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Development of an in-house hospital information system in a hospital in Pakistan

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ABSTRACT

Objectives: To review our experience of development and implementation of an electronic hospital information system, its costs and return on investment as well as incorporation of some key quality standards.

Methods: Cost and saving trends of the project were calculated using different tools including project expense, cost saving through cessation of printing radiology films and paper. Net present value with payback period was utilized to evaluate the efficiency of the health information systems. Qualitative improvements in different healthcare functions were also analyzed.

Results: The total saving of the project was approximately US$ 5.1 million with net saving of US$ 3.5 million for the period from 2001 to 2011. The net present value of the project is US$3.2 million with a payback period of 3.4 years.

Conclusions: Electronic hospital information systems and health records hold the potential to be useful tools for quality improvement and error reduction. Adoption of such systems, however, has been slow and erratic, worldwide. Utilizing the concept of net present value, development of such a system may be financially viable for some institutions. Instead of simply replacing paper, these systems may also be used to improve information management and improve quality of patient care.

1. Introduction

The aim of any medical institution is to be able to provide high quality medical care to its patients. Yet, medical errors remain an important cause of mortality and morbidity in hospitals [1]. There have been great expectations of reduction of such risks as a direct result of institution of information systems in hospitals over the last four decades [2]. Use of hospital information systems (HIS) may be an important tool in

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reduction of errors in the health care setting. Specific interventions which may have an impact on improving quality have included computerized physician order entry, clinical decision support systems and computerized notification of critical laboratory alerts [2,3]. In the United States, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) has provided additional impetus in this field. Taken together, these factors may all lead to an increase in the heretofore poor uptake of computing by the healthcare industry in the developed world [4]. At the same time, electronic health records (EHR) also pose special risks, as highlighted in a recent review [5].

Development and implementation of hospital information systems present particular difficulties in developing countries, and we present here our experience of successful in-house development and implementation of an integrated hospital information system in Pakistan. We have also attempted to quantify savings achieved specifically in two areas, namely implementation of a paperless laboratory reporting system and a film-less radiology department. This article does not present direct clinical benefits or indirect financial, planning and research benefits that the system may have had. We are unaware of a published report from our country on this subject.

1.1. *Setting*

Shaukat Khanum Memorial Cancer Hospital and Research Center is a modern tertiary-care cancer center located in Lahore, Pakistan with a referral base from all over the country and adjoining regions. The hospital opened in 1994 and provides full service cancer care to the indigent who comprise approximately 70% of the cancer patient population. To support this endeavor, the hospital's parent trust raises philanthropic donations (approximately US $20 million a year) from within the country and from the Pakistani diaspora. This 180-bed hospital has 1800 employees and sees over 6000 new cancer patients each year. In addition, the hospital has a nationwide chain of phlebotomy centers to provide diagnostic laboratory services to the general population. In 2011, there were over 142,000 outpatient visits, 7600 admissions, 7800 surgical operations, 54,600 chemotherapy visits, 44,500 radiation treatments, 144,000 imaging procedures and 3.25 million laboratory tests. The pathology laboratory receives specimens for testing from 90 sites from all over Pakistan. In view of the size and complexity of the operation, use of computing for automation, quality assurance, safety and effective financial management is a natural evolution.

1.2. *Development process*

The master plan for the hospital envisaged a hospital wide computer network and a 250-node 10 mbps network was installed prior to the hospital's formal opening in December 1994. A decision was made to use the Decentralized Hospital Control Program (DHCP) developed by the United States Veterans Administration. This provided email, registration, scheduling and some aspects of pharmacy and radiology reporting at text terminals. Other functionalities available in DHCP could not be deployed due to non-availability of expertise in this programming environment within Pakistan. At a review in 1999, it was discovered that various clinical departments were using a multitude of individual software programs to meet their needs. In the non-clinical areas, the financial records were maintained in a locally developed program but were not connected to any clinical data. Human resource and other administrative departments were similarly disconnected from one another. A task force was appointed to review the situation and recommend a way forward. These recommendations formed the basis of an overall plan to develop a comprehensive clinical, financial and administrative package to meet the needs of the hospital. Formal approval from the hospital's board of governors was sought and obtained prior to the implementation of what was perceived to be a gargantuan task.

A decision was taken to use Oracle products (Oracle Corporation, Redwood Shores, CA, USA) for developing the system. With this objective in mind, a team of information technology professionals was created, starting in 2000 although formal development did not start until 2001, when a core group had been formed. The team was given a brief to develop a fully integrated hospital information system with clinical, administrative and financial domains. A steering committee headed by senior management and clinical leadership was formed for weekly review of progress, prioritization and implementation. A patient-centered approach was taken to develop modules and these were prioritized based on perceived benefits to the organization. The development proceeded with continued and direct input from end-user departments. Implementation was phase wise and approximately reflected the development cycle. Development, training and implementation teams were made up of the same individuals and live support was given to end-users during the implementation phase of every module (Table 1). The first module (patient registration and scheduling) was implemented in April 2001. Mandatory computerized physician order entry was implemented in February 2002. This was followed by pharmacy (internal process flow and inventory management) in the same month. Other significant implementations included: radiology (April 2002), pathology (November 2002), surgery and inpatient modules (May 2003) and the blood bank (March 2004). A radiology imaging module and picture archiving and communication system (PACS) was implemented in 2004 to coincide with the acquisition of digital imaging capability in the department, whereby images from radiology equipment were sent directly to database servers where they were integrated with the patient record and shown in the HIS. Physician notes were implemented in May 2006 via a combination of structured, semi-structured and free text entry options. Experiments with voice recognition were not successful. A parallel process of archiving old paper charts using high-speed scanners has been pursued. This archived information is tagged to specific records and is viewable in real time from the electronic interface. In parallel with the hospital's aim to gain international accreditation, a number of recognized patient safety goals and techniques have been incorporated in ongoing development to add to the value of the system. Examples include mandatory falls risk assessment, built in "time out" prior to procedures, requirement of dual signatures for key interventions and multiple other steps. A timeline of significant implementation dates is listed in Table 1.