

# E-Health System: A Study of Components and Practices in Developing Countries

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## Abstract

E-health systems used in different health setups are rare in developing countries but they consist of the computerization of patient records in hospitals and clinics, document delivery through Internet, information exchange and communication, e-Cards for patient ID, electronic scheduling system, hospital labs and hospital admission, computerized diagnosis and support for treatment. It also provides advanced decision-making and sophisticated use of diagnostic laboratories. Every e-health system establishes a basic 'infrastructure' of computers, networks, communications and a technical department filled with IT professionals to continuously uphold and improve the infrastructure, give training to the doctors & physicians and other medical staff and continuously provide technical support as and when required by them. Given the uncontrollable nature of technical support for e-health systems, developing countries like Pakistan are facing issues in creating full-bodied infrastructural facilities that are both competitive with the external environment and compatible with the internal user requirements. This piece of writing is an effort to highlight some of the main issues in developing countries in connection with adoption and use of e-health systems. Also this study intends to identify some of the prospects for IT-applications in healthcare organizations in countries like Pakistan just for the reduction of their sense of isolation in the world by connecting the doctors' community online through internet facilities to learn, and do business and carry out organizational processes effectively.

**Keywords:** ICTs, E-health systems, components (e-health) and practices (e-health).

## 1. Introduction

E-Health systems are scattering all over the world and therefore promoting health and prosperity for humans. Easiest definition of e-health system is computer application in hospital (Kimaro, 2006). E-health is an N- tier application suit built for a particular place or multi setting environment. Significant characteristics of a successful and useful e-health system should include easy, friendly and ready to use, well integrated, customization property and possible tracking and alert facility. Finally, computerization back up is necessary so that no data is lost (Mengiste, 2010).

E-health system has introduced so many tools and devices to perform the aforesaid key functions effectively. For instance mobile phones can be utilized to convey information about visit and appearance of various vaccinations squads in far flung areas especially the villages; whereas internet can offer the means for distance learning and far-off monitoring. These two apparatuses have main influence on endorsing high-quality public health services (Miscione, 2007). Yet another illustration of the usefulness and power of ICTs in delivery of public health services is telemedicine/telematics. These technologies facilitate a variety of goings-on including distant treatment and care especially in country side areas (Androuchko, 2005). WHO proposes that telemedicine/telematics has key character of early training and ongoing education. A study of health-informatics in 15 European countries carried out by European Health Telematics Observatory (EHTO), explains that the 6% use of e-health systems is due to training and education (WHO, 2006).

E-Health systems provide better healthcare services and education especially in far-flung areas. The term Telematics is used for carrying out healthcare functions and activities in remote areas by making use of information and communication technologies to promote healthcare, maintain control over various diseases and educate the people (MacFarlane et al., 2006). E-Health systems have the shifted the old routines and practices of the hospital-based treatment and care activities to homes of people. Telemedicine as a major component of e-health has facilitated this shift. IT-applications for the delivery of health services offer all-time and cheaply available modern-day healthcare services (Raghupathi & Wu, 2011).

Developing nations lack the websites that contain the health related information. Furthermore few healthcare-related websites in developing countries are but these are not used for managing the healthcare services according to present-day requirements. According to Paul (2006) a variety of health-related websites are available in developed countries while developing nations are lagging-behind. Furthermore those fewer available

website carry academic papers, promotional messages and information about different equipment's, meetings and conferences. Health-related websites in developing nations carry irrelevant and disarranged information mostly in other languages. According to (Bellika et al., 2007) Methods and procedures are the backbone of implementation and operation on the other hand, in the e-health system framework; use of information is taken as an output instead of a process. Also, data quality indicators such as completeness and correctness (appropriateness) are used for evaluating the processes of data collection and communication, which generate confusion between data quality as an output and routine health information system processes. Likewise, how clearly data are publicized and exposed indicates whether the data have been converted into information, and demonstrates its significance for management, supervision or planning objectives. Feedback is a significant procedure for identifying the issues to be resolved, for controlling and enhancing the performance at individual and system levels, and for pointing-out the opportunities for learning (Mishra et al., 2009).

## 2. E-Health Systems

Evidence-based procedures play a major role in efficient health information system quality, results and efficiency of health. Healthcare services and activities can be enhanced by having timely and accurate information for evidence based decisions at all levels of healthcare institutions (Ganapathy, 2009). Practical uses of e-Health Systems in healthcare sector empowers consumers of health services as they can easily access health information as well as decision tool and by the employment of HIT, healthcare providers can work together more easily when distance is a key factor. In past HIT applications were used for administrative activities and financial activities rather assisting and delivering healthcare services (Chisolm et al., 2010).

E-Health Systems are crucial for developing and maintaining public health inspection and security systems. IT-applications in healthcare organizations makes it possible to collect, analyze and distribute the information about different diseases, their attack-agents and main risk factors along with various other healthcare related events to the healthcare professionals for their decision-making(Lazarus et al. 2008). Since these surveillance and security systems carry a variety of information therefore are very helpful in finding out about the main causes, symptoms of the disease that has affected the public at a very early stage of the disease for more appropriate treatment (Sengupta et al., 2008).

E-Health systems are capable of generating very useful information which can be shared between different healthcare workers from all the levels of health services organizations. Telemedicine is one of such IT-applications whereby telecommunications technologies are used to give all sorts of clinical and treatment information (Stanberry, 2006). Regardless of the fact that the usage of universally and cheaply available interactive technologies such as internet and video-conference is the main feature of telemedicine but there is very low investments in these technologies especially in developing countries. Furthermore the willingness to use the e-health systems by the doctors can effectively be gained via government e-policies for example making available all infrastructural facilities to generate an environment where future of telemedicine may become visible (Shaqrah, 2010).

Electronic health record (EHR) means electronic documentation of current and historical health, tests, referrals, and medical treatments concerned with the health of a person (WHO, 2006). This e-health system holds the information about a specific individual in connection with his/her demographics, medical history, and the kind of disease he/she is suffering from (Thakkar & Davis, 2006; Thielst, 2007). Many previous research studies have highlighted that EHR is such a well-organized and effective system that considerably reduces the chances of medication errors and generates access to patients' information in an improved manner for example during a crises or an emergency situation regardless where ever the location of the patient is, EHR provides easy and relevant access to the patients' information (Ouma & Herselman, 2008).

HIT means the use of computer in the form of physician digital assistance, electronic health records, computerized physician order entry system by doctors, patients, hospitals, laboratories, x-ray facilities and all other stake holders (Mishra et al., 2009). Health information technology is very significant part of continuously changing environment of healthcare system. Healthcare information can be communicated in a better and effective manner by making use of e-health systems and which can be used in evidence based decision making process. Advantages of HIT consist of lesser paper work in healthcare organizations consequently reducing the chances of medical errors, eliminating the duplication of medical tests and thus reducing the overall cost of healthcare services (Das, 2010).

Furthermore, Interconnectivity is responsible for several aspects of e-Health and Telemedicine service delivery when installing and running it: Technical, Organizational, Psychological, Social and socio-cultural, Financial,

Legal, Political, and Security aspects (McCullough et al., 2010). All these aspects are intertwined (knotted) with all the sections and contributions to be found in this document. Nonetheless, it is important to describe the major features since they may serve as important criteria to be observed and integrated for the development of 'running tele-medical systems' (Laurinda et al., 2012).

### **3. Components of an e-Health System**

#### **3.1 Organizational**

The crucial forms of organization surrounded by hospitals and the medical practices are just partially attuned to each other. Because there are no broad-spectrum suggestions regarding how to manage and coordinate services which have to deal with a more thorough computerization of medical facilities and services (Hussein et al. 2007). It should however be noted that this is independent of the essential ICT-applications used. Employees' tasks and performances in an organization are controlled by the rules, regulations, and procedures of that organization. The users of e-health system work in such an environment whereby the behavior of the healthcare professionals of both public and private healthcare organizations, are controlled through strict obedience of rules. Several other organizational factors like; little support from the management for the use of e-health systems, lack of proper supervision & control by the authorities and insufficient IT-professionals and finances, affect the adoption and use of IT-applications in healthcare organizations (Mostafa et al., 2011).

The organizational factors affect e-health system's performance directly or indirectly due to behavioral factors. E-Health systems support evidence-based decision making, control knowledge and generate clearness and good control without changing the organizational structure (Niamatullah et al., 2009). The e-health systems have to follow the existing communications channels of organizational hierarchy. In socio-technical systems, the main stress is to check and control the business processes carried out by means of human and technology interaction that lead to quality healthcare services. Likewise, every information system is developed to accomplish exactly the results it achieves', showing that performance is a system characteristic. The executive's role is considered as a role model and facilitates organizational processes (Ishtiaq et al., 2012).

All sorts of Organizational processes work best if carried out in concordance with the established principles and standards and not according to the formal structures that only project the relationships between human and non-human resources of the organization. Employees generally don't work effectively for what they are dictated to do so instead workers perform and give maximum output if they perform according to the organizational values, management sharing with them about what is important for the organization and must be achieved in the light of the organizational values (Hussein et al. 2007). The performance of information system depends upon organizational values such as culture of information or, data collection culture, the well-defined purpose of the system and proper support of management for training and supervision of the users of the very system (Robert et al., 2012).

#### **3.2 Technical**

We defined technical determinants as all the factors that are related to the specialized know-how and technology to develop, manage and improve e-health systems processes and performance (Shaqrah, 2010). These factors refer to development of indicators; designing data collection forms and preparing procedural manuals; types of information technology; and software development for data processing and analysis. These factors also are described by others as potentially affecting e-health system's performance. Information technology will remain the engine for information system development as computers operate and communicate faster (Bhutto et al., 2010).

Electronic patient record systems (PRS) try to integrate not only the stationary and ambulatory medical workflow of diagnostics and therapy, but deliver real-time medical patient data in a ubiquitous fashion. The PRS therefore provides the basis for a global data exchange in the field of medicine. The main stakes today are information servers and many other existing and expected documentation standards (Asangansi et al., 2008). Furthermore, the availability and performance of terrestrial communication lines are becoming continually better: from analogue telephone line to digital ISDN lines. These communication systems are financially affordable usually for private and small business applications and services, however, lines of better quality (Fiber Optic) are too expensive (Wyynchank & Fortuin, 2012).

Thus, it is necessary that e-health systems' users have good knowledge and information technology skills to effectively use and continue with it. However, in low technology settings, well-designed, paper-based e-health systems can still achieve acceptable levels of performance (Braa et al., 2007). If indicators are irrelevant, data collection forms are complex to fill, and if computer software is not user-friendly, it will affect the confidence

level and motivation of e-health systems' implementers. When software does not process data properly and in a timely manner, and resulting analyses do not provide meaningful conclusions for decision-making, it will affect the use of information. Therefore, technical determinants might affect performance directly or through behavioral factors (Durrani & Khoja, 2009).

### **3.3 Psychological & Behavioral**

Many staff members in a medical setting – irrelevant of their hierarchical position – are still reluctant to use computer-based help in their daily routine work. It has clearly been shown that for physicians, the “option to possess a gadget” to handle medical instructions is interesting, but this interest soon enough loses intensity after a very short period of time (Connell & Yound, 2007). For the paramedics, however, such gadgets often become integrated for good into their medical routine, and they are thought to use them much longer, much more intensely, and with a greater understanding of the gadget's practical value (Latifi, 2011).

E-Health users' demand, confidence, motivation and competence to perform digital tasks affect information-related processes and performance directly. How an individual feels about the utility or outcomes of a task or his confidence in performing that task, as well as the complexity of the task, all affect the likelihood of that task being performed (Khoja et al., 2008). Limited knowledge of the usefulness of e-Health system and data is found to be a major factor in low data quality and information use. Motivating digital users remains a challenge despite training on data collection and data analysis (Durrani et al., 2012).

The new models of e-Health postulate that if people understand the utility of RHIS tasks, feel confident and competent in performing the task, and perceive that the task's complexity is challenging but not overwhelming, then they will complete the task diligently (Mishra et al., 2009). Having effective information systems implies solving problems using information. However, problem-solving skill development was not a large part of e-health systems capacity building in the past. We bring attention to this neglected area. The blind spot shows that people are unaware of a gap between their perceived and actual competence in performing a task. It is possible to use this gap for learning to change and meet expected behaviors. The organizational and technical determinants also affect behavioral determinants (Rezai-Rad et al., 2012).

### **3.4 Social and Cultural**

Many studies have shown that socio-cultural changes of a society towards the incorporation of electronic gadgets into daily life have great influence on the way people think and even expect how medicine should work. Technocracy has become one of the outstanding features of medicine in the opinion of most people (Chetley, 2006). Irrelevant of whether this view is correct or adequate, medicine now is no longer in a condition to reluctantly defy all technological advances made. The standard of ubiquitous communicability for man has to become a feature of medicine as well. Furthermore, hierarchical structures no longer being accepted the way they used to be, a tendency can be noted which strengthens the individual's home right: More and more applications and services are directly integrated into the consumers homes, and they are expected to be both safe and trustworthy (Durrani & Khoja, 2009).

### **3.5 Financial**

The ongoing everyday usage of Information and communication technology has given rise to telecommunication access solutions associated with continually decreasing and thus affordable prices which make this technology usable for the large majority of users. This is, however, true only for the conventionally used analogue and digital communication lines up to ISDN (Mishra et al., 2009).

### **3.6 Security**

Security threats – not merely in the sense of a technological impact (virus attacks, worms, malicious scripts), but also relating to human behavior in carrying out national or international conflicts – are most important in people's minds when it comes to data security. This issue, has nothing to do with the underlying method of communication, but refers to the application and service layers (Chetley, 2006).

The recent insights of information society theories reveal that there has been a gradual shift of emphasis ‘from a preoccupation with technology as a strategic resource to a growing interest in information and its exploitation’ (Chattopadhyay, 2010). This ‘information-centered’ or ‘information-intensive’ concepts have been clarified with the explanation that the intrinsic role of ICTs is two folds: First, when, as a process, ICTs perform ‘handling of data electronically or digitally’, they either change data into information or move data from sources to recipients. Second, when ICTs facilitate as ‘sources of outcome’, they turn information into knowledge that helps either in learning or decision-making or taking action. Therefore, ICTs are ‘processors’ or ‘communicators’

to enhance communication processes for transmitting information and exchange of knowledge (Soar et al., 2012).

They term 'information' as a 'message to inform people' which is sent from a sender to a receiver in the form of documents or audible or visible communications 'to change the way the recipient perceives something' or 'to have an impact on his judgment and behavior'. The messages including traditional mail, e-mail, Internet transmissions are delivered through hard and networks. In ICT, 'information' is central - originating from data and moving towards knowledge (Shivute et al., 2008). Although 'data' provides no judgment or interpretation, it is essential raw material for the creation of information which is important for effective data management in any electronic development initiatives particularly in the health sector. Knowledge management utilizes how these data can be transformed into another resource. Thus, knowledge constructs a shared understanding of how information can be applied to solving problems and getting things done by utilizing intuition, judgment, and wisdom (Durrani & Khoja, 2009).

The impacts of the role of ICTs in this data-information-knowledge continuum are of great value in development informatics since ICT embodies the 'message' (information), the 'cement' (communication) and the 'vehicle' (technology). The discourse on issues of technological rationality indicates that the medium is not the message (information) but it strongly affects it. Message is more important than the delivery vehicle. This implies the notion that more and new digital ICTs will not necessarily improve the access to information (Chattopadhyay, 2010). In practice, there is not enough literature on 'demand-driven information' or 'people-oriented information' in the review or assessment of ICT applications in development projects. This bottom-up approach is vital for the real success of these projects which are targeted for the rural poor who often lack in access to information for their vulnerabilities. Their real need of information and the socio-political realities are often ignored while initiating ICT interventions in resource-poor settings with the overemphasis on technology determinism. As a result, there remains a design-reality gap and consequently many health-related ICT projects start to fail (Rezai-Rad et al., 2012).

#### **4. Discussions**

E-health systems can improve the performance of public health service machinery in developing nations especially by accessing and using quality information through well-structured websites for effectiveness and sustainability of healthcare institutions (Raghupathi & Wu, 2011). Developing countries don't have a considerable number of both healthcare providers and general public as users IT-applications in healthcare. Many of the approaches being used are still at a relatively new stage of implementation, with insufficient studies to establish their relevance, applicability or cost effectiveness (Martinez et al., 2005). This makes it difficult for governments of developing countries to determine their investment priorities (Chandrasekhar & Ghosh, 2001). Different studies reveal that how organizational cultures are created and maintained. Organizational culture is the values and behaviors that contribute to the unique social and psychological environment of an organization. Organizational values have a positive impact upon the behavior of the employees towards attainment of organizational goals.

Likewise healthcare organizations with a clear cut existence, understanding and acceptance of the values of information-culture and data collection-culture can generate the understanding and willingness for the e-health systems in healthcare organizations especially in developing states (Hussein et al. 2007). In the same way it is also assumed that the information collection culture in an organization can improve the performance of e-health systems. Furthermore there is not any specific definition for a culture of information. However the culture of information is the capacity and control to promote values and beliefs among members of an organization by collecting, analyzing and using information to accomplish the organization's goals and mission. The culture of information in an organization can be measured by the existing routines for data collection, analysis and use of the information for rational decision-making and feedback from staff and thus showing a genuine support for e-health systems in that organization (Burney et al., 2010).

#### **5. Conclusions**

E-health applications are crucial for providing better healthcare services. ICTs play two major roles in connection with public health services: 1. It teaches a community the preventive measures for different diseases. 2. Distributes systematically health related information among health professionals and the populous. With the use of health technology both short-term (rehabilitation) and long term care (which includes drugs, devices and procedures) can be improved. IT-applications in healthcare sector draws attention to disregarded health information systems processes, for instance checking data quality, displaying of information and giving feedback, and makes them part of the accepted norms. Measurement is a key for identifying the improvements. Assuring measurement quality is not possible without establishing a formal process for checking data quality. However,

feedback continues to be a weak process of e-health systems in many developing states. Healthcare staff gets the feedback from self-evaluation of their performance by using their own records and reports, and from the district management. The same procedure can be adopted and carried-out at district or higher administrative levels. Furthermore besides having attractive features of e-health systems there is a very limited support and acceptance of this technology by the healthcare professionals in developing states. To induce the recognition of the IT-applications among healthcare providers, they must have fuller level organizational support and motivation to adopt the change in their healthcare practices and perform their tasks in a more efficient manner for ultimate satisfaction of the patients.

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