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Role of PACS Technology for the Development of Radiology Diagnostic Imaging Services

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Abstract: ***The complexity of radiology process resulting from the explosion of medical technology made it difficult for radiology personnel to render high quality, defect free, cost-effective radiology service. Rapid changes in the medical industry have brought developments in the medical image technology, promoting most hospitals to introduce PACS (Picture and Archiving and Communication System). This research paper describes and proved how PACS will produce adequate health services to improve Radiology diagnostic imaging more than the traditional radiological workflow. PACS would be enhanced by acquiring better data from direct or computer radiography, new data from magnetic resonance imaging (MRI) or Positron Emission Tomography (PET), or more data from multi-detector (CT). Quality issues are addressed by optimized adopting a performance improvement approach that can achieve quality goals and information technologies requires by diagnostic imaging services. The purpose of the study is to produce adequate health services to improve radiology diagnostic imaging and to assess the usefulness of PACS and whether this service changed patient management and help in the management of the health Services in all medical areas. This had been made by compare a traditional radiological workflow with one based on PACS system.***

Keywords: PACS; digital radiography**;** diagnostic services**;** telemedicine**;** teleradiology

1. Introduction

The ability to obtain images in one location, transmit them over a distance, and view them remotely for diagnostic or consultative purposes—has been explored for nearly 50 years and is part of the more encompassing concept of "telemedicine"— the delivery of health care services over a distance. Major advances in telecommunications and computer systems and advances in the ability to capture medical information in digital form have accelerated the ability to apply telemedicine methods in a practical and affordable manner. These enabling factors are especially relevant to radiology, which currently stands out as one of the most technologically and clinically advanced areas for telemedicine applications.(1)

Technological advancement seems not enough to fill the quality gap . The processes surrounding diagnostic imaging services had not kept pace with the imaging acquisition and information communication systems. Today's imaging technologies provide greater speed and superior image quality (2). Computerized Tomography (CT) scanning of any body system may take few seconds while imaging processes takes 30 minutes or more (3). If processes are redesigned and standardized, significant reduction in the costs of poor quality could be achieved. Even with the latest equipment installed, many organizations face delays in report turnaround time and a buildup of patients waiting for appointments(4). This situation can lead to a variety of problems for diagnostic imaging facilities or departments, including patient dissatisfaction, delay in diagnosis and treatment, emergency department bottlenecks, increased length of stay, patient dissatisfaction referring physician dissatisfaction, and potential loss of outpatient business revenues (5). Optimizing technology through process improvement is the key to success in improving the level of quality. To optimize performance, technology must not only be leading edge, it also must be appropriately aligned with the people and process steps involved in the delivery of safe and cost-effective patient care. One approach that has proven to be effective involves the implementation of technical strategies of picture archiving computerize system PACS (Figure 1). During the past seventeen years, many large and small PAC systems have been installed and are running smoothly. Around the world, many more systems will be planned and installed for coming years before 2016 (6) .

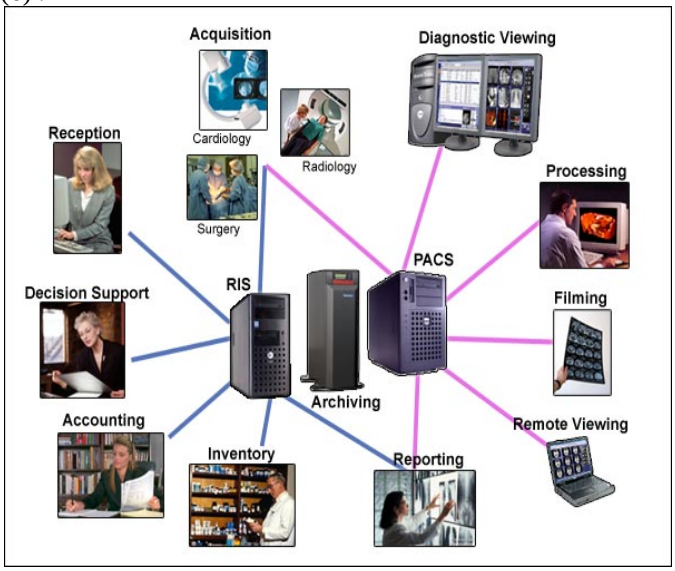

Figure 1: Communication with PAC system

2. Materials and Methods

In this study, Data is collected for a month duration In king kalid hospital - radiology` department .The plan would include collection of baseline data for the individual radiologist for CT scans cases duration of the steps of the whole radiological process (Process Time) was measured. Process Time is defined as the interval running from patient arrival at the Front Office of the Radiology Department (for registration) to report delivery. The times were acquired to

compare a traditional radiological workflow with one based on PACS system. The analysis was by comparing management methodologies and computing the average time of each step, after the definition of the main steps for both working flow s. The total mean time was then computed.

3. Result

Statistical analysis of the process data showed that the service of PACS changed patient management , were the process flow time steps are reduced due to the digital format of patient registration and the retrieval of patient data from the PACS . The reduction was 89% as shown in table (1) below.

Process	*Traditional department*	*Digital department(PACS)*	*Reduction %*
Patient registration time	25 min	5 min	80%
Execution time	15 min	10 min	33%
Reporting time	240min	20 min	92%
Typing time	25 min	5 min	80%
Signature time	15 min	00	100%
Report delivery time	90 min	5 min	94%
Total time	410 min	45 min	89%

4. Discussion

Transition from analogue to digital department was aimed to improve the quality and efficiency of the radiology services through improving the processes, the quality of imaging acquisition, producing timely and accurate reports, while simultaneously increases the throughput and financial benefits of the radiology services[6]. In the past century the radiologic operation was based on the film screen recording the development of film on chemical either manually or by using automatic processors which was later developed to daylight system. The technologist was able to process x-ray film without going into a darkroom in only 90 seconds (7). Automation of the imaging processes was not the end goal, further innovations on digitization of whole department in the last 15 years lead to dramatic changes in imaging acquisition, image recording, patient flow and process time. The availability of a flat –panel digital detectors radiographic system that do

not require cassette handling has made further enhancement of the workflow possible, in a study by Flynn (2003) . it was shown that due to advances in digital radiography system (Figure 2) in the traditional workflow were reduced shortened or even eliminated(8). With this type of systems the technologist never leaves the patient alone which means better patient care. The productivity in terms of more patient throughput is increased A considerable impact is created on management of the workflow process. In some departments it was demonstrated that, when integrating information systems and digital units the process was reduced from 59 major steps to only 9 for an inpatient chest radiograph(8). Another study showed a time saving from 8% to 25% in report turnaround.

In the past and before the widespread use of CT and MRI to evaluate patients presenting in the emergency room, many radiologists expected their emergency physician colleagues to review the images from conventional radiography studies they ordered for their patients off-hours and to take responsibility for a provisional interpretation. physicians covering the emergency room reviewed the radiographs and radiologists were called in only for difficult cases or for contrast material–enhanced studies, fluoroscopy, angiography, or nuclear scintigraphy. At this juncture, emergency physicians were no longer comfortable “going it alone” because of the complexities of interpreting CT scans versus conventional radiographs, and radiologists have been scrambling ever since to respond in ways that meet the service needs and expectations of referring physicians and patients while preserving a reasonable work life for themselves .

One obvious answer has been The use of teleradiology PAC system.

It is a strategy that radiologists have widely adopted to meet the changing needs of their practices (9). In a 1999 survey of radiologists in the United States, Larson et al (10), found that 75% of responding multiradiologist practices and 30% of solo practices used teleradiology. In 92% of the former practices, radiologists used teleradiology to provide preliminary oncall interpretations. The most commonly reported modality covered through teleradiology was CT, at 95%, followed byUS, at 84%. Conventional radiography was cited in only 43% of responses and MR imaging in 47%. In another survey of 114 private hospitals reported by Saket khoo et al (11), among the 97 responding institutions, 82% reported the use of picture archiving computerize system PACS for nighttime coverage. The data from these surveys indicate that radiologists in the United States have embraced teleradiology and, by inference, must believe that it meets necessary requirements for accuracy and timely service.

The use of on-call teleradiology for interpretation of images from off-hours examinations has continued to increase, due in part to the activities of a number of commercial enterprises founded specifically to provide outsourced off-hours coverage for radiology practices but also due to some academic and private practices that have begun offering substantially similar services(12) . Within the Hundreds of hospitals and radiology groups have taken advantage of the services of outsourcing companies or other radiology groups to provide and maintain timely radiology coverage for their institutions and to make better use of their own manpower while maintaining a reasonable work life (13). Several factors—including the prevailing shortage of radiologists, the increasing use of advanced imaging methods, the consolidation of hospitals into regional delivery systems, and heightened expectations of patients and referring physicians for timely service—have fostered the increasing use of the picture archiving computerize system PACS. These factors have also helped underwrite the creation of new and potentially disruptive business models for service delivery that can be viewed as threats, opportunities, or both, but cannot be ignored.

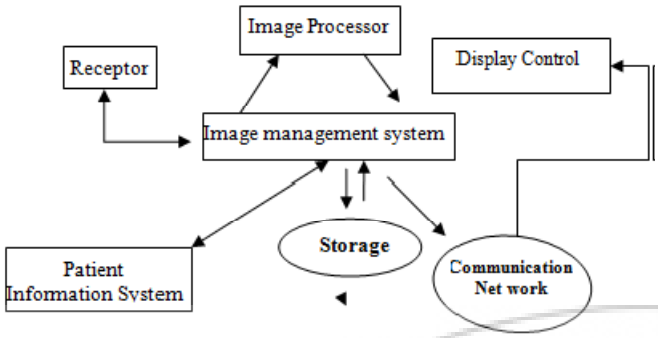

Figure 2: Digital Radiography System

5. Conclusion

Several factors—including the prevailing shortage of radiologists, the increasing use of advanced imaging methods, the consolidation of hospitals into regional delivery systems, and heightened expectations of patients and referring physicians for timely service—have fostered the increasing use of the picture archiving computerize system PACS. PACS is a dynamic system integration of evolving medical imaging, computer, networking, data base and soft ware technologies over the world. Concerning the importance of this strategy, the introduction of PACS in the radiological services is among the most important motivators in sharing in the digital revolution in medical imaging .This revolution has changed not only the manner in which images are acquired, transmitted, stored and interpreted, but also profoundly altered the tasks associated with professional roles.

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