A KM perspective on implementing an Electronic Patient Record within an NHS hospital

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Abstract
The Electronic Patient Record (EPR) is being developed by many hospitals in the UK and across the globe. We class an EPR system as a type of Knowledge Management System (KMS), in that it is a technological tool developed to support the process of knowledge management (KM). Healthcare organisations aim to use these systems to provide a vehicle for more informed and improved clinical decision making thereby delivering reduced errors and risks, enhanced quality and consequently offering enhanced patient safety. Finding an effective way for a healthcare organisation to practically implement these systems is essential.

In this study we use the concept of the business process approach to KM as a theoretical lens to analyse and explore how a large NHS teaching hospital developed, executed and practically implemented an EPR system. This theory advocates the importance of taking into account all organizational activities - the business processes - in considering any KM initiatives. Approaching KM through business processes allows for a more holistic view of the requirements across a process: emphasis is placed on how particular activities are performed, how they are structured and what knowledge demanded and not just supplied across each process. This falls in line with the increased emphasis in healthcare on patient-centred approaches to care delivery. We have found in previous research that hospitals are happy with the delivery of patient care being referred to as their 'business'.

A qualitative study was conducted over a two and half year period with data collected from semi-structured interviews with eight members of the strategic management team, 12 clinical users and 20 patients in addition to non- participant observation of meetings and documentary data. We believe that the inclusion of patients within the study may well be the first time this has been done in examining the implementation of a KMS. The theoretical propositions strategy was used as the overarching approach for data analysis. Here Initial theoretical research themes and propositions were used to help shape and organise the case study analysis.

This paper will present preliminary findings about the hospital's business strategy and its links to the KMS strategy and process.

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Introduction

There has been relatively little research about how to actually carry out KM within a health care organisation. Hansen et al (1999) argue that this could be due to a gap between the theories, strategies and frameworks of KM that are presented and the approaches for their practical application. Additionally, Maier and Remus (2003) concur that uncertainty towards KM is fuelled by the lack of a commonly agreed method or procedure for implementing KM. This remains the case in 2012. Ultimately deciding to 'do' KM is not the same as actually 'doing it'(Edwards, 2009). The Business Process Approach to KM provides a method for 'doing' or implementing KM and has been explored by a number of authors and practitioners such as Edwards et al (2005), Maier and Remus (2003), Kwan and Balasubramanian (2003), Bou and Sauquet (2004). The majority of studies exploring this approach have however not been in healthcare. This study therefore attempts to fill this gap and contribute to the theory on KM implementation in health, by focusing on the process of KMS implementation from the theoretical lens of Business Process theory.

This research is thus exploratory in nature. According to Collis and Hussey (2003), exploratory research focuses on gaining familiarity and insights with the subject area for more rigorous investigation at a later stage. Phillips and Pugh (2000) define exploratory research as the type of research that is involved in tackling a new topic about which little is known. Furthermore, as a study specifically exploring the implementation of a KMS (EPR) from the perspectives of the various 'customers' (i.e. clinicians and 'patients') it is unique.

This paper is structured as follows: the next section provides a brief review of related literature on KM and KMS implementation in health and the Business Process approach to KM and the subsequent sections provide a description of the research methodology and approach for data collection and analysis. The paper closes with our preliminary findings and indications of the direction we are pursuing.

Literature Review

Definitions of both knowledge and KM vary from the broad and practical to the conceptual. Space does not permit a thorough discussion on the concepts of both knowledge and KM and so for the purposes of this research we take the pragmatic approach that we regard something in an organisational context as being knowledge or KM if people in that organisation say that it is.

Definitions of KM in health mirror more generalised definitions of KM but in addition acknowledge the benefits associated with managing knowledge for the delivery of and the quality of patient care. For instance Brailer (1999) describes KM in health as any "systemic process designed to acquire, conserve, organise, retrieve, display and distribute what is known" (Brailer, 1999, P6). The Healthcare Information & Management Systems Society in the UK defines KM as the "aligning of people, processes, data and technologies to optimise information, collaboration, expertise, and experience in order to drive organisational performance and growth. Specific factors influence KM in health. Healthcare organisations and in particular hospitals are large and complex in the way in which they are structured. Patient care is delivered through a collection of professional specialists who operate in distinct, hierarchical arrangements across organisational units. The delivery of care is thus said to be fragmented (Van Beveren, 2003). This unique operational arrangement has a profound effect on the ability of these organisations to create, distribute and share knowledge. Cegarra-Navarro and Cepeda-Carrion (2010) highlight the need for customised KM programs to support KM in health.

Strategies for the implementation of KM that is how ideas and theories of KM are made relevant to an organisation are numerous (Hansen et al., 1999, Earl, 2001, Alavi and Leidner, 2001). However although these strategies present theories on how to approach KM, there remains a gap between these theories and their practical application (Edwards and Kidd, 2003). That is how these strategies, theories and frameworks for KM can be applied, carried out or executed.

Process orientated KM highlights the importance of the core processes of an organisation, the organisational activities and the knowledge used by each of these processes. Barcelo-Vaalenzuela et al (2008) claim that over 90% of an organisation's activities can be described in terms of processes. A business process then, can then be described as "a collection of interdependent activities or tasks organised to achieve specific business goals" (Barcelo-Vaalenzuela et al., 2008, p324). Moreover, Edwards (2009) proposes that business processes display a number of key characteristics which substantiate why they should be used as the foundation for KM: They comprise a set of structured actions (they flow), they have identifiable customers (they do things for people), they cut across organisational boundaries and they can be measured.

Business processes as the name suggests are the core operative processes along the value chain, and represent how an organisation does business. So, thinking 'process' enables the organisation to visualise itself as a whole. A holistic view in KM terms means that emphasis can be placed not only on what the organisation actually does but also on *how it does it* (Edwards, 2009), something that does not appear on a typical organisational chart. This approach also offers a number of other key benefits: It allows knowledge to be integrated and incorporated into the underlying procedures and key practices of the organisation. Moreover, as highlighted by Braganza (2001) thinking 'process' can assist an organisation to think about the demand for knowledge, across each process and not just the supply. Thinking about the knowledge demands of a process allows the consideration of the participants in the process and their knowledge requirements in enacting the process.

The process approach provides the missing link between KM and business strategy (Maier and Remus, (2003). According to Grover and Davenport (2001), the alignment of KM strategy with business strategy allows the organisation to consider how business strategy can be enhanced through the more effective management of knowledge. From a strategic perspective this is important as process knowledge can be considered to be a source of core competence, hence the management of such process knowledge can provide a strategic contribution (Kwan and Balasubramanian, 2003, Hammer, 1990). The alignment of business strategy to a KM initiative allows an organisation to also consider factors such as the current and future culture and learning environment (Grover and Davenport, 2001). For example, thinking of how the current culture of an organisation is reflective of a knowledge sharing culture and an environment for learning. So that the creation, sharing and use of knowledge is encouraged to provide knowledge based benefits (Grover and Davenport, 2001).

Business Process approach to KM in Healthcare

KM projects within healthcare have typically tended to be either technology or people driven, however the consideration of processes is also of importance. Edwards et al (2005) argue that the application of a process view of KM within healthcare, would allow for a more universal view of the whole care process to be envisaged. Thus, allowing the knowledge needs of all stakeholders along the care pathway to be met. Rothschild et al (2005), also advocate a system-oriented perspective to assist in the improvement of the delivery of health information systems particularly within Acute Care.

Healthcare organisations are complex and unique both in the way in which they are structured and how they operate. For instance, a typical hospital tends to be structured departmentally according to medical specialities with the focus internal rather than across functional silos (Edwards, 2011). Clinicians however need to be able to share knowledge regarding patients across various speciality departments and processes, following a patient along a care pathway. Business processes typically cut across organisational boundaries and thus organisational silos, consequently boundary spanning knowledge can be provided across the organisational silos (Edwards, 2011). Thus process thinking allows those involved in "adjacent" or connecting activities within a process to share knowledge (Edwards, 2011) which is of particular importance in health. Studies focussing on the process approach to KM in health include Reuthe and Allee (1999) who argue for the arrangement of knowledge through an entire clinical care process as opposed to around what they term an 'episode' of care. Batalden and Splaine (2002) advocate a process view of health care provision with an emphasis on what they describe as microsystems (a group of people that are actually involved in the care of an individual patient). Others include Desouza (2002) and Berg and Toussaint (2003).

Knowledge Management Systems

Definitions of KMS are dependent on the perspective of knowledge that is taken, that is what is termed as knowledge, how knowledge is created and held and its relationship with information and data (Moteleb and Woodman, 2007). We concur with Alavi and Leidner (1999) who refer to a KMS as an IT or technological system used to facilitate the sharing and integration of knowledge. However we postulate that a KMS stores not just knowledge but whatever anyone finds that is valuable to store in an electronic form that is a mix of knowledge, information, and data. An EPR system can thus be assumed to be a type of KMS, in that it is an IT system which has been developed to assist in the sharing of vital knowledge, information and data across a hospital, with the aim to improve clinical decision making at the point of care.

There have been several studies looking at the implementation of technology based KMS, for example, Chalmeta and Grangel (2008) develop a methodology to assist in the process of developing and implementing a KMS in any type of organisation. However, since healthcare organisations are unique in the way in which they are structured and in how they operate such methodologies are tricky to apply. Studies examining KMS in the health space, include Ghosh and Scott (2007) who investigate KM processes and organisational enablers associated with effective KMS within the clinical nursing setting; Fahey (2008) who uses the development and implementation of a KMS within a hospital to illustrate the diffusion of innovation processes and why the implementation of some KMS fail. Other studies of IT based KMS in health include: Davenport and Glaser (2002), Pedersen and Larsen (2001), and McNulty (2002).

KMS in Health and the patient perspective

Looking at IT-based healthcare systems more generally than just KMS the literature on the development and implementation of such systems reflects a strong emphasis on the view of the clinician as the primary 'customer' of such systems. For example, Andersen (1997) focuses on the physician in building physician friendly clinical information systems and the benefits of involving clinicians for successful implementation; while Jensen and Aanestad (2007) explore how healthcare professionals interpret and respond to an EPR, their conceptions of technology and how it relates to their professional roles from a sense making perspective.

The NHS mission statement asserts that "the patients' needs and experiences are the first and uppermost consideration and the best outcomes result when patients, their carers and relatives and staff are active parties in decision taking". Therefore, the patient could be defined as the ultimate 'customer' of a health information system. However, studies exploring the 'patient' perspective generally evolve from clinically orientated work conducted in the medical and health informatics field. These studies tend to focus on clinician performance and patient outcomes or example (Hunt et al., 1998), (Garg et al., 2005), (Johnston et al., 2003). Other relevant studies focus on the use of systems to assist in patient education and the acceptance of technology by patients in relation to the management of chronic diseases (Osheroff et al, 1995), patient-clinician communication (Shachak and Reis, 2009) and the quantitative measurement of patient perception following a clinical consultation (Haddad et al., 1999).

The health information systems literature tends to neglect the significance of the patient. Ultimately both 'customer' groups clinicians and patients should be given consideration in the design and development of KMS in health. Leonard (2004) does draw attention to the importance of the role of patients in the design of health information systems, and the importance of patients having access to information to assist and enhance the process of joint decision making in chronic disease. Apart from this there is a dearth in the literature reflecting the patient perspective. This research aims at closing this disconcerting gap by presenting an analysis of the different perspectives of both 'customer' groups. Additionally, an in depth case study exploring the implementation of a KMS through the lens of process theory will allow the exploration of how people, processes and technology fit together for effective KM across healthcare organisational functions.

The aim of this research is to use the concept of the Business Process route to implementing KM as a theoretical lens, to analyse and explore the development, execution and implementation of a KMS, i.e. the EPR system. The outcome will be a better understanding of EPR as a KMS and its effect on the hospital, users and patients.

Methodological Approach

This study aims at providing an in-depth understanding of how an EPR was developed and implemented across a large UK NHS hospital. We consider our work as theory-building and theory-extending and therefore a qualitative inductive approach was chosen. This helped us to explore our assumptions and examine relationships, and concepts (e.g. Eisenhardt, 1989;Weick, 1996). It also assisted with the examination of subjective descriptions of the participants, their thoughts and feelings which helped us to increase our insight and understanding of the development and adoption of the EPR from both a managerial and user perspective. It is believed that due to the nature and structuring of the NHS all NHS hospitals have a certain similarity. Thus the case chosen represented a typically large NHS Foundation Trust teaching hospital. A case study offered an opportunity to provide a rigorous and fair presentation of the empirical data which is particularly appropriate when researching a 'contemporary phenomenon in its real life context' (Yin, 2009).

The investigation was carried out over a two year period (2009 to 2011), with data collected from four main sources: Interviews, non-participant observations, documentary data and process flow maps. Multiple sources of data were used to avoid potential bias resulting from a single source (Denzin and Lincoln, 2000, Eisenhardt, 1989). Semi-structured interviews were conducted with eight members of the EPR board (strategic management team), in addition to interviews with 12 clinical users from varying specialities and 20 patients.

A semi structured interview schedule was used to provide a flexible structure to questions, and helped to provide rich detailed information of the participant's thoughts and beliefs and accounts of their particular

experiences. Interviews also revealed details of the process of implementation and adoption. EPR board meetings at the hospital were also observed in a non-participatory manner over the two year period. These observations were essential in providing detail on the strategy and of implementation and the decisions taken. Process maps developed by the hospital provided information on process changes. Additional secondary data was collected from internal documents such as reports, meeting minutes, policy documentation, promotional literature and stakeholder websites. Documentary data offered further information to assist in triangulation process and to strengthen reliability and reduce bias.

Data Analysis

The theoretical propositions strategy as recommended by Yin (2009) was used as the overarching approach for data analysis. Here Initial theoretical research themes and propositions were used to help shape and organise the case study analysis. An advantage of this strategy was that it allowed us to define and examine alternative explanations for the case (Yin, 2009).

Figure 1 shows Creswell's (2007) model of the data analysis process. Analysis proceeds by moving in analytical circles or spiralling rather than moving through a fixed linear approach which is typical of quantitative enquiry (Creswell, 2007). Data management precedes data analysis, here data is organised into files or folders. Analysis begins with the commonly known process of 'coding. Data is converted or reducing down into meaningful segments, themes or text units each being assigned an appropriate name. To assist in the identification of codes the reading and memoing loop is an important initial element of the process. Here a sense of the whole database is obtained, by "immersing oneself in the data".
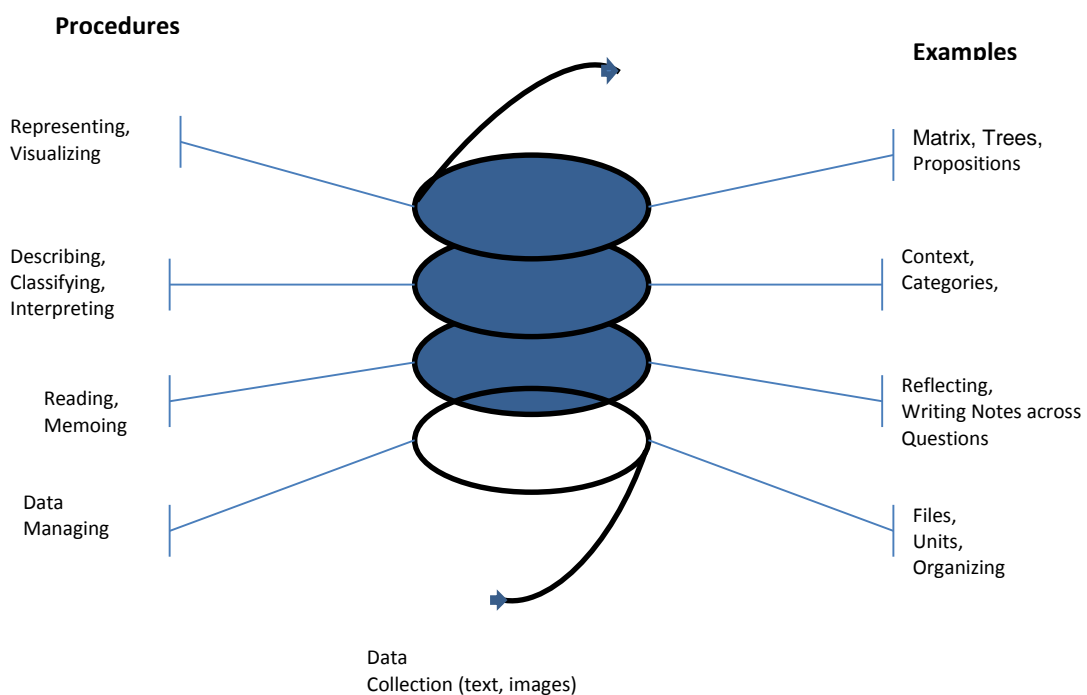
Procedures

Examples

Representing, Visualizing

Matrix, Trees, Propositions

Describing, Classifying, Interpreting

Context, Categories,

Reading, Memoing

Reflecting, Writing Notes across Questions

Data Managing

Files, Units, Organizing

Data Collection (text, images)

Figure 1: Data analysis process (Creswell, 2007)

For example interview transcripts in their entirety were read several times to try and get a sense of the interview as a whole before they were segmented into parts. Notes were written in the margins of the transcripts and field notes for ideas and key concepts that occurred.

The spiral of describing, classifying, and interpreting allowed the codes that were developed to be represented as detailed descriptions, individual words or texts, themes or dimensions. In this case these codes were contextualised from the theoretical literature i.e. the Business Process approach. Codes were then sorted, categorised and classified, unwanted data was 'winnowed' out and discarded. An exercise of

classification was then conducted for further analysis of the developed codes, here the qualitative information was taken apart to look for categories, themes, or dimensions of information. A 'family' of themes and subthemes (Creswell, 2007, pp153) were identified to represent the patterns in the data. Further detailed description, theme generation and classification were conducted to provide an interpretation of the data from the perspective of the analyser and from the views from the literature. Data analysis, coding and theme development was supported by the software tool NVivo.

Preliminary findings

Is the EPR a KMS?

In our interviews, the EPR executive board consisting of both senior board managers and clinicians were asked if they thought of an EPR as a type of KMS:

"It's about I suppose managing knowledge in terms of everyone now knows they've got one place to go they don't have to go into disparate systems anymore, everything's in one place, it's easy to find and if they know which folders to look on they can quickly attain the knowledge that they need to make some snappy decisions about their patient" Respondent 6.

"What we see the EPR as being fundamentally is a clinical decision support system" Respondent 5.

"It's about how we will pull those disparate threads of information together in such a way that it provides a meaningful record to our clinical communities" Respondent 3.

Lack of a rigid plan

Members of group when asked if their EPR strategy been translated into a written document, most members reflected that there was no formal documentation of the strategy. The result of this strategy meant that they chose not to follow any particular project management practice.

"We've quite deliberately never had any rigid sort of project plan for the overall thing, there are project plans here and there for different components of it but there's never been a definitive project plan" Respondent 4.

"Can't have the sort of rigid project plan, iteration is the key where you have design and development working hand in hand" Respondent 1.

"So no prince II methodology, no PIDs, no business case" Respondent 5

Hence a series of smaller projects enabled them to have clear and relevant measures to demonstrate progress. This provided flexibility and control allowing them to be more responsive to the rapidly changing environment.

Key clinician involvement

Based on our interviews another key component of the approach was a high degree of clinician involvement in the development.

"Clinical Engagement principles were a high level of clinician involvement" Respondent 5.

"We have tried to take a route of clinical engagement" Respondent 2.

"So there are a core group of clinical champions that actually are made up of physicians and surgeons from multiple specialities that have influenced the design and build" Respondent 6.

This strategy allowed them the opportunity to concentrate and emphasise on the people management side of their project methodology. This concurs with the wider view of KM which places a focus on the 'people' aspect (Hansen and Crawford, 2003).

Process mapping

Before the implementation of the KMS a process mapping exercise was conducted to map out a "process flow for every service [that we've gone live in] in its current state" Respondent 6

"There was a lot of [is so much] variation in how much time it took [takes] to prepare the models for each speciality because each speciality behaved [behaves] slightly differently" Respondent 6.

"from the clinical perspective the requirement to process map was about understanding what it was that happened to […] patients as they went through the process" Respondent 3. Processes were mapped out by a team who "actually sat down with [those] people to almost go through [typical business analyst type process where they have documented and analysed] their business processes" Respondent 3 and " understand what bits of paper they use or what electronic information they gain access to and how they run their clinic's" Respondent 3. Additionally, time was also spent evaluating current processes to consider how any potential change to practices could add value.

Patient perspective

The analysis for the pertinent perspective will available for presentation by the time of the conference.

Discussion

Although the Trust did not explicitly describe the EPR as a type of KMS, the system can be described as a KMS as it was still 'doing KM type things'. It provided both structured and less structured content and knowledge making it available and accessible to the right people and processes at the right time.

The strategy for the development of the EPR incorporated both codification and clinical decision support akin to the codification and personalisation strategies advocated by Hansen et al (1999), where the codification strategy uses IT to store and provide reusable codified knowledge, and the personalisation strategy focuses on the communication and sharing of knowledge through people. Hansen et al (1999) also suggest that the different strategies have different drivers and that pursuing both presents a risk of failing in both. In this case the Trust followed both strategies. What is apparent is that the IT support for the personalisation strategy relies on tools built on top of a system used for codification (by definition, any patient record is codified). This is a very unusual approach which is one of the central elements of our on-going further analysis of the data.

The Trust chose not to follow a formal structured methodology for the development of the EPR. Instead they opted to take a flexible approach incorporating high levels of clinical involvement. The system was thus tailored to incorporate and encourage clinical use. This approach strikes a similarity with the move from the waterfall and similar big developmental approaches in IS towards more agile methods. It also agrees with the proposition of Edwards and Kidd (2003) that "staged approaches to IT support and knowledge management may be the most effective".

The process mapping exercise allowed the hospital to examine the process flows for each of its speciality units. By working alongside individuals specifically involved in the operation of the process the technical team were able to closely examine the structure and function of each process, recognise any problems or issues with operational performance and thus formally recognise areas of the process that required changing to aid improvement. These findings concur with *process* theory, and the importance of thinking *process* when implementing a KM initiative.

References

ALAVI, M. & LEIDNER, D. E. (1999) Knowledge management systems: issues, challenges, and benefits. *Commun. AIS,* 1**,** 1.

ALAVI, M. & LEIDNER, D. E. (2001) Review: knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly,* 25**,** 107-136.

ANDERSON, J. G. (1997) Clearing the way for Physicians' Use of Clinical Information Systems. *Communications of the ACM,* 40.

BARCELO-VAALENZUELA, M., SANCHEZ-SCHMIZ, G., PEREZ-SOLTERO, A., MARTIN RUBIO, F. & PALMA, J. (2008) Defining the problem: Key element for the success of Knowledge Management. *Knowledge Management Research & Practice,* 6**,** 322-333.

BATALDEN, P. & SPLAINE, M. (2002) What will it take to lead the continual improvement and innovation of health care in the twenty-first century. *Quality Management in Health Care,* 11**,** 45-54.

BERG, M. & TOUSSAINT, P. (2003) The mantra of modeling and the forgotten powers of paper: a sociotechnical view on the development of process-oriented ICT in health care. *International Journal of Medical Informatics,* 69**,** 223-234.

BOU, E. & SAUQUET, A. (2004) Reflecting on quaality practices through knowledge management theory: Uncovering grey zones and new possibilities of process manuals, flowcharts and procedures. *Knowledge Management Research & Practice,* 2**,** 35-47.

BRAGANZA, A. (Ed.) (2001) *Knowledge (mis)management...and how to avoid it,* London, Olympia.

BRAILER, F. (1999) Management of knowledge in the modern health care delivery system. *Journal of Quality Improvement,* 25**,** 6-19.

CEGARRA-NAVARRO, J. & CEPEDA-CARRION, G. (2010) How to implement a knowledge management program in hospital-in-the-home units. *Leadership in Health Services,* 23**,** 45-56.

CHALMETA, R. & GRANGEL, R. (2008) Methodology for the Implementation of Knowledge Management Systems. *Journal of the American Society for Information Science and Technology,* 59**,** 742-755.

CRESWELL, J. W. (Ed.) (2007) *Qualitative Inquiry & Research Design: Choosing Among Five Approaches,* London, Thousand Oaks, Sage.

DAVENPORT, T. H. & GLASER, J. (2002) Just-in-Time Delivery Comes to Knowledge Management. *Harvard Business Review,* 80**,** 107-111.

DENZIN, N. & LINCOLN, Y. (Eds.) (2000) *Handbook of Qualitative Research,* CA, Sage.

DESOUZA, K. C. (2002).

EARL, M. (2001) Knowledge management strategies: toward a taxonomy. *Journal of Management Information Systems,* 18**,** 215-233.

EDWARDS, J., S (2011) A Process view of knowledge managemen: it ain't what you do, its the way that you do it. *Electronic Journal of Knowledge Management (Forthcoming).*

EDWARDS, J., S & KIDD, J. B. (2003) Knowledge Management sans Frontieres. *The Journal of the Operational Research Society,* 54.

EDWARDS, J., S. (2009) Business Process and knowledge management. IN (ED.), I. M. K.-P. (Ed.) *Encyclopedia of Information Science and Technology.* Second Edition ed., PA: Hershey.

EDWARDS, J. S., HALL, M. J. & SHAW, D. (2005) Proposing a Systems Vision of Knowledge Management in Emergency Care. *The Journal of the Operational Research Society,* 56**,** 180-192.

EISENHARDT, K. M. (1989) Building Theories from Case Study Research. *The Academy of Management Review,* 14**,** 532-550.

FAHEY, D. A. B., G. (2008) Application of Diffusion of Innovations Models in Hospital Knowledge Management Systems: Lessons to Be Learned in Complex Organizations. . *Hospital topics* 86**,** 21-31.

GARG, A., ADHIKARI, N., K. & MCDONALD, H. (2005) Effects of Computerized Clinical Decision Support systems on Practitioner Performance and Patient Outcomes: A Systematic Review. *Journal American Medical Association,* 293.

GHOSH, B. & SCOTT, J. E. (2007) Effective Knowledge Management Systems for a Clinical Nursing Setting. *Information Systems Management* 24**,** 73-84.

GROVER, V. & DAVENPORT, T. H. (2001) General perspectives on knowledge management: fostering a research agenda. *Journal of Management Information Systems,* 18**,** 5-21.

HADDAD, S., POTVIN, L., ROBERGEA, D. & PINEAULT, R. (1999) Patient perception of quality following a visit to a doctor in a primary care unit. *Family Practice,* 17**,** 21-29.

HAMMER, M. (1990) Re-engineering Work: Don't Automate, Obliterate. *Harvard Business Review,* 68**,** 104-112.

HANSEN, H. & CRAWFORD, K. (2003) Codifying or enabling: the challenge of knowledge management systems. *Journal of the Operational Research Society* 54**,** 184-193.

HANSEN, M. T., NOHRIA, N. & TIERNEY, T. (1999) What's your strategy for managing knowledge? *Harvard Business Review,* 77**,** 106-118.

HUNT, D. L., HAYNES, R., B., HANNA, S. E. & SMITH, S. (1998) Effects of Computer-Based Clinical Decision Support Systems on Physician Performance and Patient Outcomes. *Journal American Medical Association,* 280.

JENSEN, T. B. & AANESTAD, M. (2007) How Healthcare Professionals "Make Sense" of an Electronic Patient Record Adotion. *Information Systems Management,* 24**,** 24-42.

JOHNSTON, M., LANGTON, K. B., HAYNES, R., B. & MATHIEU, A. (2003) Effects of Computer-based Clinical Decision Support Systems on Clinician Performance and Patient Outcome: A critical Appraisal of Research. *Journal of the American Medical Informatics Association,* 10**,** 235-243.

KWAN, M. M. & BALASUBRAMANIAN, P. (2003) Process-Oriented Knowledge Management: A Case Study *The Journal of the Operational Research Society,* 54.

LEONARD, K. J. (2004) The Role of Patients in Designing Health Information Systems: The Case of Applying Simulation Techniques to Design an Electronic Patient Record (EPR) Interface. *Health Care Management Science,* 7**,** 275-284.

MAIER, U. & REMUS, R. (2003) Implementing process-oriented knowledge management strategies. *Journal of Knowledge Management,* 7**,** 62-74.

MCNULTY, T. (2002) Reengineering as Knowledge Management: A Case of Change in UK Healthcare. *Management Learning,* 33**,** 439-458.

MOTELEB, A. A. & WOODMAN, M. (2007) "Notions of Knowledge Management Systems: a Gap Analysis". *The Electronic Journal of Knowledge Management,* 5**,** 55-62.

PEDERSEN, M. K. & LARSEN, M. H. (2001) Distributed knowledge management based on product state models — the case of decision support in health care administration 31**,** 139-158

PHILLIPS, E. A. D. P. (Ed.) (2000) *How to geta PhD* Philadelphia, PA.

REUTHE, E. & ALLEE, V. (1999) Knowledge management: Moving the care model from a "snapshot" to a "story". *Health Forum Journal,* 42**,** 26.

ROTHSCHILD, A. S., DIETRICH, L., BALL, M. J., WURTZ, H., FARISH-HUNT, H. & CORTES-COMERER, N. (2005) Leveraging systems thinking to design patient-centered clinical documentation systems. *International Journal of Medical Informatics,* 74**,** 395-398.

SHACHAK, A. & REIS, S. (2009) The impact of electornic medical records on patient-doctor communication during consultation: a naarative literature review. *Journal of Evaluation in Clinical Practice,* 15**,** 641-649.

VAN BEVEREN, J. (2003) Does health care for knowledge management? *Journal of Knowledge Management,* 7.

YIN, R. K. (Ed.) (2009) *Case Study Research: Design and Methods,* London, Sage Publications Ltd.