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RESEARCH ARTICLE

A STUDY ON A MULTI-MODALITY IMAGING SYSTEM IN A TERTIARY CARE HOSPITAL: A CASE ON CARDIAC IMAGING.

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Abstract

Objectives: The increased need for optimizing the use of imaging modalities in the hospital setting has led to the introduction of numerous applications in various disciplines to meet health objectives. One medical discipline that depends on imaging is cardiology, which uses a full-fledged multi-modality picture archiving and communication system (PACS) solution. This research explores how healthcare professionals are using this PACS solution, as part of a transformational process in the healthcare system in general.

Methodology: A qualitative study was conducted on the PACS solution system at King Khalid University Hospital (KKUH) during the month of December 2013. The study used a semi-structured interview protocol to understand how cardiologists and technicians at the King Fahad Cardiac Center(one of the research centers in KKUH) interact with this system.

Results: Three out of 10 cardiologists (33.3%) and four technicians were interviewed during the visit. Responses were then analyzed using thematic analysis. Themes analyzed were clinical benefits of the system and challenges of using the system.

Conclusion: An overall positive experience was reported by the participants in the study. The system has not only increased the quality of the care provided at the center but also provided fast and effective access to patient-imaging data from anywhere in the hospital. Moreover, the system helped clinicians to perform research on patients' data. Several recommendations to optimize the use of this system include combining it with a lab order system to augment the clinical decision-making process and addressing the managerial issues.

Introduction:-

The increased need for optimizing various imaging modalities in the hospital setting has led to the introduction of numerous applications in different disciplines to meet that objective. One of the medical disciplines that depends on imaging is cardiology, which uses a full-fledged multi-modality picture archiving and communication system

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(PACS) solution. The system can be present in either a single workstation or it can be a fully integrated multiple-work station system. The general aim of this system is to improve clinical workflow by providing a single access point for advanced clinical applications, multi-modality images and reports [(1)]. It is integrated with advanced tools for numerous modules related to cardiovascular imaging, including echocardiography, catheterization, electrophysiology, cardiovascular X-ray, nuclear medicine, computed tomography (CT), magnetic resonance imaging, and electrocardiography [(2)].At present, only echocardiography and catheterization modalities are covered by this system at theKind Fahad Cardiac Center at the King Khalid University Hospital (KKUH) where this study was conducted

The King Fahad Cardiac center, established in 2002, serves patients with heart disease. It is also a research and teaching hospital for heart disease and related conditions. Most of the hospital's research and treatment requiresthe echocardiography modality provided by the PACs system as it is less invasive and uses lower levels of radiation than other technologies. The cardiology PACS solution was introduced to KKUH in 2011, andtook two years to become fully implemented.

After wide implementation of the multi-modality cardiology PACS solution, major improvements in quality and care were observed, but few studies have been done to assess outcomes. In one study done on the PACS system in Denmark back in 2013, participants found the system convenient and easy to use, improving clinical outcomes [(3)]. Another studydone in 2008 showed excellent resultsobtained by the systemin viewing the heart mitral valve leaflets through a trans-esophageal Echocardiogram (TEE) [(4)].

Following the growing trend of computerization of healthcare systems, numerous hospitals around the world have moved towards efficiency-based electronic systemswith the objectives of delivering cost-effective,high-quality healthcare. Hence, there is a need for more extensive studies to assess the results of using such systems. This is a preliminary study on healthcare providers' experience of using multi-modality cardiology PACS at King Khalid University hospital.

Methodology:-

Thisa qualitativestudy was conducted on the use of the multi-modality cardiology PACS solution in King Fahad Cardiac Center during the month of December 2013.The study used semi-structured interview protocol that wasdeveloped byZakaria et al [(5)]to explore this issue in depth. The interview protocol contains background information on the system (including its organizational background);clinical and educational uses; how it has benefited overall healthcare quality versus problems reported; how it is operated in general; and who the original developers, main users, and maintainers of the system are.

The target population is the cardiologists and technicians of the King Fahad Cardiac Center in KKUH. These professionals meet the purpose of the study,due to their direct use of this system and their experience with using this system. A visit to King Fahad Cardiac Center in KKUH was undertaken in December 2013. This center has a total of 12 cardiologists and 20 technicians who use this system on a daily basis.The participants' responses were recorded and analyzed using thematic analysis. Participants' responses were coded andthemes and subthemes were generated from the data. All ethical considerations were taken into account by ensuring participant's anonymity, and patients' informationfor the attached imageswas kept confidential.

Results and Observations:-

Three cardiologists out of a total of 10 (33.3%) and four technicians were available at the time of the interview. The sample size is small due to the specificity of those who have constantly used the system since its implementation. However, the depth of data obtained make up for the small number of interviewees who can be representative to the rest of the hospital's staff.

System Background:-

The functionalities of the system can be summarized as (1) statistics and comparative studies; (2) documentation, storage, and retrieval of images; (3) reporting of certain cases and; (4) use for educational purposes. PACs is a vendor–based system, developed and maintained by Philips Company.

Cardiologistsare the main users. Multiple PACs stations are situated around the hospital for convenience. Secondary users are technicians and nurses of the cardiology department only. External parties (such as physicians from other departments and medical students) can use and access the systems but with limited access and solely for getting information.

Theme 1: Clinical Benefits:-

Clinical benefits of this system that were mentioned were in the diagnosis of heart diseases, along with reporting and storage of radiological images. The system has also helped with comparing different images of the same patient or different cases at the same time. Furthermore, the system helpedwith increasing the Key Performance Indicators (KPIs) of the organization, which are metrics used to assess the factors that are necessary for institutional success. As for educational benefits, any faculty member at theKing Saud University College of Medicine, with access to the system can import the images to be used in lectures and demonstrations. In addition, this systemprovides statistics and comparative studies for cardiac sciences and research.

Participants also reported the ease of use that was observed immediately after its implementation.The technician first performs the required modality (Echocardiography/Cath) in the clinic, after which he uploads the image to the system. Then, the treating physician logs in to the system and enters the patient's ID (see Image 1). To look up a certain item, he double-clicks on the relevant image, which is attached to a full report of the procedure (Image 2). Finally, he can either contact the technician for more images (e.g. Doppler) or he can compare a new image with a patient's previously archived images (up to five years) and report findings (Images 3 &4).

Image 1:- Main Search Interface

Image 2:- Medical Report Review Interface

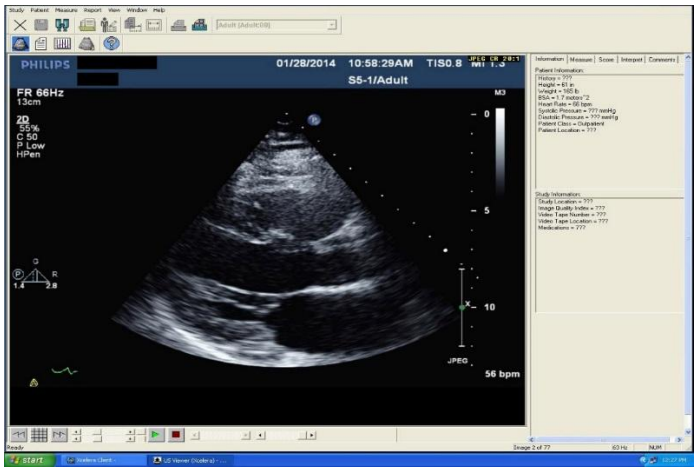

Image 3- Radiological Imaging Review Interface #1

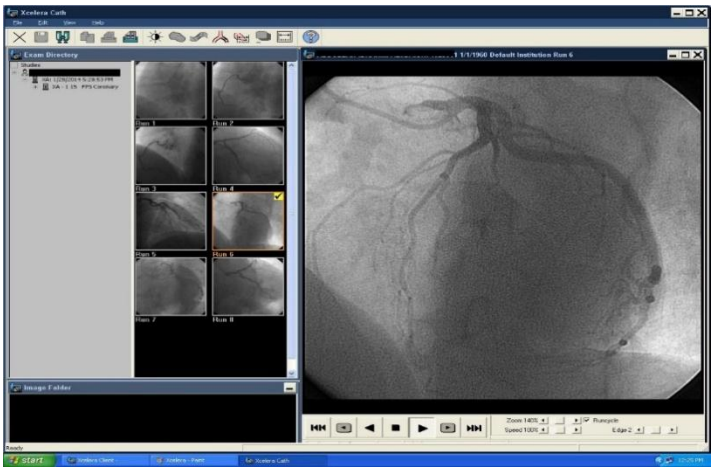

Image 4- Radiological Imaging Review Interface #2

Theme 2: Challenges Using the System:-

Regarding managerial issues,those encountered were: (1) Limited storage space for the images and (2) a lack of local technical support from the vendor. The organization proposed addressing these issues by (1) expanding the hard drive capacity from time to time and (2) by appointing and training members of the local IT department to solve some of the technical difficulties that may arise. Those measures have yet to be implemented, however.

Discussion:-

As the results suggest, this system has led to improvements in the overall accessibility and efficiency of the clinical workflow. Currently, there are numerous and diverse electronic systems that serve to augment the administrative functions for any given health institute; these are collectively known as Health Information Systems (HIS). Al-Ali et al. performed a survey study in Qatar back in 2013 to assess and describe the current state of Hospital Information Systems in large hospitals, and to establish a baseline or reference point. This study showed that all Qatari public hospitals and four out of six private hospitals use some form of a Hospital Information Systems (HIS) and/or Hospital Management System (HMS). Radiology Information Systems (RIS) and Laboratory Information Systems (LIS) were also commonly deployed HIS components. On the other hand, Electronic health records (EHR) and Pharmacy Management Systems (PMS) were absent or underused [(6)].

However, because there is an accelerated implementation and growth of HIS to enhance the safety and quality of care delivered, the process of implementation and optimization of an HIS requires a pre-intervention baseline from which comparisons pertaining to performance and impact can be elicited. Furthermore, since the benefits the PACS would deliver are influenced by the acceptance of users, further knowledgeof their concerns and acceptance rates is needed. This has also been shown in a fewother studies found in the literature. One study that was done in 2012looked at the usage of the PACs system at a university hospital in Jeddah, Saudi Arabia to assess the level of acceptance among staff in the radiology department. In this study, users found PACS to have improved the quality of their work inproviding better patient care. Though technologists had lower ratings than did clinicians/radiologists, acceptance level was not found to be influenced based on gender, age, or length of experience using the PACS. Before implementing a PACS system, however, the health organization must consider their system users' acceptance and whether they will adapt to the new system[(7)].

In addition, some articles in the literature have reported on a newer form of web-based PACS, which are more attractive than conventional, server-based systems. One 2013 article showcasedthat the web-based cardiology PACS allowed for better interoperability, broader access, remote accessibility to data and images, and reduction in IT burdens. In addition, having one system that combines all the separate workstations in one place allows the cardiologist and support staff to conduct their daily duties from a single point of entry. Staff may handle and manageall cardiac imaging modalities and related reports, echocardiograms (ECG), procedural reports and prior exams from any computer with Web access. Moreover, it allows for new workflows, such as doing rounds using a tablet rather than a clipboard, and gives more freedom of mobility to the cardiologist and technician. However, a limitation of this system might be the need for special software to be installed to permit access to data using a web

browser. This will need to be addressed as many physicians now expect to be able to use mobile devices such smart phones and tablets to access data and images[8].

Conclusions and Recommendations:-

In summary, the findings of this qualitative study showed that the system not onlyimproves the quality of services provided by theCardiac Center but also provides fast and effective access to patient imaging data from anywhere in the hospital. In addition, it decreases medical errors and time needed for treatment decisions. The system also helps with performing research and gathering statistics on patients' data.

We recommended that the Centerprovide restricted access for students interested in cardiology coupled with a simple education and training program. Limited access for consultationsby other organizations could be offered as part of inter-institutional collaboration. Additionally, yearly updates and maintenance for the PACs system in King Fahad Cardiac Center should be conducted; this couldbe optimized by a visit from a local company representative to address technical issues. Finally, the center should combine a lab order system with the imaging system for more efficient decision-making.

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References:-

1. Xcelera- Philips.
2. http://www.healthcare.philips.com/gb_en/products/healthcare_informatics/products/cardiology_informatics/xcelera/ (Accessed January 24 2014)
3. What is Xcelera? http://www.medextra.net/xceleradem/ppt/whatis.pdf (Accessed January 24 2014)
4. Connected Cardiology for a Better Care.
5. http://www.medextra.net/jupgrade/attachments/article/51/Final_Xcelera_Customer_Story_A3Print_V5_20110607.pdf (Accessed January 24 2014)
6. Sugeng L, Shernan SK, Salgo IS, Weinert L, Shook D, Raman J, Jeevanandam V. Live 3-dimensional transesophageal echocardiography initial experience using the fully-sampled matrix array probe. Journal of American College of Cardiology 2010; 52(6): 446-449
7. Nasriah Zakaria, Amr Jamal, Ahmed Albarrak (2012). Clinical informatics Site Visit Requirements. Internal document, College of Medicine, King Saud University
8. Al-Ali R, Reti S, Feldman H et al. Hospital Information System Survey in Qatar. Stud Health Technol Inform. 2013;192:959
9. Aldosari B. User acceptance of a picture archiving and communication system (PACS) in a Saudi Arabian hospital radiology department. BMC Med Inform Decis Mak. 2012; 28(12):44
10. The Evolution of Cardiac Web-Based PACS. http://www.itnonline.com/article/evolution-cardiac-web-based-pacs(Accessed January 24 2014)