Effectual Dynamics and Prolific Usage of Knowledge Management & Engineering in Health Care Industry

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Abstract: Knowledge management is about managing and sharing knowledge. Knowledge management includes areas such as organizational behavior, IT, leadership, training and strategy which is very important for both organizational and individual's health. This study aims at applying this concept of knowledge management to the health care industry. The health care industry is one of the most important industry in any economy. Although this industry is showing growth trend in many countries but still there are many medical errors that are occurring. Errors are even occurring in developed countries. In order to reduce these errors, this study has recommended a model which involves "The ministry of health" and "NADRA" of Pakistan. These ministries will help in record keeping (Record of patients and best practices). This model will in return improve the quality and reduce the errors of the health care industry.

The objective of this study was to investigate if the implementation and integration of knowledge management shall improve the performance of the health care industry or not. The present health care industry of Pakistan has been evaluated in this study. The main aim was to determine the main benefits that knowledge management has to offer to the healthcare industry of Pakistan.

"Knowledge management is the name of a concept in which an enterprise consciously and comprehensively gathers, organizes, shares, and analyzes its knowledge in terms of resources, documents, and people skills" (Angus and Patel, 1998).

Knowledge management is generally concerned with sharing and transferring of knowledge. This knowledge makes the basis of best practices in health care industry. These best practices can then help in improvement of performances (Angus and Patel, 1998). This study will help in determining what positive effect knowledge management will bring to the health care industry of Pakistan.

It is a known fact that the sharing of knowledge is most critical in the health industry. This is because human life is involved and the information is very personal. So this study focuses on the improvement in performance in health care industry that can be brought about by the implementation of knowledge management and knowledge engineering.

Problem Statement:

Analyzing the factors responsible for effective implementation and integration of knowledge management and engineering in health care industry of Pakistan.

The objective of this research is to design a knowledge management framework for the health care industry. This study has been done to identify through the use of knowledge management framework whether the performance of health care industry can be improved. The performance of the health care industry depends highly on knowledge sharing. Knowledge sharing is critical in the health care industry, since the underlying value is of human life and privacy. There are many countries that spent heavily on their health care. This is a critical and sensitive industry for any country. Yet there are many errors happening in this industry. The occurrence of these errors increases the operating cost instead of reducing them.

In this paper the main aim was to come up with a knowledge management model along with other management tools that helps in reducing these errors, sharing of knowledge, and saving more human lives. The proposed model (given by this study) will help the health care professionals in making better decisions and hence improves the quality of the health care industry.

2. Knowledge Management

Different organizations have different meaning and purpose of knowledge management and depend on the type of initiative. Managing knowledge is almost the heart of everything that happens in the health sector today. There is a strong urge and need to have fast access to wide range of sources for accurate information to help and deliver the best possible services for users and (Beverly, 2007). Knowledge management is a practice and not just a technology or a set of methodologies. Three main components of knowledge management are people, process and technology. For any health sector to have a good practice in 21st century

it should make sure that these three components are in place and functioning properly to achieve the best practice. From the health sector point of view the knowledge management can be thought of ensuring the right information is available to the right people and practiced by the right people at the right time (Beverly, 2007). As health sector is very much interconnected and interrelated so a successful initiative in one department can be easily extended to practice in other departments. According to Beverly (2007) "Knowledge management is concerned with creating, managing and sharing explicit knowledge (e.g. reports, policy statements, procedures, practice guidelines, books, journals articles), as well as tacit knowledge (i.e. encouraging employees to share knowledge that they have gained through experience).

According to Boss (2002), knowledge management consists of the following four processes:
 Knowledge creation
 Knowledge structuring
 Knowledge dissemination
 Knowledge application

Figure 1 presents the four processes that are involved in the knowledge management cycle as proposed by Boss (2002).

Most health care organizations are poor in knowledge management and information. Although health sector is knowledge and information rich sector but there is not much quality information available to use effectively for the best practice.

According to Rector (2001) "Getting the right information to the right people at the right time in the right form to make a difference is still the exception rather than the rule".

There are lot of restrictions in place for information and knowledge sharing in the health sector which results in inefficient use of resources, loss of many resources and clinical errors that leads to serious financial and health problems for people and government respectively.

Health care industry consists of hospitals, clinics, pharmacies and customers that are connected in information and knowledge sharing activities leading up to the improvement of the quality care and best practice.

Boss (2002) and (Ruggles, 1997) believe that to implement the knowledge management environment of four processes several categories of knowledge management capabilities needs to be supported by organizations.

3. Industry Analysis
3.1 Business strategies related to knowledge management

The business activities that are linked with knowledge management according to Newman (1991) are:

- o   Change management

- o   Best practices
- o   Risk management
- o   Benchmarking

The advantage derived from knowledge management is that a record of the best practices is kept. If a person comes up with an even better way of doing things then that is recorded. Then that process is followed. The information can be of anything; corporate asset to business strategies and policies. Knowledge management helps in reducing the risk factor by not repeating the same mistakes again.

In knowledge management emphasis is given to creativity, creating new knowledge value while other programs emphasize leveraging existing knowledge. (Sveiby, 1996)

According to the United Nation the health care industry includes, (ISIC Rev.4)
1)   hospital activities,
2)   medical and dental practice activities,
3)   other human health activities

The people that are involved in this industry are innumerable, (ISIC Rev.4)

Nurses, midwives, physiotherapists, scientific or diagnostic laboratories, pathology clinics, ambulance, nursing home, or other para-medical practitioners in the field of optometry hydrotherapy, medical massage, music therapy, occupational therapy, speech therapy, chiropody, homeopathy, chiropractic, acupuncture, etc.

No one can neglect the importance of the world health industry (Economy Watch, 2005). This is why a general growth trend is seen in the health care industry. Many different countries such as China, Turkey, Indonesia, Russia, India, Brazil, and Mexico are showing a growth trend. These countries compromise approximately 1/5th of the world health care sales.

It is also seen that the developing countries are also going for the health care industry. This is because it helps in generating higher revenues and contributes a lot to the GDP. According to the statistics of the U.S. the health care industry of U.S. alone is raising 13.4 million job opportunities. It is also expected that the job opportunities will further rise by 19% by the year 2014. (Economy Watch, 2005)

The providers of the healthcare look at quality as cost efficiency, whereas the patient sees the quality as cost efficient and accurate diagnosis. To improve the quality of the healthcare further the providers must anticipate the requirement of the patient. If the providers try to cut cost in improving these services they will significantly increase their costs. This is because it might increase the duration of the patients stay (Stewart, 2003). The healthcare providers must look into the TQM practices. This will bring forth many advantages. A learning culture will be created, new ways to solving problems will be adopted, there will be improvement in

service, team work will be promoted, and the service will be market oriented (Ovretveit, 2001).

3.2 Rate of medical error in advanced countries

Health care is very expensive. A lot of countries invest a significant percent of GDP on their health care. USA spends the highest amount on its health care then UK and Canada. Still there are many errors that are occurring (A Research Center of the University of Sheffield and CITY Liberal Studies, 2005).

According to a research done by Kaiser Family Foundation (2008), almost 7000 patients die in USA due to errors. In another research it was said that one out of every twenty five patients die due to medical errors (AHRQ, 2000). These medical errors cost the USA almost $37.6 billion. It is said that 54 percent of these errors were preventable (IOM, 1999).

In a report according to National Health Services of the UK 72,000 patients have died due to medical errors where as in Canada 24,000 patients have died because of the same reason (CBC, 2004).

3.3 Data, Information, Knowledge and KM

Data is like raw information. In the healthcare system this raw information does not provide complete details. It consists of the name of the patient and doctors name along with the treatment he is about to receive basically general information (London hospital, 2001). Information is when a doctor makes a decision or decides a treatment for a patient by looking at the previous information provided to the doctor. This means using the data to make it into a useful form. The information systems have been made so that the collection and analyzing of data is made easy (Herring, 1992). Whereas knowledge is an integration of know-what, know-how, know-where, know-who and know-why processed from information (White, 2000). KM is where knowledge is creatively, effectively and efficiently applied to benefit patients (Prince, 2000).

The aim of KM is to improve the learning with in the healthcare system. To ensure such a system a knowledge storage space will be required, this knowledge space needs to be accessible, and the knowledge should also be convertible and understandable (Sharma, Wickramasingha & Gupta, 2005). This whole process of data turning into Knowledge can be summarized below in figure1.
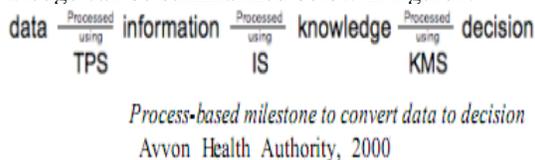

Figure 1 Data transformation into knowledge

4. Health Care Industry in Pakistan

The healthcare of Pakistan is in a bad state. It is not well funded. The healthcare is said to receive only 0.75% of the GDP (Economic Survey of Pakistan, 2005-06) where as the USA receives about 25% of the GDP (WHO, 2005). The expenditure till now is as follows.

1) Federal Government Spending on Health (2007-08)

Development Expenditure	Rs. 14.272 billion
Current Expenditure	Rs. 3.791 billion

Source: Ministry of Health, 2007

Despite these challenges the health ministry has initiated many programs. These programs are to generally fight against diseases such as Cholera, Crimean Congo Hemorrhagic fever, Dengue Hemorrhagic Fever, Hepatitis C, HIV, Swine Flu, Tuberculosis and leishmanisis (Akram and Khan, 2007). The medical force that is present to overcome these diseases are,

2) Human Resources (Registered, 2007)

Doctors	107,835
Doctors registered as specialists	19,623
Dentists	7446
Dental specialists	433
Nurses	43,646
Midwives	2,788
Lady Health Visitors	3,864
Lady Health Workers	95,000
Lady Health Supervisors	3,385
Population per doctor	1,475
Population per dentist	21,362
Population per nurse	3,644

Source: Ministry of Health, 2007

Despite having such a strong medical force and good health programs, not having sufficient funds catches up. This can be shown in the following table.

3) The Mortality Rate per Disease

Infant Mortality Rate (IMR) (per 1000 persons)	76.7
Maternal Mortality Rate (MMR) (per 100,000 live births)	350
Under -5mortality rate (per 1000 persons)	101
Parasite Incidence of Malaria (per 1000 persons)	0.75
Incidence of TB (per 100,000 persons)	181

Source: Ministry of Health, 2007

The health care industry comprises of the following health service providers.

4) Health Services Providers (2006-07)

Total Health Facilities	13,937
Hospitals	965
Dispensaries	4,916
Basic Health Units	4,872
Rural Health Centers	595
MCH Centers	1,138
TB Centers	371
First Aid Points:	1,080
Beds in hospitals & dispensaries	105,005
Population per bed	1,515

Population to health facility ratio   11,413
Source: Ministry of Health, 2007

The three main stake-holders in any health sector are people, administration and government. They all are involved in knowledge and information sharing activities. For a successful knowledge management in any health sector all the three stake-holders should adopt a learning approach in creating, transforming and retaining knowledge. For example, for people i.e. patients to have the best facilities available in hospital , for administration i.e. doctors to have the best environment for patient care by capturing and sharing knowledge and for government to be able to operate efficiently and effectively in any health care initiatives. And for the above stakeholders to be able to measure and evaluate learning outcomes for the best practice, open system architecture capable of using shared resources and serving all the three stake holders might be a solution for best practice.

5. Research Methodology

The research methodology that has been adopted is interpretive and analytical. The theory of knowledge management was studied in great detail before this research was carried out. This was done in order to understand the impact that knowledge management has in the health care industry. Inductive reasoning was used with the aim to determine the possible advantages that knowledge management has to offer.

Interview method was used and in these interviews the main interviewees were doctors working in management areas. These doctors were selected randomly. Doctors from different hospitals of Islamabad both public and private were interviewed. The sample size taken into consideration was 40. All those interviewed were health industry or health industry related professionals.

Qualitative data was gathered in order to find out the potential benefits that knowledge management has to offer the health care industry of Pakistan. In order to do so, semi structured interviews were conducted. On the basis of this data the knowledge management adaptation and integration issues were determined.
The 40 health care professionals that were interviewed were informed about knowledge management. They were given the basic back ground information of knowledge management. This was done so that they could prepare themselves for the interview, so that they could gather their thoughts.

- The basic information about knowledge management.
- The benefits knowledge management can offer.
- The present status of their IT.
- The potential of their extension into IT.
- The budget allocated for the extension of IT.

After giving the interviewee the information a second interview was conducted. By this time the interviewee had gained considerable information. The interviewee's had also aligned their thoughts by then. This time the discussion was based on the proposal of implementing knowledge management. Their response was then recorded. The second interview recorded information such as:

- The cost of implementing knowledge management.
- Comprehending the advantages that knowledge management would bring to health care industry.
- Describing the knowledge management system in foreign countries.
- How knowledge management will enable hospitals to improve patient care.
- Possible drawbacks and limitations associated with such implementations.
- Current management resistance to this change

The information gathered from all sources was carefully recorded. The careful recording was done in order to assure the authenticity of the information. It was also being done to make sure that quality and accurate information was gathered.

5.1 Data Interpretations and Findings

In this research the primary data was collected through interviews. Therefore the data is mainly qualitative. The resposnse of the interviewees was recorded and analysis of data gathered is as follows.

Table 1: The present status of their IT

Satisfaction Level of Doctors with Current IT Status		
	Satisfied	Unsatisfied
Public Sector Doctors	10%	90%
Private Sector Doctors	80%	20%

Most of the hospitals in private sectors are advanced in the equipment and IT systems. They have good record keeping systems. The new patients when they enter the hospital for treatment, they are given a reference number and in this reference number the patient records are kept. These are the records of the treatment that a patient receives in that particular hospital.

Mostly the information system in these private hospitals is good as long as the patient keeps on taking treatment from that hospital. If ever the same patient cannot find a particular treatment available in that hospital then he/she would have to go to another hospital which would not be aware of the prior problems of the patient.

The public sector hospitals in Pakistan totally lack in IT structure. They have no proper reporting systems, record keeping and communication. The technology

that is used in these hospitals is mostly obsolete. There are no computers used, hence there is no communication/record keeping.

During our interview with the doctors of the private sector, we found out that they are mostly satisfied with their current IT systems. 80% of the doctors in private sector are satisfied with their current IT status. Whereas the other 20% are the senior doctors that find operating on the systems a little confusing. This is mainly the only reason for their dissatisfaction.

Table 2

Extension in Current IT Status		
	Agreed	Non-Agreed
Public Sector Doc	70%	30%
Private Sector Doc	20%	80%

The doctors in private sector say that they are very much satisfied with their current IT status. They say that the only extension would be to bring in more advanced medical technology that could help them in treating patients more efficiently and accurately. Where as 20% of the doctors felt that there should be some more advancement in their hospitals. They want that the communication between departments should be improved further.

The public sector doctors are highly unsatisfied with their almost non existent IT status. They say that they are already lacking in medical technology, so it is highly unlikely to expect any extension/improvement in their IT status.

When we asked about the budget allocation they have for IT in private sector hospitals, different doctors came up with different figures. This is because the doctors interviewed were from different hospitals and of different sizes. The figure when averaged was about 30%.

The doctors in the public sector were asked this same question, they remarked we are already very much underfinanced and the hope for the extension in IT is near to zero.

Table 3

Satisfaction with Current Management to handle Changes		
	Satisfied	Not Satisfied
Public Sector	30%	70%
Private Sector	80%	20%

80% of the doctors in administration of private sector feel that their management staff can handle the change. This is because the staff is already used to the advance operating systems present in the IT area. They are educated enough to learn new things.
In the public sector, doctors have some reservations about handling the change because the staff of public sector hospitals are not educated enough to learn the

new things of technology. And they are resistent to accepting the change.

Electronic patient record (EPR) and the electronic health record (EHR) are the way forward for the Health care industry (Razzaque and Jalal-Karim, 2010).

So in order to implement the EPR and EHR system the whole health care system should be made electronic consisting of secure computer systems. This should be done so that the hospital computers should communicate with each other. So if a doctor of one hospital happens to come across a patient of another hospital can get access to his past records. These electronic records will help the health care professionals make better decisions and save more lives (Razzaque and Jalal-Karim, 2010)
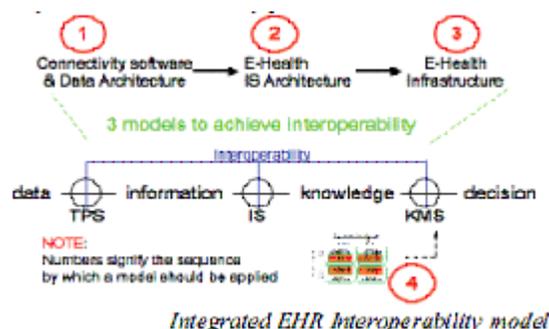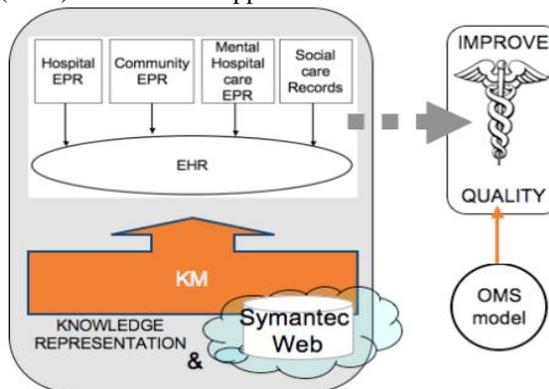
5.2 MODELS

MODEL 1

Figure 2 Integrated EHR Interoperability Model
Source: Razzaque and Jalal-Karim, 2010

MODEL 2
The HC KM model to improve the quality of healthcare was proposed by Razzaque and Jalal-Karim (2010). This model supports the EPR and EHR.

HC KM facilitator model to improve quality of healthcare
Adopted from – (Jalal-Karim and Balachandran, 2008).

Figure 3 HC Facilitator Model to improve quality of Health Care

Source: Jalal-Kari and Balachandran, 2008

In this model knowledge representation is referred to as the storing and the processing of information and knowledge so that it can be used by other applications. The Sementic web is referring to the web site where this information will be available (Wickram et al., 2009).

6.   Recommended Model

6.1 Proposed Model to improve healthcare industry & government

Model that is recommended is based on the data that was analyzed from interviews conducted in hospitals by the team. The model has been designed according to the requirements of Pakistani hospitals and health care industry. The health care knowledge management (HC KM) will significantly improve the quality (Wickram et al. (2009, p. 1).

The proposed model is not going to only help Pakistan but may also be used and implemented in other developing counties. The application of this model will improve functioning of many health care departments including hospitals, health care centers and governmental departments in Pakistan.

There are 4 steps that are proposed by this model they are:

Step 1 (A): NADRA should add a memory chip to the Pakistarni ID card. This chip should have the ability to store up to 1 MB to 10 MB of data. This will not be that difficult a task because UBL (united bank limited, pakistan) already is providing a credit card that possesses a chip. This task will increase the little cost of production for NADRA, this is because the chip will cost an extra 100 Rs (Naaptol.com, 2010). The existing charges of NADRA are,

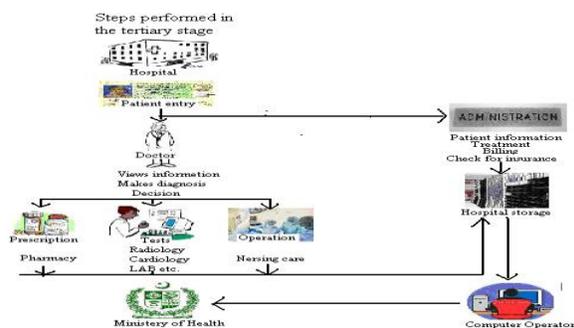| Ser	Category	Normal (Rs)	Urgent (Rs)	FastTrack (Rs)	FastTrack with Home Delivery* (Rs)
1	Fresh CNIC	0	200	1000	1100
2	Modification	150	200	1000	1100
3	Renewal	75	200	1000	1100
4	Duplicate	150	200	1000	1100

Source NADRA, 2010

Now what we suggest is that NADRA should reduce the validity of the ID card to period of 2 years and make a contract with the chip producers and order in large bulk to minimize the cost of the memory chips. NADRA can then increase the charge per ID card by 50 Rs. or can also be subsidized by the government. After a period of 2 years when the ID card is supposed to be renewed the chip from the old ID card can be reused.

This chip will be used for the purpose of storing the medical record of the individual. The record in this chip will be stored in 5 sections.

1.   The Primary information: This will contain information about the general physician and the diagnosis he makes along with prescription.
2.   The Secondary information: This will possess the information prescribed by the specialist. It will also possess the prescription.
3.   The Tertiary information: This will possess the information provided by the hospital. This portion will require the most memory space. This is because it will contain the test results, the nursing care, and the progress report.
4.   The fourth section called "General" will contain general information about who to contact in case of emergency. If the patient has medical insurance then that will be also available in this section.
5.   This fifth section called "Allergies" will contain information such as the medicine the patient is allergic to and other common medicine that doesn't suit the patient.
6.   The sixth section may contain the old history of patients that shall help the doctor to understand patient and about his history.
7.   The seventh section may also help the government that each chip in ID card may also contain patient's legal history.

The ID card will act like an ATM. The health information will only be displayed if the right pin number is given by the right person. The other advantage of this model can be that if the ID card is lost then the finger print recognition can be used to find out the identity and medical history of the patient.

Step 1 (B): Now when the expiry period comes the individual is to turn in his old ID card. The ID card will be destroyed but the chip will be erased of all information and then reused.
Now this time when the ID card goes to the NADRA it will need to be verified. This is the step
2 of NADRA they call it Verification and Clearance
from NADRA Data Warehouse. When this is being
done the new chip will get information from the
Ministry of Health data base
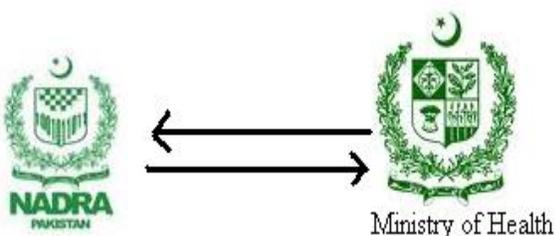
Step 2: The Ministry of Health's budget shall also be increased to implement this project. For the proposed model the health ministry will have to open another department that will maintain a data base. This data base will be the back up of the patient information. The updates to the patient information will come through the hospitals.

Step 3: An operating system is required to be made. This operating software should be user friendly. The government should come up with such software or it should be sponsored by the government. This software should be adopted by all healthcare providers. Moreover, the locally developed module can also be installed with the compatibility of windows operating system.
If the software is a little difficult to understand then training campaigns should be set up, so

that people can learn how to operate such a system. These trainees can also be hired by the hospitals to maintain the patient record.

Step 4: All the providers of health care must have online facilities. This is so that data can be updated in the ministry of health where the data base is being maintained. The hospitals should possess some good storage facility where all this information about their patients is maintained.
    The need for online is that when a patient receives some treatment a record of the patient changes. This change will have to be recorded in his permanent file that is being maintained at the data base by the ministry of health. So in the event if a person looses his ID card a record will be present in at least two locations, the hospital where the patient receives most of his treatment and the ministry of health.
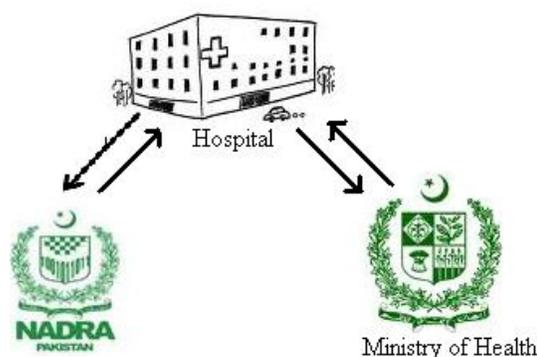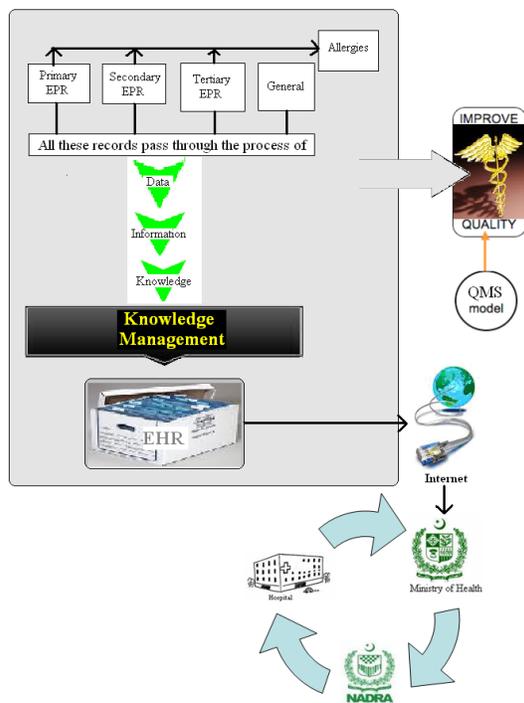   At times it is seen that there has been an accident. The person that is injured is unknown. His wallet is stolen and the contact person is not known. Due to this reasons the individual dies because they do not know who to contact. Now in this situation the hospital should take a finger print and send it to NADRA. NADRA will then run it through the finger print scanner. When the identity is known then the information will be sent to the hospital. The hospital will then establish contact with the Ministry of Health and withdraw his medical record. In this record his contact person will also be mentioned.

MAIN MODEL

7. Conclusion

Knowledge Management is about sharing and managing the knowledge. Many factors have been identified, discussed and recommended for rapid improvement of health care sector in Pakistan. Moreover, the same information can also be used by the government in security and tracing issues. For effective use of knowledge and information in health sector, necessary skills needs to be developed to store, retain and share knowledge. As described earlier people are the most important part in any knowledge management strategy. But for an effective KM strategy, technology and people should be supported by appropriate technology.

Knowledge management can improve the performance of an organization because sharing of knowledge is the most critical in the health industry. If the proposed model is followed then all the record keeping system will change and the files will be made electronic. This will make the records be easily available and improve the communication, coordination and quality that the health care has to offer.

This model can offer great success to the health care industry by reducing the number of medical errors. There are also some additional merits of this system. Fake medical centers, doctors and nurses can also be caught which are playing a quite important role in killing the patients by given them wrong injection or medicine. This model can also be modified to help insurance companies.

Knowledge management should be considered a business model to coordinate and collaborate efforts to improve the organizational performance by creating, sharing, retaining and applying the knowledge. It is also believed that organizational productivity can be enhanced by reusing knowledge across organizations

References

1. Adel, K. and Manar, A.T. (2009), a preliminary open source software infrastructure for the health sector in the UAE, European and Mediterranean Conference on Information Systems 2010 (EMCIS2010) April 12-13 2009, Abu Dhabi, UAE
2. Angus, J and Patel, J (1998), Knowledge Management: Great Concept...But What Is It?, Information Week.
3. Beverly, C (2007) "Knowledge management strategy for the adult social care directorate 2007-2010", Cumbria county council, version 1, march 2007.
4. Rector, A (2001) "From an information poor to an information rich health environment", a research study in health informatics for the UK institute for health informatics, January 2001.
5. Boss, R. (2002) "Knowledge management-enabled health care management systems: capabilities, infrastructure, and decision-support", Expert Systems with Applications, Vol. 24 No.1, pp.59-71.
6. Bali, K, R and Wick, N (2006) "Managing knowledge: the NHS and beyond", Knowledge Management Specialist Library, 16 Oct 2006.
7. Muir, J. A (1998) "where is the chief knowledge officer?: to manage the most precious resource of all?" British medical journal 3 (17): p 832.
8. Knowledge management in the department of health available at www.library.nhs.uk/knowledgemangementEuropean, Mediterranean & Middle Eastern Conference
9. Avvon Health Authority 2000. Electronic Patient Records Electronic Health Records, Schofield, J, Bristol.Commission on Systemic Interoperability 2005. 'Ending the Document Game'. U.S. Government Official Edition Notice, Washington.
10. Hayrinena, K., Sarantoa, K. and Nykanenb, P. 2008. 'Definition, structure, content, use and impacts of electronic health records: A review of research literature'. International Journal of Medical Informatics, 77(May 5): 291-304.
11. ISIC Rev.4 structure (2008, United Nations Statistics Division)

12. Jalal-Karim, A and Balachandran, W 2008. 'Interoperability Standards: the most requested element for the Electronic Hea15lthcare Records significance'. 2nd International Conference – E-Medical Systems, 29-31 October 2008, E-Medisys2008, IEEE, Tunisia.

13. M. Akram and Khan, F.J. (2007), Health Care Services and Government Spending in Pakistan, PIDE Working Papers 2007

14. Mukherjee, A. S, Lapre, M. A. and Wassemhove, L. N. V. 1998. 'Knowledge Driven Quality Improvement'. Management Science, 44(11): 535-549.

15. Newman, B (1991), KM Forum Archives -- The Early Days, What is Knowledge Management, "An Open Discussion of Knowledge Management".

16. Nonaka, I (1991). "The knowledge creating company". Harvard Business Review 69 (6 Nov-Dec): 96–104

17. Ofranidis, L. (2005). 'Data Quality Issues in Electronic Health Records'. Seerc Technocal Report Research track no: 2 Information Technology and IT Policy No: 05/2005. South East European Research Centre.

18. Prince, A. (2000). 'A Knowledge management or information management?. Newsletter of IFM Healthcare, 10(2): 6.

19. Razzaque, A and Jalal-Karim, A (2010), conceptual healthcare knowledge management model for adaptability and interoperability of EHR, European, Mediterranean & Middle Eastern Conference on Information Systems 2010 (EMCIS2010), April 12-13 2010, Abu Dhabi, UAE

20. Razzaque, A and Jalal-Karim, A (2010), the influence of knowledge management on EHR to improve the quality of healthcare services, European, Mediterranean & Middle Eastern Conference on Information Systems 2010 (EMCIS2010), April 12-13 2010, Abu Dhabi, UAE

21. Sharma, S., Wickramasingha, N. and Gupta, J. N. D. 2005. 'Knowledge Management in Healthcare'. United Kingdom: Idea Group Publishing. In M. Wickramasinghe, J. N. D. Gupta, & S. K. Sharma (Eds.), Creating Knowledge-Based Healthcare Organizations: (pp. 1-9). London, UK: Idea Group Publishing.

22. The American Heritage Dictionary of the English Language (2009), 4th Edition, Published by Houghton Mifflin Company.

23. Webster's New World College Dictionary (2010), Wiley Publishing Inc. Cleveland, Ohio.

24. White, K. (2000). 'NHS Knowledge Management in Bradford: the evaluation of a service to meet the demands of healthcare professionals'. VINE, 20(4): 24-30.

25. Wiley, J (1997), Business Change and Reengineering will become Knowledge and Process Management.

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