than in face-to-face groups, and it took them longer to reach decisions. Participation was higher in technology-supported groups, though participants used more inflammatory remarks during interpersonal interactions.

Straus (1997) [30] examined the consequences of face-to-face and GDSS on group social interactions. The results of her meta-analysis demonstrated that groups using technology for communication had less personal communication; were more task focused; disagreed more; and were more participative than face-to-face groups. Additionally, technology-enabled groups had lower cohesiveness than did face-to-face groups.

In a field study, [10] examined the effects of technology on group social interactions. The field experiment created two task forces, one composed of retired employees and the other of employees working but eligible to retire. Both groups were given the same task of preparing company reports on retirement planning issues and were randomly assigned to different interventions. The first group had regular office support, and the other had the same support as the first, with the addition of networked computers, e-mail, and other office software. Investigators interviewed members of the groups four times during the year and collected e-mail communications. The authors found that

groups using technology developed different social interactions than the group without technology. The technology-supported group took advantage of technology to participate and developed a more fluctuating pattern of leadership, one largely dominated by retirees. The other group had a more consistent type of leadership within the group. Other findings relating to the influence of ICT on social interaction included a higher degree of communication in the technology-supported group with a lessened feeling of isolation plus higher involvement in group work and higher satisfaction in work-related outcomes.

Overall, ICTs seems to dampen social interaction processes [13]. Group members using ICT were found to be less goal oriented; to use less integrative and influence statements than were the face-to-face groups [37]; to use more inflammatory remarks; to disagree more [30] than face-to-face groups [29]; to have less personal communication between group members [30]; and to have less stable leadership [10]. However, ICT enabled groups were more participatory [10, 29, 30]; members were less likely to conform to the expectations of other group members [13]; members were more satisfied with work-related outcomes [10]; and members were more task focused [30].

The previous literature discusses the general impacts of ICTs on various group processes. The following discussion explores the more detailed workings of the groups such as the impact of time, genre, group size, and task.

Because of the many social interaction processes researchers have observed, it is worthwhile to explore how groups develop social interaction norms within a technology-enabled environment. The ICT literature tends to view social interaction norms within a group as a way to bring a form of governance to online environments where group members learn about what is or is not socially acceptable within a group. Group social interaction norms are crucial for the smooth operation of groups using ICT to collaborate at a distance [9]. As [19] notes: "The introduction and widespread use of a new medium of communication may restructure a broad range of situations and require new sets of social performances" (p. 39).

In the early 1990s, the important concept of genre entered ICT literature. First introduced by [35], genre provided a way to identify how various forms of communication (e.g., memo, proposal, expense form, and resumes) can affect group norms, behaviour, and work structures. Yates et al. (1997) [36] suggest that group members use genres for specific communication purposes. Their use has a particular function and meaning associated with various work practices and group interaction norms [36]. The genres not only shape group communication, but they also influence how the group adopts various social interaction norms within the group. When an established genre is changed and becomes widely shared within a group or an

organization, new genres, or a variant of the original, may emerge. Changes in genre may occur due to the introduction of a new communication medium [36].

For example, a resume is a document used by employers to make decisions about hiring an individual for a particular job. As a genre, the resume has a particular form in which it is communicated (fax, e-mail, online) and a specific linguistic style to which it adheres [36]. If the established communication method were to change exclusively to online from fax or e-mail, new social interaction norms would emerge due to the introduction of a single medium for resume submissions. New norms would require job seekers to apply through a website where they would enter information in fields predetermined by the employer. Potential job seekers would be required to create a login name and password to apply and edit their applications. This new system for submitting resumes would create new social interaction norms for job seekers.

Yates et al. (1997) [36] used the concept of genre to examine the use of an electronic document management system that facilitated collaboration among organizational group members. Studying three teams within an organization for a seven-month period, the investigators found that social interaction norms developed differently in different groups. These differences were attributed to group size, task, and orientation towards the new technologies. Group members replicated similar social interaction norms within the new genre system and made innovations in creating new norms, such as highlighting text in documents, embedding documents created in other media, and implementing faster turnaround in group-group discussions.

In another instance, [22] studied the e-mail communication of knowledge workers collaborating on a multi-year project. The participants were computer language designers, who developed various programming languages. The authors analyzed over 2,000 transcripts of archived e-mails in their analysis, finding that when a group forms, members come to an agreement, whether implicitly or explicitly, on which genres and communication media to use. When group members incorporate these norms within the group, they produce social interaction norms that define how the group works together. Over time, the group reinforces the pattern of social interaction norms, and they define how group members work with each other. These groups continue to change and evolve as circumstances change within the group. Group members will need to respond to time pressures, task demands, new projects, and new technologies, and this will continue to change group social interaction norms.

Other studies, not based on genres, have described the effects of technology on social interaction norms within groups. In a field case study, [18] presents an analysis of why groups fail to develop social interaction norms in

technology-enabled distant environments. In his study of the implementation of an electronic document management system that would facilitate co-operation between federal agencies in the German cities of Bonn et al. (2002) found that it took 2 years for group members to develop social interaction norms to facilitate group interaction via the document management system. The author noted that the failure to develop social interaction norms within the group was a result of several factors: group members' inability to observe other group members; lack of mechanisms to monitor group adherence to norms; and the inability to apply pressure on group members to conform to group social interaction norms. The author also notes that the violation of social interaction norms may be attributed to such factors as self-interest in following individual work processes as opposed to the group work process.

In another field case study, [1] looked at social interaction norms of groups using teleconferencing technologies to support group communication. Using high audio quality for communication, users had the options of listening and speaking during group discussions. The group consisted of nine members working on engineering related projects. The authors described the group as cohesive prior to the implementation of the teleconferencing system because the members knew each other well and had spent time working with each other. The group members developed social interaction norms for dealing with background noise; for knowing when someone was present and listening; and for limiting violations of personal privacy. For instance, to clarify when someone was present and listening, group members developed social interaction norms for signing off and on to the group communication system. To sign off, group members were required to inform other group members of their action, and to sign on, the group members would notify and greet each other. Since these social interaction norms were easy to evade, sanctions were put in place to stop unwanted behaviour. Other norms also developed within the group. For example, the authors found that it was more difficult for group members to avoid participating in group discussions because they could not make themselves appear busy with another task or avoid eye contact in an audio only communication mode. However, group members did find other ways to avoid participation, such as reporting equipment failure. Finally, disclosure of private information was more difficult to control because group members, while speaking, were unable to hear other members' verbal reactions to information disclosed by the speaker.

Overall, in face-to-face settings, people are more aware of other group member's behaviour, and social interaction norms tend to develop implicitly over time, primarily through group observation [9]. However, when working at a distance via various forms of ICT, social interaction norms are more difficult to develop because group members are not able to observe other group members. Therefore, when introducing ICT to communicate at a distance, group members will begin to form new social interaction norms to facilitate group interactions [18]. These agreed-upon rules of interaction help develop group process gains and increase the chances of positive group work [18].

Recent literature

Recently, little research has focused on the impacts of ICTs on social interactions norms, in general, and especially, within healthcare groups. Some of the recent literature between 2006 and 2009 have focused on social interactions in asynchronous web forums using visualisation tools to analyze interaction patterns to monitor terrorist activities [34]; a case study that uses a virtual online learning system for dispersed groups working in the digital cinema industry to produce virtual movies [20]; another case studying identifying success factors of ICT in developing a learning community [6]; and a study of social interactions and participation in continuing medical education [12]. A majority of the articles found during the period focusing on the topic of this review were centred around the use of technology to support education. Little information is provided in these articles that can inform the topic at hand.

Impacts of findings on knowledge exchange

The review of the literature on the impacts of ICTs on knowledge exchange social interaction norms, found no relevant literature discussing this specific subject. However, much literature was found during the 1980's, 90's, and early 2000's on the general impacts of ICTs on group social interactions. In general, the review demonstrated that ICTs can dampen the social interaction process because group members are more likely to disagree more, have less personal communication, and less stable leadership within the group. For knowledge exchange activities, this would mean that ICTs can dampen the knowledge exchange process because they are heavily reliant on group interaction, building relationships, and trust. Enhanced group interactions, building relationships, and trust is primarily done in face-to-face settings.

Furthermore, it is possible that knowledge exchange groups may begin to adapt to the ICTs and create new forms of social interactions to compensate for the loss of the richness of social interactions found in face-to-face groups. According to the literature review, group members find it easier to observe each other in face-to-face settings and begin to develop new social interaction behaviours as

they observe one another. However, when working at a distance new social interaction norms will develop through the new methods of communication that may include e-mail, teleconferencing, web-conferencing, video-conferencing and other such mediums. These new social interaction norms would become a new form of social interaction for knowledge exchange groups.

Although not discussed in the literature, ICTs can have the advantage of increasing the amount of interactions between groups. For example, a Canadian national group working on various knowledge exchange activities with members located in different provinces may find it difficult (financially and because of time) to meet face-to-face on a weekly or monthly basis. Such groups, would have to resort to the use of ICTs to facilitate such frequent communication. These interactions may not be as rich as face-to-face meetings, however, they can be more frequent.

Conclusion

The review of the literature on ICT in relation to group processes relevant to knowledge exchange revealed that technology-enabled groups develop various social interaction norms even though using ICTs may dampen the social interaction process. As researchers and decision-makers increasingly engage in collaborative research, tools, such as teleconferencing, video-conferencing, or web-conferencing are needed to facilitate this process. However, only limited research studies, formerly and more recently, to the best of our knowledge, have examined the potential impacts of ICT on knowledge exchange processes in healthcare groups. Furthermore, the literature shows that for knowledge exchange groups working at a distance from one another, it is important to note that social interaction norms will not be as dynamic as they would be in face-to-face sessions. As a result, the groups will start to introduce new social interaction norms within ICTs to improve group social interactions. The advantage of using ICTs for communication will be that they can increase the number of interactions between knowledge exchange groups by allowing them to meet more often. However, the level of social interactions between group members will not be as strong.

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