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ADOPTING PROACTIVE KNOWLEDGE USE AS AN INNOVATION: THE CASE OF A KNOWLEDGE MANAGEMENT SYSTEM IN RHEUMATOLOGY

Research-in-Progress

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Abstract

The aim of the study is to present a tentative framework to explore and investigate the drivers and barriers of adoption of the innovation of proactive knowledge use in connection to a knowledge management system (KMS) in health care. Semi-structured interviews were performed with champion implementers and physicians using the KMS along with a document analysis depicting significant events of the implementation process. The findings from the study suggested that drivers of the innovation were the characteristics of change agents, quality improvement, budget control and knowledge brought to the physician-patient dialogue by the KMS. In particular, there were indications of the KMS facilitating the process of making tacit knowledge explicit in the physician-patient dialogue. Identified barriers towards the innovation were resistance from clinical management, lack of motivation to share knowledge, lack of time and perceived flaws in the interface and compilation of data in the KMS.

Keywords: Health informatics/health information systems/medical IS, Innovation diffusion, Knowledge-based systems

Introduction

Health care organizations are knowledge-intensive organizations, where the need for professional development and knowledge sharing is considerable. Rapid changes in treatment techniques, pharmaceutical products and legal requirements necessitate an ongoing professional development of health care professionals (Chu and Robey 2008). Moreover, there is an emerging movement of “empowering the patient”, by e.g. web-based health portals and the development of patient communities. The empowered patient is supposed to take an active part in making informed choices of treatment and care (Edenius 2007; Hasselblad and Bejerot 2007). To make this happen, knowledge sharing and gaining access to the decision arena between health care professionals and patients becomes even more important. Knowledge management systems (KMS) could be regarded as an answer to the call for professional development and knowledge sharing. Knowledge management systems refer to a class of information systems applied to managing individual and organizational knowledge processes and information flows. They are based on information and communication technology (ICT), and developed and used to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer and application (Alavi and Leidner 2001; Carlsson 2003).

Knowledge creation in health care organizations ideally aims at collecting evidence-based knowledge to evaluate treatment outcomes in order to further develop the treatment and health status of patients. Knowledge management systems aim at distributing evidence-based knowledge in order to improve quality of health care (Martin 2003; Montgomery 2006). In medical quality registers, patient and treatment data are registered, stored, retrieved and compiled in order to enhance the quality of care. The evidence-based knowledge provided by the KMS could be considered as a support of clinical judgment in the medical consultation, but also as a means of treatment development. In the case of the Swedish national quality register in rheumatology, physicians and patients are encouraged to enter data in the KMS from a web-based user interface, and evaluate the health status of the patient together during the consultation. By doing this, the value of the KMS could be extended by incorporating more adequate and valid information, as well as altering the physician-patient encounter. This is a change in the traditional physician-patient relationship and also a change from reactive to proactive use of patient and treatment data in health care. This change could be considered as an innovation in the sense described by Nonaka (1994): “... *innovation, which is a key form of organizational knowledge creation, cannot be explained sufficiently in terms of information processing or problem solving. Innovation can be better understood as a process in which the organization creates and defines problems and then actively develops new knowledge to solve them.*” (p. 14). Hence, the innovation at stake does not just refer to an outcome (a new idea for example), but also to the process, i.e. how new ideas emerge and how they are technologically supported on a continual basis (Gupta et al. 2007).

The innovation of proactive use of knowledge in connection to the quality register is considered as a way of solving the problem of treatment of a chronic disease more effectively, by bringing patient empowerment to the medical consultation. This is characterized as a quite radical innovation in the physician-patient relationship, because physicians and patients reach a clinical judgment together.

The paper is organized as follows: First, the research approach of the study is described. Second, the case of the Swedish national quality register in rheumatology is presented. Third, findings from the case study is presented and analyzed. Finally, conclusions from the case study and suggestions for further research are put forward.

Research Approach

This study is a part of an ongoing multiple case study aiming at developing a knowledge management system for the practice of evidence-based medicine. However, evidence-based medicine does not only refer to clinical expertise integrated with conscientious and judicious use of current best evidence from clinical care research (scientific literature etc.), but also from the practice based environment (Sim et al. 2001). It has, for example, been found that best care must also incorporate or be complemented by patients’ values and preferences (Bassler et al. 2009). The aim of this study is to present a tentative framework to explore and investigate the drivers and barriers of adoption of the innovation of proactive knowledge use in connection to a KMS in health care. This framework should also be regarded as a source of an extensive analysis about knowledge management systems and sustainable innovation climate in the health care sector. The aim was fulfilled by performing semi-structured interviews with champion implementers and early adopters of the KMS in the Swedish professional community of rheumatologists, as well as a document analysis depicting significant events of the implementation process. The respondents were chosen by

theoretical sampling in order for the researchers to gain as much insights into the research area as possible (Glaser and Strauss 1967). Ten interviews were performed with implementers and rheumatologists from six Swedish hospitals in four county councils. The interviews lasted from 45 minutes to one and a half hours each, and were tape-recorded and subsequently transcribed. Parallel with the empirical fieldwork we started to conduct a thematic analysis linked to critical incidents (Gremler 2004). By the use of content analysis, we identified different data and put them into different sub-themes of classified patterns, with the ambition to reach distinct points of origination (Taylor and Bogdan 1984; Krippendorff 2004). Documents, including e.g. agreements, meeting minutes, and documentation from presentations, were listed in summary forms and categorized into themes by means of content analysis (Miles and Huberman 1994; Krippendorff 2004).

The Case of a Knowledge Management System in Rheumatology

In Sweden, 21 county councils and regions are responsible for supplying health care services. This includes hospital care, primary care and psychiatric care. The main means of financing the health care system is a county council tax supplemented by a state grant. In addition, fees are paid by patients. Each county council or region is governed by a political assembly, with its representatives elected for a four-year period. The county councils and regions differ in size. The largest regions, which include the three cities of Stockholm, Gothenburg and Malmö, have a population of between one and two million each, while the smallest region (Gotland) has about 60 000 inhabitants. Most of the other county councils have populations of about 200 000 to 300 000 inhabitants (Swedish Association of Local Authorities and Regions and The National Board of Health and Welfare 2008). Rheumatology care is provided by 58 public and private hospital clinics in Sweden (Swedish Quality Register of Rheumatoid Arthritis 2009).

National quality registers were introduced in Swedish health care during the latter part of the 1970s, when the specialty association representing orthopedic surgery began a nationwide collection of data from hospitals describing treatment outcomes and complications in connection with various surgical methods (Garpenby 1999). In 2007, 64 quality registers were established in Sweden, including e.g. respiratory diseases, diseases of childhood and adolescence, circulatory diseases, endocrine diseases, gastrointestinal disorders, musculoskeletal disorders and diseases of the nervous system. The electronic health records (EHRs) in Sweden have not facilitated compiling and analyzing data required for quality improvement, as, for reasons of secrecy safeguards, they are specific for each patient and each health care provider (Swedish Association of Local Authorities and Regions 2007). The Swedish quality register of rheumatoid arthritis was introduced in 1995, after two years of negotiations among the members of the Swedish professional community of rheumatologists. In 2008, 500 health professionals at 58 clinics used the KMS and treatment data of 26 470 patients were registered (Swedish Quality Register of Rheumatoid Arthritis 2009). The implementation of the KMS has been championed by one well-known and trustworthy change agent belonging to the professional community of Swedish rheumatologists. The KMS has not been implemented by a top-down strategy by hospital management, but more as a result of a continuous information flow in professional formal and informal communities. The decision to adopt the KMS has been voluntary among health care professionals. Once adopted, training in the use of the system and support is provided by specialized staff.

The patient data entered into the KMS include treatment, findings of laboratory tests and x-ray examinations, self-assessed patient evaluations of general pain, tiredness, as well as swelling and tenderness of 28 index joints. The data are compiled to create a patient health status index, labeled as DAS28 (Disease Activity Score). The DAS28 index serves as a point of reference from which treatment outcomes are evaluated. From the start of the register in 1995, patient data were registered after the consultation from forms, previously filled in by patients. From 2001, physicians and patients are encouraged to enter data in the KMS from a web-based user interface, and evaluate the health status of the patient together during the consultation, thus using knowledge proactively instead of reactively. The official aim of the register is to improve the health of Swedish rheumatoid arthritis patients through continuous feedback of treatment results to patients and physicians directly during the medical consultation. This way, patients gain further knowledge about their chronic disease and achieve a higher degree of participation in their own treatment.

Adopting Proactive Knowledge Use as an Innovation: Findings and Analysis

The findings of the study can be grouped into four main themes; adopter categories, drivers of the innovation, barriers to the innovation, and knowledge brought to the physician-patient dialogue by the KMS.

Adopter Categories

Adoption is, in this paper, defined as “a decision to make full use of an innovation as the best course of action available” (Rogers 1995, p. 21). From the empirical data, several ways of adopting the innovation could be discerned. Typically, two significant dimensions of the use of the KMS were identified: 1) if patient data were registered after (reactively) or during (proactively) the medical consultation and 2) by means of what medium the registration was performed (paper or a web-based computer interface). Some physicians registered patient data after the medical consultation by means of paper-based forms or by the web interface, thus not taking advantage of proactive knowledge sharing with patients during the consultation. Other physicians register patient data during the consultation, either using paper forms or the web-based user interface, actively interacting with patients on their data and health status. The four adopter categories are depicted in figure 1.

		Registration media	
		Paper	Web
Registration performed	proactively	Patient-focused partial adopter	Full adopter
	reactively	Laggard	Register-focused partial adopter

Figure 1. Four adopter categories of the Swedish quality register of rheumatoid arthritis.

Full adopters (125 or 25% of register users) combine proactive and web-based registration, *patient-focused partial adopters* (75 or 15%) evaluate patient data and treatment outcomes proactively during the consultation but register the data reactively after the session, and *register-focused partial adopters* (295 or 59%) combine reactive and web-based registration. Finally, *laggards* (50 users of 1%) use paper-based forms for registration of patient data and register the data reactively, after the consultation. This rather complex, and somewhat unexpected, adoption pattern is an example of innovations being subject to reinventions and reconfigurations by adopters (Rogers 1995; Slappendel 1996). Reinvention should not be seen as something bad. On the contrary, it is often beneficial to the adopters of an innovation as the flexibility in the adoption process may reduce mistakes and encourage the innovation to fit more properly into local conditions (Rogers 1995).

Drivers of Adoption

The factors driving the innovation fell into three main categories: the characteristics of change agents, quality improvement, and budget control. The change agents, the champion implementers of the KMS, were respected physicians among the Swedish professional community of rheumatologists. As a result, the implementation of the KMS was perceived as originating from the profession more than from hospital or county council management. The perception that implementing the innovation was led from the professional community rather than imposed by management is hypothesized to have improved the rate of adoption. The change agents took on the role of both administrative leaders of the implementation process and knowledge management leaders with great effort, actively discussing what kind of knowledge should be embedded in the KMS. The existence of such a knowledge management leadership is in line with the now widely accepted notion that innovative activity is promoted by champions who, by definition identify the idea as their own, and put ideas into action that go beyond the

requirements of their job (i.e. Schön 1963; Slappendel 1996). Champions have previously been identified as a critical success factor of KMS implementation (Skyrme and Amidon 1997; Butler and Murphy 2007).

The compilation of data provided by the KMS result in statistics of treatment outcomes on a clinical, regional and national level. The opportunities of evaluating treatment outcomes have increased as well as the standardization of treatment between physicians and clinics (Carli et al. 2006; 2008). As the newly developed biological drugs used in treatment of rheumatoid arthritis are very expensive, the knowledge of treatment outcomes has become an indispensable means of argument towards politicians of the county councils in proving that the treatment is needed and that the increase in costs brings an improved health status of patients : *“By means of the register we can tell politicians that a certain number of patients need the biological drugs... without the register we wouldn’t had stood a chance.”* (rheumatologist). *“We have to use the quality register. It’s our only means of quality improvement.”* (clinical manager).

Barriers to Adoption

The barriers to adopting the innovation were observed to relate to four different areas: resistance from clinical management, lack of motivation to share knowledge, lack of time and perceived flaws in the interface and compilation of data in the KMS. Lack of interest, or resistance, from clinical management to implement the KMS was stated as a significant barrier, not only to using the KMS but to quality improvement, as illustrated by a physician: *“Management is very important. If management does not take responsibility to lead change, the inertia will be enormous.”* (rheumatologist). According to e.g. Davenport and Prusak (1998), motivating employees to share their knowledge is a critical success factor in KMS implementation. From the interviews, it is evident that most health care workers are willing and motivated to share knowledge, but not all: *“Perhaps they don’t want their patients to be judged by others... Some colleagues do not simply find it very interesting to share knowledge.”* (rheumatologist). A number of rheumatologists also experience lack of time as a barrier to KMS use, as consultations are tightly scheduled, and the examination of the patient must be given priority before the registration of data in the KMS. If the added value of the use of the KMS is not very clear to the physician, it will not be used when time is scarce. This also stresses the importance of management attributed to understanding and supporting physicians to allocate their time more appropriately.

Perceived flaws in the interface of the KMS and the compilation of data were also identified as barriers to adoption. Not being able to comment on data entered in the KMS is one identified flaw: *“It is possible to make extra comments about the health status of the patient in the patient journal system, but not in the quality register...”* (clinical manager). Also the compilation of data from the KMS is sometimes perceived as being unclear and insufficient: *“When it comes to aggregated statistics from the register, some things really remain to be done...”* (rheumatologist). *“There are no data from the quality register that I couldn’t find in the patient journal system. Preferably, the two information systems should be interacting.”* (clinical manager).

Knowledge Brought to the Physician-Patient Dialogue by the KMS

Knowledge could, in the traditional epistemological sense, be defined as “justified true beliefs” (Nonaka 1994). Knowledge can be viewed from several perspectives, among them as a state of mind, an object, a process, or a condition of having access to information or a capability (Blackler 1993; Alavi and Leidner 2001). One important categorization of knowledge in our context is between tacit and explicit knowledge (Polanyi 1966; Nonaka 1994). Tacit knowledge has a personal quality which makes it hard to formalize and communicate to others. This is described by Polanyi (1966, p. 4) as *“we can know more than we can tell”*. Tacit knowledge is often rooted in action, commitment and involvement in a specific context (Nonaka 1994). Explicit knowledge is articulated, codified and communicated, either in symbolic form or in natural language (Alavi and Leidner 2001). The knowledge stored and compiled in the KMS could be defined as explicit knowledge, while clinical judgment during the medical consultation is considered to be a combination of explicit knowledge and tacit skills (Montgomery 2006).

The KMS is adopted as part of the practice of medicine at the rheumatologic clinic. A practice is an institutionalized way of performing work (Berger and Luckman 1967). According to Montgomery (2006), the practice of medicine is characterized by a combination of a body of scientific knowledge and a collection of well-practiced skills. Clinical judgment is defined as the practical reasoning that enables physicians to fit their knowledge and experience to the circumstances of each patient. There is evidence from the interviews that the characteristics of the physician-patient

dialogue are changed by proactive use of the KMS. The physician and the patient sit together in front of the computer and study and talk about the results from laboratory tests, x-ray examinations and the disease activity index (DAS28) i.e. As one rheumatologist describes it: *“It is like having a third person in the room... But it feels secure and comfortable, as the computer presents facts and not guesses or beliefs.”* There is thus evidence of the KMS making knowledge explicit, knowledge that is perceived as more clear and discernible. There is also evidence of tacit knowledge of patients and physicians being confirmed or made explicit by the KMS (Nonaka 1994), as e.g. a vague perception of decreasing health status of the patient could be confirmed as an increase of disease activity measured and compiled by the system: *“The patient tells me that he or she doesn’t feel very well. Then I take a look at the results from the laboratory tests or the [DAS28] index, and I can confirm that the patient’s health status has decreased. It is a fact and not just a vague perception or whimpering.”* (rheumatologist).

Discussion and Suggestions for Further Research

In a meta-analysis of studies exploring the impact of physician-patient relationships on health status of patients, Ottosson (1999) identified a number of factors that improved the health status: 1) The patient takes an active part in the interaction with the physician during the medical consultation. 2) The patient is encouraged to take control of the symptoms of the disease. 3) The patient receives information about examinations and treatments. 4) The physician and the patient agree on diagnosis and treatment. 5) The psychosocial circumstances of the patient are recognized by the physician. The innovation of proactive use of knowledge in the quality register could be considered as a way of solving the problem of managing a chronic disease more effectively, bringing patient empowerment to the medical consultation. Drawing on the findings of the study, using proactive knowledge is an important prerequisite of making these enabling factors a part of the physician-patient dialogue. As such, the KMS provides opportunities not only to improve treatment outcomes but also to improve the physician-patient relationship.

The proactive knowledge use is an essential change of work routines. Changes in work routines do not always come effortlessly and resistance to change is understandable if added value of system use could not be discerned among health care professionals. This might be one explanation of barriers to adoption. The implementation process fulfils several of the criteria characterizing successful implementation of KMS, such as a clear knowledge management (KM) leadership, provision of enabling resources and training, and KM champions regarded as trustworthy in the organization, and contributing with great effort (Skyrme and Amidon 1997; Butler and Murphy 2007; Persson and Stirna 2007). Furthermore, there are reasons to believe that the perception of the innovation originating from the medical profession (Striem, Øvretveit and Brommels 2003) more than the management is an additional critical success factor.

Sim et al. (2001) conclude that *“Although the promise of clinical decision support system-facilitated evidence-based medicine is strong, substantial work remains to be done to realize the potential benefits”* (p. 527). The findings of the study – tentative as they might appear – calls for more research on the characteristics of the knowledge sharing taking place between the physician and the patient during the consultation, as well as deepened research on the underlying motives for resistance towards the innovation. Relatively few examples of knowledge management systems are to be found in practice that encompass both literature-based and practice-based evidence (Sim et al 2001). Although literature pinpoints examples where clinical decision support systems are difficult to implement and use (see e.g. Bassler et al. 2008; Patwardhan et al. 2009; Sim et al. 2001), we do believe that a KMS that encapsulates these two methods can improve health care from many different aspects; better decision support, material to further improve evidence-based-medicine decisions, further empowerment for patients, etc. However, to make this happen depends on a health care sector that can maintain a climate of innovation surrounded by, or based on, KMS.

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