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Impact of picture archiving and communication system (PACS) on radiology staff

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ABSTRACT

Background: Picture Archiving and Communication System (PACS), a necessary asset in modern hospitals, has proven its crucial status in the radiology department for archiving and fetching medical images followed by their integration with the radiology information system (RIS). Although PACS has proven its worth technically, this study assesses its impact on its end users. The purpose of this study is to measure the level of PACS's impact on its users in a hospital facility in Saudi Arabia.

Methods: The cross-sectional quantitative study is designed using the survey approach as a method of data collection. All PACS active users at the radiology department are considered as the target population. Out of the 160 distributed questionnaires, 100were returned with complete answers, having a response rate of 62.5%. The questionnaire was developed to examine PACS impact from users' perspective on five inter-related variables, i.e., external communication, service outcomes, personal intentions, personal hassles, and increased blame. The study was conducted at the KAMC-National Guard radiology department in Riyadh.

Results: The study results showed that PACS has a positive impact on its users. In addition, it showed a significant relationship between the number of user characteristics and five inter-related variables, i.e., external communication, service outcomes, personal intentions, personal hassles, and increased blame.

Conclusion: Users have shown a positive insight towards the PACS for its impacts on their daily work. The findings of this study can greatly contribute to assist the radiology department and help them understand the user's perception on PACS. Nevertheless, the study showed a positive impact, i.e., an indication of the status and insight of PACS users having a high perception rate towards PACS, which promises more future advancement in its usage. Users have shown a positive insight towards the PACS for its impacts on their daily work. The findings of this study can greatly contribute to assist the radiology department and help them understand the user's perception on PACS. Nevertheless, the study showed a positive impact, i.e., an indication of the status and insight of PACS users having a high perception rate towards PACS, which promises more future advancement in its usage.

1. Introduction

1.1. Background

Nowadays, hospitals have become more digitalized and are aiming for a paperless environment to ease their process and workflow [1]. The hospital information system (HIS), radiology information system (RIS), picture archiving communication system (PACS), clinical information system (CIS), cardiovascular information systems (CVIS), and electronic health record (EHR) are the integral components of a hospital. These systems are supposedly integrated with one another within the hospital to ensure that the patient's health records are complete, correct, and up-to-date. However, the imaging processes in the radiology department are in need of a whole systematic entity as the medical images cannot be processed here alike other hospital data. In addition, medical images require routing, storing, and retrieving for which the invention of a specialized system such as a picture archiving and communication system (PACS) is required to fetch, archive, and process images from one or many sources. The main purpose of the system is to improve image routing, retrieval, and display capabilities among a healthcare facility, specifically the radiology department. PACS is integrated with more than one imaging modalities such as X-Ray, magnetic resonance imaging (MRI), computed tomography (CT), ultrasound and nuclear medicine (NM), and other similar technologies.

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Images taken by PACS are stored in an archive from which they are retrieved or fetched and displayed for review on a reviewing station after being integrated by using network infrastructures [2]. The PACS solve a lot of radiology related issues by digitalizing the traditional process; however, it has a drawback of not being able to retrieve and display the patients' medical images automatically and thus, the user needs to retrieve the images manually [3].

Many hospital staff including radiologists fear that the systematic solutions might take away a part of their profession and individualism. Some staff even described the new system solutions as a threat to their overall performance.

Few studies suggest that young radiologists seem to cope more with technological solutions like PACS, RIS, etc. Some even reported that these systems aided them in various ways in their profession [4]. In Saudi Arabia, a psychosocial study was conducted to assess the user acceptance of the PACS system in the radiology department of hospitals by using a technology acceptance model (TAM). The study found that the range of acceptance lies between 33 and 48% [5].

1.2. Aim of the study

Most PACS-related studies focus on the technical aspect rather than the psychosocial aspect. Thus, this study aims to explore the level of impact of PACS on the radiology staff at King Abdulaziz Medical City in Riyadh. In addition, this study seeks to find the correlation between the user's characteristics and behavior towards the PACS.

1.3. Study objectives

1. To determine the impact of PACS on its intended users and their performance.
2. To assess the unique aspects of PACS that influences the users in radiology department.
3. To identify the user's characteristics associated with their interaction with the PACS.
4. To measure the level of acceptance of PACS and its impacts on users.
5. To measure the amount of user experience towards PACS in the study area.

2. Methodology

2.1. Study setting

The study is to be conducted on all radiology personnel who are using PACS in King Abdulaziz Medical City (KAMC) in Riyadh during the data collection period. KAMC has been expanding its growth by providing services to the people of the kingdom, which is in rapid growth and become one of the most distinguished healthcare providers in the Middle East. The radiology department in KAMC has a mission of providing the finest and accurate diagnostic and intervention imaging services to their patients, physicians, and students by utilizing its state-of-the-art equipment and highly skilled clinical work force in a pleasant, safe, dignified, and respectful environment.

2.2. Ethical considerations

Most importantly, participants were informed that their participation in the study is voluntary, and the provided information will be completely anonymous and confidential.

2.3. Participants

All radiology personnel having access to PACS and actively using it in their work routine, i.e., radiologists and technicians were considered for the study. We have excluded radiology personnel who do not use PACS in their work routine, administrators like IT staff, personnel who are not employed under KAMC, and higher management. The radiology department with an estimated population size of 200 users who actively use PACS in King Abdulaziz medical city (KAMC) in Riyadh was the target population in the study. They were invited to participate in the study and were requested to return the survey once completed during data collection.

2.4. Study design

This quantitative study uses an exploratory descriptive approach as a general concept for the study and relies on the distributed questionnaires to gather the required data. The present study used five variables that describe the health information system's impact, i.e., external communication, service outcomes, personal intentions, personal hassles, and increased blame.

Exploring the radiologists' response to these variables would help us in gaining a better understanding of the impact of PACS on them. Furthermore, by analyzing the relationship between user characteristics and the study impact variables, we can identify which of the user characteristics has the most significant relationship with the study impact variables.

Since the study explores the impact of PACS on radiologists, the study design is most appropriate for gathering information and building a foundation to understand the research questions' limitation and extents.

The questionnaire, obtained from the works of Kaplan and Duchon [6,7], was used as the data collection instrument for this study after its effectiveness was found to be proved in previous studies. The wordings of the statements were slightly modified and updated to accommodate the current radiology workflow at King Abdul-Aziz Medical City. Furthermore, the instrument was used and validated. It was given to four colleagues for review: two radiologists, a laboratory technologist, and a pharmacist having work experience with health information systems within and outside KAMC. After receiving their feedback, some adjustments and re-wording of few statements were made.

The alpha coefficients of each variable of the original instrument that assessed the impact are stated in Table 1.

The main goal of this questionnaire is to collect data on variables mentioned in the study design that investigates the impact of PACS on the radiologists. The questionnaire contains 33 questions in English divided into two sections. The first section of the survey (Questions 1–8) gathers demographic and background information of the participants including gender, age, healthcare experience, area of work inside radiology department, job position, type of PACS training, computer knowledge, and experience with PACS. The second section of the questionnaire contains 25 statements covering the five impact variables of the study, i.e., external communication, service outcomes, personal intentions, personal hassles, and increased blame. First three statements are related to external communication (Questions 9–11), the next six statements are regarding service outcomes (Questions 12–17), the following two statements measure personal intentions (Questions 18–19), the next seven statements measures personal hassles (Questions 20–26), and the last seven statements assess the increase in blame (Questions 27–33) (Appendix I).

3. Results

3.1. Data collection and analysis

One hundred out of the160distributed questionnaires, with a response rate of 62.5%, were collected. Once the data collection phase ended, the data analysis phase was initiated. To ensure data integrity, there is also the need to ensure the accuracy of our analysis. Moreover, 25 questionnaires were discarded due to the bias in responses (selecting all