Managing Tacit Knowledge in Rural Healthcare using Mobile Technology

Ahmad Mohammad Ali Qtaishat, Mohd Syazwan Abdullah,
Wan Rozaini Sheikh Osman
Department of Computer Sciences, College of Arts and Sciences
Universiti Utara Malaysia, 06010 UUM-Sintok, Kedah, Malaysia
ahmmed_q@hotmailcom, {syazwan, rozai174}@uum.edu.my

ABSTRACT

Knowledge Management plays an important role to safeguard and sustain organizations' human capital. This paper discusses the importance of managing nurses' knowledge assets using knowledge management technology. In particular, this paper examines the effectiveness on the use of mobile technology to assist and enable the nurses working in the rural areas to make faster and improved decisions in providing better healthcare and services to rural communities.

Key Words: Knowledge Management, Rural Health Care, Knowledge Management Technology, Mobile Technology

1. Introduction

Knowledge management is the process of systematically managing individual, group and organizational knowledge that can be considered as valuable assets. According to Hussain and Haza knowledge management "concerns the gathering, organization, refinement and distribution of knowledge" [1].

Therefore, Knowledge management involves the following steps: first identification and analysis of available and required knowledge assets and their related processes. Second the subsequent planning and control of actions to develop both the assets and the processes so as to fulfill the organization is objectives.

Today, the need to manage knowledge in organizations has become a key factor for success particularly in the knowledge economy. Organizations throughout the world are engaging with knowledge management projects and strategies to harvest the value of knowledge in order to stay competitive and to be innovative as knowledge is often viewed as 'information about information'. Therefore the main goals for using knowledge management in organizations is to achieving organizational goals through the strategy-driven motivation and facilitation of (knowledge) workers to develop, enhance and use their capability to interpret data and information (by using available sources of information, experience, skills, culture, character, etc.)[4].

Indeed research in the field of knowledge management concentrates mainly on finding effective ways of managing this knowledge assets through social and management perspectives. This is because knowledge resides in human memories, and managing knowledge is seen as a human-oriented process rather than one that is technological-based. However, as new technology emerges, it may now be possible to harness relevant technologies to find plausible solutions that will be of value to knowledge management.

This paper discusses how to employ mobile technology in healthcare industry using knowledge management, and in particular, it looks at the role and potential technology for knowledge management in the rural healthcare using the mobile technology.

This paper has been organized as follow: Section 1 introduces the paper and section 2 briefly discusses about the important of knowledge management. Section 3 presents technology for knowledge management, section 4 discusses about healthcare, healthcare process, nursing process and clinic process. Section 5 presents healthcare in rural area, while Section 6 discusses healthcare information technology. Sections 7 propose PDA as a device for rural healthcare. In section 8 will discuss how we will manage tacit knowledge in healthcare. Section 9 concludes the paper.

2. The Important's Of Knowledge Management

The importance of Knowledge management is widely seen in all business and economical establishments. Economics and business theorists have alluded to or identified knowledge as the ultimate competitive advantage for the modern firm.

In other words, it is a resource that is difficult to imitate or co-opt, giving its possessor a unique and inherently protected commodity. Therefore, any techniques or methods that sustain knowledge growth and distribution are considered a key to the success of today's organizations. Varieties of factors have contributed to the growth of an interest in knowledge management. Robert identifies seven of them as:

- Accelerating pace of change.
- Staff attrition (especially that resulting from years of downsizing and reengineering).
- Growth in organizational scope.
- Geographic dispersion associated with globalization of markets.
- Increase in networked organizations.
- Growing knowledge-intensity of goods and services.
- Revolution in information technology.

Knowledge is distinct from data and information. Data are the collection of facts and information is the outcome of the data process. For example, a plan or a strategy for solving a medical problem could be considered as data, however, the way of solving that problem and the utensils used for solving the problem could be considered as information. Conversely, knowledge is the ability to manipulate information by adding elements of experience in a particular context. (Figure 1) [5].

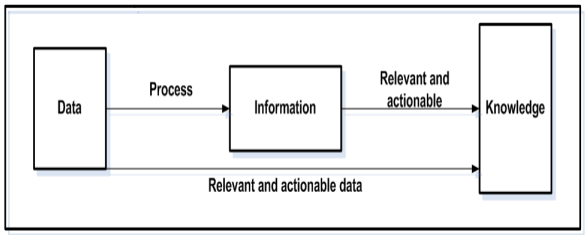

Figure 1: Data, Information, and Knowledge

Knowledge is divided in two kinds; the is the tacit knowledge. This knowledge is usually the domain of subjective, cognitive and experiential learning. Tacit knowledge depends on the experience the person encountered and this is not documented information. Second is the explicit knowledge that deals with more objective, rational, and technical knowledge (data, policies, procedures, software, documents, etc.).

This paper will focus more on the former instead of the later. An example of this can be seen when a patient visits the hospital for health examination, the doctor will normally diagnose the patients' illness. Subsequently, the doctor will read or gather the medical history of that patient before any medicine can be subscribe to him or her. The information gathered by the doctor could be considered as explicit knowledge [1].

Such knowledge is important to help doctors make decisions, and subsequently provide effective medicines and advise to patients. Such knowledge could also be transferred and transformed from tacit to explicit knowledge and vice versa using Nonaka's Knowledge Model [2]. Following are elaborations of such transformation of knowledge:

Socialization (tacit to tacit):

Sharing of information within the health industry is monumental. These include the shared formation and communication of tacit knowledge between people by the act of socialization, interaction, and engagement and discussion among the health professionals. For example, when a new medical problem appear in a particular heart disease case, the professionals attending the case would meet to discuss the case amicably which may produce new tacit knowledge.

Externalization (tacit to explicit):

Tacit knowledge can also be transformed to become explicit knowledge. For example, when attending a particular case, many questions and answers must be attended to. Every professionals involved will participate accordingly, and subsequently such discussion will produce reports which are new explicit knowledge. In this scenario, tacit knowledge has been transformed to explicit knowledge.

Combination (explicit to explicit):

Sharing of knowledge and information is important. This can be done in many ways and avenues. For example, explicit knowledge can be shared in meetings, via documents and e-mails. Such practices will help the team members of a particular case to share the same explicit knowledge together and subsequently take appropriate actions.

Internalization (explicit to tacit):

In order to act on information, individuals have to understand and internalize the information. This involves creating personal tacit knowledge, and this can be achieved by efforts through research, and reading. It is through such efforts that the medical professional will develop and enhance his or her tacit [2].

3. Technology For Knowledge Management

The effects of technology on our daily life cannot be refuted. It is impacting on every facet of human activities, and knowledge management in the health industry is no exception. Explicit knowledge needs to be hared within professionals in organizations. With the assistance of technology, it is not necessary for the professionals to meet face-to-face during the working hours. Discussions, meetings are now made possible through on-line discussion, teleconference and emails, and this has significantly changed how organizations work and function [6].

In particular, software like Lotus Note groupware is an innovative technology that facilitates the sharing of documents and discussions. It allows users to have asynchronous discussions. Such software which is known as groupware helps individuals to work together in groups or teams. Groupware can to some extent support all four facets of Nonaka's knowledge transformation model[6].

The babble system is another type of knowledge sharing, but much more like conversation. With this system, tacit knowledge could be formed and made explicit. Nevertheless, not all on line meeting systems have the properties of face to face meeting. For example, the videoconferencing system was more like a video telephone rather than a face to face meeting[6].

Therefore, knowledge management is useful and can be employed in almost all facets of human's life. The following section will show how knowledge management and technology can be used in hospitals in general and in nursing in particular.

4. HealthCare

Until the early part of twentieth century, very little could actually be done in hospital to improve the health of patients. Quite often, the rich can afford better health services than the poor ones. Today, patients want to have good and fast care by doctors and nurses. This depends largely on how they assess, plans, implements, evaluates and diagnose the patient in a short [8]. In addition, many healthcare services are now delivered in outpatient settings, where patients receive the required care, and then are allowed to leave. During such care, patients assume significant responsibility for monitoring their own health status, managing their recovery, and communicating with clinicians from home. This increasingly

distributed system of specialized outpatient health care places new demands on patients [9].
We can see that there has been a huge revolution in healthcare in a short period. This dramatic increase was due to the development of new techniques such as imaging machines and healthcare technology that could only be delivered in an institutional setting. Another factor helped enhancing healthcare in that time is the rise of the nursing profession that improved hygiene and the quality of care[7]. It is important to realize that healthcare system has three primary goals: the provision of high-quality care, ready access to the system, and affordable costs. The practical problem in health care policy is that the pursuit of any two of these goals aggravates the third. Thus, a more accessible system of high-quality care will tend to lead to higher costs, while a low-cost system available to everyone is likely to be achieved at the price of diminishing quality. In order to have a good healthcare service, healthcare providers must work as a group , they have to share all their experiences to solve any problems faced by them. Therefore, it is imperative for the healthcare providers to work together. This require implementation of knowledge management and share their experience
This section will discuss the following: - healthcare process, nursing process, and clinic process

4.1 Healthcare Process

Healthcare process can be defined as a set of activities, methods, practices to provide healthcare service, and maintain the environment that support the service provider. As healthcare processes are characterized by the fact that several organizational units can be involved in the treatment process of patients and that these organizational units often have their own specific IT applications. It becomes clear that getting data, which is related to healthcare processes, is not an easy task for example diagnostic tests, medical treatments, and laboratory examinations protect and restore health and save lives[10].
Therefore, healthcare can be divided into two processes clinical process and nursing processes in order to organize healthcare process. These processes can not work independent, they work as a group. Therefore, in order to provide a good healthcare processes we have to connect clinical processes with the nursing process, hence they work as team.
Nursing and clinical have a direct and indirect connection for example, nurses should have a connection between the clinic so they can know what kind of drugs that they can use for patients.
Now we will talk about clinical process and nursing process

4.3 Clinic Process

Health care practices involves complex clinical processes in which high risk and high cost activities take place. A clinical process can be view as a particular workflow where medical (e.g. treatment, drug administration, guideline execution and medical) and non-medical (e.g. patient enrollment, medical records instantiation) activities and events occur [11].
The clinical process is to obtain information from unstructured sources, and stored these in the structure of machine-readable form. This large amount of data can be used in the data mining technology that can detect patterns of adverse events, errors and cost dynamics, hidden in the structure of clinical trials, the risk of his career and poor performance.
The maintenance of patient records requires a lot of time and effort, even in the cases that is well documented. Furthermore, patient records usually do not capture information from communication sessions (e.g. face-to-face communication) between physicians. As a result, technology are used such on the PROGEMM (PRocess-Oriented GEneric Management of Medical Knowledge) in order to support the specification, maintenance, and execution of clinical processes[12].

4.2 Nursing Process

Nursing process is a process by which nurses deliver care to patients, supported by models of nursing.

In 1980, The American Nurses' Association defined nursing as "The diagnosis and treatment of human responses to actual or potential health problems." The practices (steps) of the nursing process including assessment, diagnosis, plan, implementation, and evaluation are cyclic, overlapping and interrelated[3, 4]

Step one. Assessment- is the most critical step and answers the questions: "What is happening (i.e., actual problem)?", or "What could happen (i.e., potential problem)?" This step involves collecting, organizing, and analyzing information/data about the patient. That is two parts: data collection and data analysis. In general, the data collection is a holistic approach and the methods of data collection can be observation, interview, and examination. The data types include subjective and objective data. The former can be "symptoms" that the patient describes; e.g. "I can't do anything for myself." The later can be "signs" that can be observed, measured, and verified; e.g., swollen joints.

Step two. Diagnosis- is a statement that describes a specific human response to an actual or potential health problem that requires nursing intervention.

Step three. Plan- provides consistent, continuous care that will meet the patient's unique needs, includes patient goals and nursing orders. The patient goals are directly related to the patient's problem as stated in the diagnosis, which describe the desired result of nursing care and the nursing order describes what the nurse will do to help the patient achieve the goals.

Step four. Implementation- involves applying the skills needed to implement the nursing order. The major tasks include reassessing the patient, validating that the care plan is accurate, carrying out nurses' orders, documenting on patient's chart and so forth.

Step five. Evaluation- compare the patient's current status with the stated patient goals and has three different operations or purposes: evaluation of the quality of the written care plan, evaluation of the client's progress, and evaluation of the status/currency of the care plan [3].

Good healthcare should be accessible to all people whether they are in urban or rural area. Most of the time rural people are left for behind than their urban counter part. The next section focuses on providing healthcare in rural area.

5. Healthcare In Rural Area

In order to provide a good healthcare for the whole country, we must not forget to provide a good care for people who live in the rural areas as they may be the group of patients that are in need due to their economy status and background. Such areas are distinct from the more intensively settled urban and suburban areas, and also from unsettled lands such as the outback or wilderness. The lifestyle in rural areas are different from those in urban areas depending on the area, mainly because the limited public service. Therefore, in order to provide a good healthcare service in rural areas we must start thinking on how we could help to improve the health service in these areas. Evidently, there are many obstacles faced by clinic in a rural area for example [5]:

Traveling: Peripheral leads to increased travel by both health professionals and patients. Nurses have reported that they see a lower number of patients in a day than their urban counterparts because of the travel distances involved. This problem could be solved by providing perhaps better training and new knowledge and effective tool. There is no need for the professionals to travel to diagnoses patients, as available technology is able to provide important information and the relevant professionals in a small personal digital assistant. As a result, professionals need not to travel every time when the

nurse face a new problem or a complex situation [5].

Staff recruitment and retention: In remote rural communities, staffing levels of health services tend to be static with a low turnover. However, because there is a need for more senior, experienced staff who can work autonomously in a range of roles, salary bills are often high. To solve this problem, this paper suggests that although the nurses may not have the enough experience, the personal digital assistant will give the nurse the confident that he/she needs to solve any problem face in the future.[5].

This is because, the technology such as PDA's is a communication tool that support the needs for a team to work closely at a distance. Rural health care has many aspects to be considered. These include access to physicians, dentists, nurses, and mental health services; the financial circumstances of the rural hospitals; federal rules concerning Medicare reimbursement rates, and the impact on rural hospitals and healthcare professionals; and the consequences of all of these on the health of rural people in general [6].

6. Information Technology In Healthcare

In general, IT allows health care providers to collect, store, retrieve, and transfer information electronically. However, more specific discussion of IT in health care is challenging due to the lack of precise definitions, the volume of applications, and a rapid pace of change in technology[7].Information technology (IT) has the potential to improve the quality, safety, and efficiency of health care. The volume of application, and a rapid of change in technology. Drivers of investment in IT include the promise of quality and efficiency gains. Barriers include the cost and complexity of IT implementation, which often necessitates significant work process and cultural changes[7]. Technology has many impacts on healthcare. For example if the doctors or nurses or other care givers want to monitor the status of their patients, they can use the wireless sensor network which enables them to know the status of their patient by receiving all changes or data of the patient on the PDA anywhere they may be at the hospital [8].

In clinics, we can see that technology has a direct impact to assist in executing the clinical process by providing intelligence functionalities based on workflow mining techniques, and in monitoring process during their execution. The doctor can know all the information about his or her patient, and the doctors could monitor the patient while he is in his room [3].

Technology can also help people with chronic conditions. By providing continuous home monitoring service this will reduce the hospital operating costs. Therefore, this will increased efficacy of health care service delivery of patients who suffer form chronic diseases such as weakness of the heart muscle, chronic obstructive pulmonary disease and diabetes, and others [9]. We can use technology for knowledge sharing in healthcare by using a semantic web standard and concepts. By using a good electronic health record (GEHR) will give us the opportunity to exchange data among different healthcare areas, sections and professionals., With proper guidelines, users will be able to find the right information when needed [10].

During a patient's life time, he or she will receive treatment from many different healthcare providers and each of these healthcares will store information of the person's medical history. Having such information available in away that it could be easily retrieved is important not only for the patient but also for healthcare providers. For this reason we want to have a standard for data integration and knowledge sharing in healthcare using Resource Description Framework (RDF) in order to have the history of the patient in less time and less effort [10] Constantly patients want emergency rooms and clinics for treatment, and they seldom saw the same doctor once or twice. Therefore the new doctor will start from the beginning

with them to diagnose there situation, that will cost them money and they will lose time. In addition, photo ID card with patient data on magnetic strip is now made possible and integrated. Thus, if a new doctor wants to diagnose on a patient, he or she can know all his medical history by accessing to the system and typing the patient's ID. As a result, patient will have a fast and good treatment even if the doctor or nurse at that time diagnoses the patient for the first time [11].

Healthcare information technology can be divided in to two parts, software and hardware. We will view several software's and hardware's that can be used in healthcare.

6.1 Software technology

• **Electronic health record (EHR):** were originally envisioned as an electronic file cabinet for patient data from various sources (eventually integrating text, voice, images, handwritten notes, etc.). Now they are generally viewed as part of an automated order-entry and patient-tracking system providing real-time access to patient data, as well as a continuous longitudinal record of their care[12].

•**Computerized provider order entry (CPOE):** in its basic form is typically a medication ordering and fulfillment system. More advanced CPOE will also include lab orders, radiology studies, procedures, discharges, transfers, and referrals[13].

•**Clinical decision support system (CDSS):** provides physicians and nurses with real-time diagnostic and treatment recommendations. The term covers a variety of technologies ranging from simple alerts and prescription drug interaction warnings to full clinical pathways and protocols. CDSS may be used as part of CPOE and HER[14].

• **Radio frequency identification (RFID):** This technology tracks patients throughout the hospital, and links lab and medication tracking through a wireless communications system. It is neither mature nor widely available, but may be an alternative to bar coding[15].

6.2 Hardware Technology

- **Large hardware**

Magnetic resonance imaging: Is primarily a medical imaging technique most commonly used in radiology to visualize the structure and function of the body. It provides detailed images of the body in any plane. MRI provides much greater contrast between the different soft tissues of the body than computed tomography (CT) does, making it especially useful in neurological (brain), musculoskeletal, cardiovascular, and cancer imaging [16].

- **Big hardware**

X-ray machine system consists of a X-ray source or generator (X-ray tube), and an image detection system which can either be comprised of film (analog technology) or a digital capture system[17].

- **Small hardware**

These small hardware can be used by physicians and nurses it depends on what they want to use it for, we will review three devices that physicians and nurses can use in there work such as:

Tablet PC's are full-featured computers designed in a portable size with a special tablet version of the operating system installed; they are smaller than laptops and come with a writing stick (pen) that replaces the keyboard and mouse. Rather than replace software, they make any software such as word processors, Acrobat, or Markin, "writable" so that the instructor is using a familiar tool to produce familiar results for the student[18].

Pocket PC handheld device that enables users to store and retrieve e-mail, contacts, appointments, tasks, play multimedia files, games, exchange text messages with Windows Live Messenger (formerly known as MSN Messenger), browse the Web, and more[19].

Personal Digital Assistant (PDA)

Is a handheld computer, also known as a palmtop computer. Newer PDAs also have

both color screens and audio capabilities, enabling them to be used as mobile phones, (smartphones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs). Many PDA's employ touch screen technology[19, 20].

7. PDA As A Device For Rural Healthcare

PDA is one tool that can used be to provide good healthcare assistant. Via knowledge management techniques on PDA systems, such technology can provide an effective healthcare service to the needy ones.

With PDA technology, there are many tasks that nurses in rural area can do for example:

- Nurses usually assess patient health status quite often through the patients' file, but this takes time and effort. With PDA such information can be stored in the PC and the nurse involved can access from her PDA to the patient file and retrieve the data that she needs [21].
- Evaluate the patient's response to the care provided. The nurse can use the PDA to evaluate the patient's responses and actions. This is much better that conventional practices where the nurse evaluate and check the patient's response manually by writing every thing in the papers [22].
- The nurse can give health teaching and continuously educate the patient and the family using PDA. The nurse will use the PDA as a reference and a backup data. Therefore, there will be no worries to forget any instructions or giving wrong information and advice to the patients and families. [23]
- Discharging of the patient and all the relevant discharge processes can be assisted by the PDA. The nurse can receive on her PDA a message that a new patient has just been registered in the clinic, and all information about that patient. Like wise, when the patient is discharged, the nurse can send SMS to the reception so they can prepare all the relevant documents (White, Allen et al. 2005).
- Check blood pressure can also be assisted using the PDA.
- The nurse can also calculate the percentage of the fluid intake and output with the PDA.
- Hand over shift report and a summary of the patients' condition can also be made available to the next shift, through data transfer from the PDA to the next nurse on shift so the nurse will know all the information that she needs about the patient(s).

The above evidently shows the potential of PDA technology in the health industry. PDA has direct impact in hospitals as well as in clinics in order to provide a better healthcare to patients.

We will focus on nurses and how technology will help them to give their patients the service that they need, and how they can save time in making decisions. There are many tools that can help nurses in their work, for example, they can use the PDA. A major problem here is that nurses may not have the knowledge on how to use the PDA. However, with the potential of PDA, a lot of information and knowledge sharing can be uploaded for general use by them.

8. Managing Tacit Knowledge In healthcare

Tacit knowledge can be extract from past cases stored in case base and use it with explicit knowledge stored in clinical practice guideline by using a particular system to look up for the optimal solution from the old cases. If the case dose not matches to the extent desired then the case

adaptation will take place using any adaptation techniques. The past cases are being thoroughly studied to identify the kind of tacit will be required and then structured in order to be stored in the case base[24]. In the begin of this paper we discussed about knowledge management and healthcare, now we want to merge them together. In doing so, we will see how can we use the tacit knowledge for the senior nurses in order to help the new nurse and the undergraduate nurse.

As we know senior nurses are more experienced compared to fresh nurses, as they experienced a lot of cases during their work. The question is how can we give this experience from the senior nurses to the new nurses and for trainee nurses? The answers to this question involve many issues. Firstly, we need to take the tacit knowledge from the seniors nurse by asking them direct questions. Then we need to write down all medical cases that they have faced in their life (the knowledge become explicit). In other words, by asking more questions, this will enable the nurse to create a background and collect all the information about these cases.

At an advanced step, and after collecting all the information that we want from the seniors, we will design software system, which will help nurses to and have a practical test on it. Later, the system will be given to the senior nurse to test it. The mechanism of this system is by asking questions to the nurse about the patient situation, and the nurse will answer until he/she diagnosis this case. After diagnosis, the system will give the nurse the right way of providing care for that situation in short time such as wound dressing, personal care and diets. Nursing students uses the basic component function of the PDA such as the address book, calculator, calendar and memo pad. They also have access to the software providing current drug and infectious disease information, calculation capabilities, growth charts and immunization guidelines. PDA's are probably most useful in clinical settings, the pace is fast and the resources may not be available, so if a nurse wants to give a king of drug, before giving the patient that drug the nurse must know the laboratory values. Therefore, the information about that drug and the amount that should be given to the patient will be in the PDA, the patient will get the right drugs with out any medical error [23, 25].

Using the knowledge, trainee nurses will learn how to use this PDA system in the class and when they go to the hospital they will use in real life. Existing nurses can be trained to use PAD as well to perform their job. After graduation, this PDA will be like a reference for them if they faced any new cases [23, 25]. The same is true for newly appointed nurses.

9. Conclusion

This paper shows how mobile technology can have a developmental impact on the health industry, and specifically on rural areas clinics. This paper shows how mobile technology can solve different problems that may be faced by nursing using the PDA system. The PDA system as been shown in this paper enables the medical practitioners in general to have almost real time data, information and knowledge that will assist the nurses for example to make good diagnose and appropriate medical action. The PDA could also function as an avenue for quick reference for the challenging work environment in the medical sector. Its potential is only building up, and the medical sector has to consider using it for general improvement of the medical services. For that reason, this paper shows how mobile technology can help healthcare providers in there career.

References

[1] E. Turban, E. McLean, J. Wetherbe, and D. Leidner, Information technology for management: transforming

organizations in the digital economy: Hoboken: Wiley, 2006.
[2] A. Marwick, "Knowledge management technology," IBM Systems Journal, vol. 40, pp. 814-830, 2001.
[3] R. Curia, L. Gallucci, and M. Ruffolo, "Knowledge Management in Health Care: An Architectural Framework for Clinical Process Management Systems," Database and Expert Systems Applications, 2005. Proceedings. Sixteenth International Workshop on, pp. 393-397, 2005.
[4] T. Hsia, L. Lin, J. Wu, and H. Tsai, "A framework for designing nursing knowledge management systems," Interdisciplinary Journal of Information, Knowledge, and Management, vol. 1, pp. 13-22, 2006.
[5] J. Dower, "Health care in peripheral and remote rural areas," 2008.
[6] K. Strong, P. Trickett, I. Titulaer, and K. Bhatia, "Health in Rural and Remote Australia," The First Report of the Australian Institute of Health and Welfare on Rural Health. Australian Institute of Health and Welfare Canberra. AIHW Cat No PHE6, 1998.
[7] J. D. Glenn M. Hackbarth, p. D. D. Reischaver, and p. D. E. Miller, "information technology in healthcare," medpac, pp. 157, 2004.
[8] M. Ashraf, M. H ن‌rknen, M. H ن‌m ن‌ان inen, and J. Riekki, "Health Care Process Management Supported by Wireless Technology," 2007.
[9] A. Prentza, S. Maglavera, N. Maglaveras, I. Lekka, E. Sakka, L. Leondaridis, and D. Koutsouris, "Quality Healthcare Management through INTERLIFE Servises," 2006.
[10] F. Nardon, L. de Assis Moura Jr, and B. de Faria Leao, "Using RDF and Deductive Databases for Knowledge Sharing in Healthcare," 2004.
[11] M. Larsen and M. Pedersen, "Distributed knowledge management in health care administration," System Sciences, 2001. Proceedings of the 34th Annual Hawaii International Conference on, pp. 10, 2001.
[12] R. Baron, E. Fabens, M. Schiffman, and E. Wolf, "Electronic health records: just around the corner? Or over the cliff?," in Annals of Internal Medicine, vol. 143: Am Coll Physicians, 2005, pp. 222-226.
[13] E. Campbell, D. Sittig, J. Ash, K. Guappone, and R. Dykstra, "Types of unintended consequences related to computerized provider order entry," Journal of the American Medical Informatics Association, vol. 13, pp. 547-556, 2006.
[14] K. Kawamoto, C. Houlihan, E. Balas, and D. Lobach, "Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success," in British Medical Journal, vol. 330: BMJ Publishing Group Ltd., 2005, pp. 765.
[15] S. Sarma, D. Brock, and D. Engels, "Radio frequency identification and the electronic product code," IEEE Micro, vol. 21, pp. 50-54, 2001.
[16] "magnetic resonance imaging," North American spine society public education series, 2006.
[17] G. Yue, Q. Qiu, B. Gao, Y. Cheng, J. Zhang, H. Shimoda, S. Chang, J. Lu, and O. Zhou, "Generation of continuous and pulsed diagnostic imaging x-ray radiation using a carbon-nanotube-based field-emission cathode," Applied Physics Letters, vol. 81, pp. 355, 2002.
[18] S. Jennings and M. McCuller, "Meeting the Challenges of Grading Online Business Communication Assignments," Exploring the Impact of Technology on Business

Communication Practice and Pedagogy, 2004.
[19] B. Wan and S. Watt, "An interactive mathematical handwriting recognizer for the Pocket PC," presented at Proc. International Conf. on MathML and Math on the Web (MathML 2002), 2002.
[20] "Medical Patient Encounter Application," Columbia University Medical Center, 2005.
[21] N. Rodriguez, J. Borges, Y. Soler, V. Murillo, C. Colon-Rivera, D. Sands, and T. Bourie, "PDA vs. laptop: a comparison of two versions of a nursing documentation application," Computer-Based Medical Systems, 2003. Proceedings. 16th IEEE Symposium, pp. 201-206, 2003.
[22] M. Berglund, C. Nilsson, P. Révay, G. Petersson, and G. Nilsson, "Nurses'and nurse students' demands of functions and usability in a PDA," International Journal of Medical Informatics, vol. 76, pp. 530-537, 2007.
[23] A. White, P. Allen, L. Goodwin, D. Breckinridge, J. Dowell, and R. Garvy, "Infusing PDA Technology Into Nursing Education.," Nurse Educator, vol. 30, pp. 150, 2005.
[24] F. Hussain and S. Raza, "A Knowledge Management Framework to Operationalize Experiential Knowledge: Mapping Tacit Medical Knowledge with Explicit Practice Guidelines.," National Conference on Emerging Technologies, pp. 93, 2004.
[25] L. George and L. Davidson, "PDA use in nursing education: Prepared for today, poised for tomorrow," Online Journal of Nursing Informatics, vol. 9, 2005.