

Original Article

Knowledge, Acceptance and Challenges in the Use of Picture Archiving and Communication System Among Health Care Workers in Delta State University Teaching Hospital, Oghara, Delta State

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ABSTRACT

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The availability of the Picture Archiving and Communication System (PACS) has revolutionized the practice of radiology in the past two decades and has shown to eventually increase productivity in radiology and medicine. Clear understanding/insight into the levels of knowledge and acceptance as well as the challenges associated with the use of picture archiving and communication systems is important for mass adoption of this technological innovation. The aim of the study is to assess the level of knowledge, acceptance and challenges in the use of PACS among the health care workers in Delta State University Teaching Hospital (DELSUTH), Oghara, Nigeria. The level of knowledge, acceptance and challenges in the use of PACS was evaluated among a total of two hundred healthcare workers in DELSUTH from various profession such as doctors, nurses, radiographers were evaluated. The data was analyzed with the aid of Statistical Software for Social Science (SPSS) v 26 (IBM, New York, USA). There was a high level of knowledge (89.5%, n=179) and usage (71%, n=142) of PACS despite formal training being received by only 55% (n=110) of respondents. High level of acceptance was noted, with PACS perceived to aid clinical decisions (80.5%, n=161), improve patient outcomes (85.5%, n=171), and be superior to traditional methods (75%, n=150). Challenges observed include varying computer skills (26.5%, n=53; highly skilled), network issues affecting usage (57%, n=114), and shortages of equipment like monitors (64.5%, n=129). All categories of healthcare workers in DELSUTH showed a high level of knowledge as well as acceptance of PACS. However, there is lack of adequate equipment especially monitors.

Keywords: Acceptance, Challenges, Knowledge, Picture Archiving and Communication System

INTRODUCTION

Picture Archiving and Communication System is a technological leap forward in radiology, incorporating a multitude of complexities that enhance the efficiency of radiological and, consequently, medical diagnosis and workflows. It is a tool that has greatly enhanced the efficiency of radiologists, radiographers and all healthcare

workers who operate or make use of medical imaging. ¹Although picture archiving and communication systems may remain unfamiliar to numerous regions worldwide, particularly in developing countries, its inception and early development can be traced as far back to the 1980s in the United States. The US Department of Defense Hospital and the Department of Veterans Affairs

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were at the forefront of advocating for the implementation of PACS.²

PACS encompasses applications dedicated to electronically storing, retrieving, distributing, communication, display and processing of data associated with medical imaging. Its primary purpose is to allow radiologists and physicians to retrieve and view radiological images on computer workstations throughout their Institute. It is an integrated electronic system used by radiology departments, which stores images electronically and displays them digitally across the hospital, even remotely, instead of relying on traditional films.³ A PACS consists primarily of an image acquisition device (an electronic gateway to the system), data management system (a specialized computer system that controls the flow of information on the network), image storage devices as servers (both short and long term archives), transmission network (which serves local or wide areas), display stations (which include a computer, text monitor, image viewing stations, and a user interface), and devices to produce hard-copy images if required (currently, a multi format or laser camera). The goals of PACS are to improve operational efficiency while maintaining or improving diagnostic ability.⁴

The availability of the Picture Archiving and Communication System (PACS) has revolutionized the practice of radiology in the past two decades and has shown to eventually increase productivity in radiology and medicine.^{5,6} The advantages and benefits of this technology are plentiful, with both patients and healthcare workers expressing high levels of satisfaction. Some of these advantages include no lost image, reduction in repeat radiographs, images available in many places simultaneously, faster reporting by radiologists, instant image availability, previous image availability and comparison and image manipulation.⁷

Technical issues had been identified as the primary challenge generally associated with PACS usage. Shortage of higher quality monitors and slow speed of communication network have been documented as major factors limiting the usage of PACS.⁸

A clear understanding/insight into the levels of knowledge and acceptance as well as the challenges associated with the use of picture archiving and communication systems will be important for mass adoption of this technological innovation. This will help both administrators and clinicians/healthcare workers identify grey areas that will require focused and concerted effort to promote adjustment and adoption of PACS for better service delivery.

MATERIALS AND METHODS

The study was carried out in Delta State University Teaching Hospital (DELSUTH), Oghara, Nigeria. It was an observational cross sectional study involving two hundred consenting healthcare workers (including doctors, nurses and radiographers) who utilize PACS in DELSUTH. Participants for this study were randomly selected using the randomized sampling technique. Data collection was done using structured self-administered questionnaires, which was divided into separate sections: Sociodemographic data comprising age, gender, profession, department, designation; knowledge of the use of PACS; acceptance of the use of PACS; and challenges faced using PACS

Data Analysis

The questionnaires were retrieved, sorted and collated and were analyzed using the statistical package for social sciences (SPSS) version 26.0

Ethical Approval

Ethical approval was obtained from the Health Research Ethics Committee of Delta State University Teaching Hospital. Informed consent was obtained from each study participant. Confidentiality and anonymity was assured to the respondents.

RESULTS

The majority of respondents were aged between 25 to 34 years, constituting 45.5% (n=91) of the sample. The gender distribution revealed that female respondents comprised 54.0% (n=108) while male accounted for 46.0% (n=92). The professional distribution of respondents in the study showed that doctors constituted the majority of the participants, making up 62.0% (n=124) of the participants (Table

1).

Majority, 89.5%(n=179), of the participants had heard about PACS. Knowledge of the existence of PACS within the hospital was also high among respondents, 83.5% (n=167). Most of the participants had formal training in PACS had been received by 55% (n=110) of the participants. Seventy-one percent (n=142) of the healthcare workers, which constituted a majority had used PACS to access medical images. Regarding the ability to independently operate a PACS system, most of respondents 60.5%(n=121) confirmed they could. A small proportion of the 19%(n=38) of respondents indicated that they always request support when using PACS. Similarly, in terms of problem resolution by the PACS team, majority of the respondents 43.5%(n=87) agreed that issues are usually resolved adequately. majority 37% (n=74) of respondents reported using PACS for less than one year (Table 1)

Only a minority 9% (n=18) of healthcare workers reported always using PACS for decision support, while 28.5%(n=57) used it frequently. Regarding the perceived benefits of PACS, majority 80.5%(n=161) of respondents (51% agreed and 29.5% strongly agreed) felt that PACS aids clinical decisions and diagnoses. Similarly, a majority, 75% (n=150) viewed PACS as superior to traditional film-based radiographs. The ease of use of PACS was affirmed by a majority 72% of respondents (n=144). The impact of PACS on the speed of image delivery and patient outcomes was also positively perceived by 85.5% (n=171). Encouragement of PACS usage among clinicians was supported by majority of 82%(n=140) of respondents. Furthermore, most of the participants 84.5% (n=19) advocated for the use of PACS in other health facilities (Table 3).

Majority of the participants had 46.5%(n=93) intermediate level of computer skills among respondents. The impact of these computer skills on the proficiency in using PACS revealed a substantial majority of 74.5%(n=149) acknowledging that their level of computer skills affects their proficiency in PACS operations. Most of the participants 57% (n=114) mentioned that network issues affected their use of PACS. Most of the participants 41%(n=82)

believed there were enough systems available. In terms of usability, the majority of the respondents 64%(n=128). found image viewing interface for PACS to be navigable. The unavailability of monitors was cited by most of the respondents 64.5%(n=129). Additionally, majority of the participants 62.5%(n=125) expressed a lack of formal training in PACS operation. Furthermore, most of the respondents 49.5%(n=99) reported inadequate computer skills as a barrier. Epileptic power supply 41.5%(n=83) and poor network coverage 30%(n=60) were also significant concerns (Table 4)

Table 1: Sociodemographic Distribution Among Health Workers in DELSUTH, Oghar

Age	Frequency	Percent
<25years	34	17.0
25 - 34years	91	45.5
35 - 44years	41	20.5
45 - 54years	21	10.5
55 - 64years	12	6.0
65 - 74years	1	0.5
Gender		
Male	92	46.0
Female	108	54.0
Profession		
Doctor	124	62.0
Nurse	58	29.0
Radiographer	11	5.5
Others	7	3.5

Table 2: Level of knowledge of Picture Archiving and Communication System (PACS) among health care workers in DELSUTH, Oghara

	Yes	%	No	%
Have you heard about picture archiving and communication systems (PACS)?	179	89.5	21	10.5
Are you aware of the existence of PACS in Delta State University Teaching Hospital?	167	83.5	33	16.5
Have you had formal training in PACS?	110	55	90	45
Have you ever used PACS to access medical images?	142	71	58	29
Can you independently operate a PACS system?	121	60.5	79	39.5
How often do you request for support in the use of PACS?	Always 38	% 19	Sometimes 115	% 57.5
When support is requested, adequate support is gotten from the PACS team in DELSUTH	SD 10	% 5	D 11	% 5.5
When support is requested, problem is usually adequately resolved by the PACS team in DELSUTH	9	4.5	13	6.5
How long have you been using PACS?	Less than 1 year 74	% 37	1-2 years 50	% 25
			2-5 years 43	% 21.5
			5 years 33	% 16.5

Table 3: Acceptance of Picture Archiving and Communication System (PACS) among health care workers in DELSUTH Oghara

	Always	%	Frequently	%	Sometimes	%	Rarely	%	Never	%
How often do you use PACS as a decision support tool?	18	9	57	28.5	61	30.5	29	14.5	35	17.5
PACS aid clinical decisions and diagnosis	SD 4	% 2	D 3	% 1.5	N 32	% 16	A 102	% 51	SA 59	% 29.5
PACS is superior to traditional film-based radiographs	5	2.5	6	3	39	19.5	99	49.5	51	25.5
PACS is easy to use	4	2	6	3	46	23	110	55	34	17
Use of PACS has improved speed of image delivery and patient outcome	4	2	1	0.5	24	12	98	49	73	36.5
Use of PACS as an aid in patient diagnosis should be encouraged among clinicians	8	4	2	1	26	13	93	46.5	71	35.5
Use of PACS should be encouraged in other health facilities	5	2.5	3	1.5	23	11.5	88	44	81	40.5

Table 4: Challenges faced by healthcare workers of DELSUTH, Oghara in usage of Picture Archiving and Communication System.

What is your computer skills level?	Highly skilled 53	% 26.5	Intermediate 93	% 46.5	Basic 47	% 23.5	No skill 7	% 3.5
Level of computer skills affect your proficiency in the use of PACS	SD 3	% 1.5	D 9	% 4.5	N 39	% 19.5	A 108	% 54
Network affects your use of PACS	5	2.5	25	12.5	56	28	80	40
There are enough computer systems for viewing radiological images in your department	20	10	50	25	48	24	65	32.5
26. Image viewing interface for PACS is easy to navigate	7	3.5	9	4.5	56	28	101	50.5
Which of these do you consider as a major challenge in the use of PACS in DELSUTH						Yes %	No %	
Unavailability of image viewing stations						129 64.5	71 35.5	
Epileptic power supply						83 41.5	117 58.5	
Lack of formal training						125 62.5	75 37.5	
Inadequate computer skills						99 49.5	101 50.5	
Poor network coverage						60 30	140 70	
Cumbersome to use						12 6	188 94	
Too advanced technology						14 7	186 93	

DISCUSSION

The study showed that a substantial majority (89.5%) of healthcare workers at DELSUTH had heard about PACS, and 83.5% were aware of its existence within the hospital. This high level of awareness is consistent with findings from other studies. For instance, a study conducted in Saudi Arabia reported that 91.7% of healthcare workers were aware of PACS.⁹ Similarly, a study in National Orthopaedic Hospital Dala-Kano, Nigeria conducted by Saidu et al¹⁰ reported that 78 (85%) of the respondents had a better knowledge on how to use PACS; 80 (87%) admitted that PACS saves a lot of their time, and 91 (99%) admitted that PACS improves the quality of their work in providing better patient care. Eighty-five (92%) admitted that images on PACS had diagnostic information and 73 (79%) were satisfied with the quality of images on PACS. Moreover, majority of the respondents in this study had positive perceptions of PACS. This finding is in consonance with previous studies on healthcare workers.^{11,12}

Formal training in PACS at DELSUTH was less widespread, with only 55% of respondents having received such training. This is contrary to findings in developed countries where training is more prevalent. For example, a study in the United Kingdom reported that 75% of healthcare workers had received formal training in PACS.¹³ This disparity shows the need for enhanced training programs in developing countries to improve the effective use of PACS. Inadequate training limits the ability of healthcare workers to fully exploit the capabilities of PACS, thus impacting their overall productivity and the quality of patient care.

Acceptance of PACS among healthcare workers at DELSUTH was notably high. The majority of respondents believed that PACS aids clinical decisions and diagnoses (80.5%), was superior to traditional film-based radiographs (75%), and improved speed of image delivery and patient outcomes (85.5%). These findings are in consonance with those of Strickland, where it was reported that PACS offered an improved efficiency resulting from electronic data handling, once the image has been

uploaded onto PACS, it cannot be lost, stolen, or misfiled and images are always available after a PACS had been installed.¹⁴ The findings are also similar to the research conducted by Ali *et al* where they reported that the PACS had a positive and productive impact on the radiologists' and technologists' work performance.¹⁵ The general acceptance is likely driven by the perceived benefits of PACS, such as enhanced image quality, quicker access to images, and the ability to store and retrieve images efficiently.

However, the frequency of PACS use as a decision support tool at DELSUTH was variable, with only 9% using it always and 28.5% frequently. This suggests that while the acceptance of PACS is high, its integration into daily practice at DELSUTH was less consistent. Factors such as lack of training, inadequate computer systems, and network issues could be contributing to this inconsistency. The general acceptance and perceived benefits of PACS are universally acknowledged, but the extent of its integration into daily practice varies. The variable frequency of PACS use as a decision support tool at DELSUTH contrasts with more consistent usage patterns reported in developed nations where PACS is more deeply integrated into clinical workflows.¹⁶

The challenges faced by healthcare workers at DELSUTH in using PACS were multifaceted. The study identified significant issues such as the unavailability of image viewing stations (64.5%), lack of formal training (62.5%), and inadequate computer skills (49.5%). These challenges were also revealed in other studies from similar settings. For example, a study in Ghana reported that 70% of healthcare workers cited equipment shortages and 60% mentioned insufficient training as major barriers to PACS use.¹⁷ Network reliability also emerged as another significant challenge, with 57% of respondents at DELSUTH indicating that network issues affect their use of PACS. This is consistent with findings from Ethiopia, where significant number of healthcare workers reported network problems as a significant barrier.¹⁸ Network issues can disrupt the accessibility and functionality of PACS, making it difficult for healthcare workers to retrieve and view images promptly. In contrast,

studies in developed countries, where infrastructure was more robust, reported fewer network-related issues. For instance, a study in Germany found that only 20% of respondents experienced network problems with PACS.¹⁸ This disparity highlights the importance of reliable network infrastructure in the effective implementation of PACS. The availability of computer systems for viewing radiological images within departments also drew mixed responses. While 40.5% of respondents believed there were enough systems available, 35% disagreed, indicating a perceived shortage or inadequacy of equipment that could affect workflow efficiency and patient management. This shortage can lead to delays in image access and interpretation, thus affecting the overall efficiency of healthcare delivery.

In terms of usability, the majority found the image viewing interface for PACS to be navigable (64%), although a notable minority found it cumbersome (6%). This suggests varying user experiences with the PACS interface, potentially influenced by interface design, user training, and familiarity with the system. A user-friendly interface is crucial for ensuring that healthcare workers can efficiently navigate and utilize PACS without significant difficulty.

CONCLUSION

The perception of PACS among healthcare workers in DELSUTH, Oghara, was generally positive, with high levels of knowledge and acceptance. However, a significant challenge was the lack of adequate equipment such as image viewing workstations, which needed to be addressed to enhance the effectiveness of PACS, ultimately enhancing healthcare delivery outcomes.

Recommendations

There is need to implement targeted interventions to address the identified challenges. Enhance formal training programs for healthcare workers as necessity to significantly improve their proficiency in using PACS. Improve network infrastructure and increase the availability of image viewing workstations which are essential steps to facilitating the effective use of PACS. Policy initiatives should

focus on ensuring reliable power supply and addressing equipment shortages. Investing in these areas can enhance the overall efficiency of PACS and its integration into clinical practice. These improvements will not only benefit healthcare workers in DELSUTH but also set a precedent for other healthcare facilities in similar settings to follow.

Conflict of interest

There is no conflict of interest

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