Interrogating the Influence of Information and Communication Technology (ICT) in Combating Clinical Errors in Jos University Teaching Hospital, Plateau State, Nigeria

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Abstract

In this era of globalization, information and communication technology (ICT) has transformed the way people collaborate in their social, economic and health seeking behavior. It is in this viewpoint that this study investigate the role of ICT in combating medical errors in Jos University Teaching Hospital. Data were collected both qualitatively and quantitatively using questionnaire, in-depth interview and non-participant observation. Although 308 respondents were sampled using stratified simple random and purposive sampling techniques respectively, the data analyzed were based on 293 questionnaires retrieved from the field. Eight (8) key informants were also interviewed, and an observation check list as well as IDI guide was used to guide the research. From the finding of this study, it was identified that the major obstacles militating against effective utilization of ICT facilities for healthcare delivery in JUTH were poor implementation of e-health policy, poor maintenance culture, and lack of internet access, erratic power supply and inadequate utilization of ICT equipments in healthcare delivery. Notwithstanding, the study found that when ICT equipments are fully utilized for healthcare delivery, the gains will certainly outweigh the pains as ICT will reduce clinical errors, it will enhance collaboration among professionals and reduce patient waiting time and wastage. The study recommended that there should be creation of a greater awareness among the health workers and training health professionals to use the available ICT equipments as these will enhance quality healthcare delivery in the nearest future.

Keywords: Medical Errors, Healthcare Delivery, Health Profess

Introduction

Since the last half of the 20th century, Information and Communication Technology (ICT) have been incorporated in the field of transportation, agriculture, banking, military, engineering, etc. in view of facilitating efficiency and effectiveness in those fields and the health sector is not left out. Thus, given the right approach, context and implementation process, ICT-based solutions can indeed improve the quality, access and efficiency of healthcare provision (UNESCO report, 2002). The World Health Organization (2006) maintained that, ICT are important tools in enhancing quality healthcare delivery in both developed and developing nations, as ICT enable healthcare workers perform remote consultation and diagnosis, access medical information and coordinate research activities more effectively than ever before.

Today's understanding about health is total well-being and not only to be a mere absence of disease or infirmity but the complete physical, mental and social well being of not just an individual but the society at large (WHO, 1946; Raebun and Rootman, 1998). Hence, good health is a complex state and achieving it requires much more than just one or two simple interventions, but an integrated range of preventive strategies, environmental changes, therapies and technology to diagnose and treat ill health, and provision of opportunities for those who need healthcare to access it (WHO report, 2014). Information and communication technologies have the potential to make major impact on improving the health of the members of each class in the society. It has also shown effectiveness in preventing medical errors by enforcing clinical guidelines and protocols and reducing healthcare cost.

The World Health Organization (2014) added that utilization of information and communication technology equipments in healthcare delivery, such as electronic health records, e-consultations, e-prescriptions, tele-medicine, e-radiology etc. has helped in reducing clinical errors and improves evidence-based medicine by increasing the accuracy of diagnoses and appropriateness of treatment approaches. ICT utilization also helps medical caregivers in their research and application processes as they can use the internet to identify research issues, search literature databases, seek out information on survey and clinical trials, and publish research results (Eysenbach and Wyatt, 2002).

Although Medical errors are unplanned mishaps resulting from either the health practitioner's carelessness, incompetence, faulty medical equipment or a combination of these factors, causing injuries, losses or increase in inconveniences to patients (Adeboyega, 2016).It is no gainsaying that the Nigerian health institutions including the Jos University Teaching is bedeviled by this phenomenon.

Literature Review and Theoretical Perspectives:

It is well established that the provision of timely information aimed at combating possible health menace among many other things is an important function of public health (Menizibeya, 2011). However, the quality of healthcare delivery depends on the integrity, reliability, and accuracy of health information. While the adoption of electronic health systems such as electronic health

records (EHR), e-prescription, e-consultation among others, promises a number of substantial health benefits, including better care and decreased healthcare costs, there are serious unintended consequences from implementation of these systems. Adeboyega (2016) maintained that many patients have suffered medical errors in Nigeria due to unsafe vaccinations, injections, blood transfusions, counterfeit drugs or unreliable medical equipment. In addition, Hassan, *et al*, (2011) identified IT literacy, infrastructural deployment, and IT usage as some of the factors affecting quality healthcare delivery in the country.

As an important element of national security, public health not only functions to provide adequate and timely medical care but also track, monitor and control disease outbreak (Menizbeya, 2011). Grober and John (2005) reported that medical errors have been recognized as a global challenge and much has been done to understand the causes, consequences and potential solution to this problem.However, it is an established fact thatinformation and communication technologies have the potentials to make major impact on improving the health of the members of each class in the society as well as reduce clinical errors (Saraswati *et al*, 2013).According to Adegboyega (2016), medical errors, include diagnosis errors, errors in administration of drugs and medication, errors in performance of surgical procedure, in the use of other types of therapy, in the use of equipment, in the interpretation of laboratory findings and error of discharge. For this study, medical error is defined as a preventable adverse effect of care, whether it is evident or harmful to the patient. This might include an inaccurate or incomplete diagnosis or treatment of a disease, injury, syndrome, behaviour, infection, or other ailment.

This study specifically adopts Talcott Parsons AGIL scheme to explain ICT and healthcare delivery in Jos University Teaching Hospital. Parsons attempted to develop and perfect a general analytic model suitable for analyzing all types of collectivities. Unlike the Marxists who focused on the occurrence of radical change, Parsons explored why societies are stable and functioning. However, for this equilibrium to be maintained, i.e. for the society to exist, four functional prerequisites have to be met. They are adaptation to environment to get basic needs for which the economic institution is charged; the attainment of goals as set by the government; integrative function and conflict resolution for which the legal institution is responsible; and pattern maintenance, which the family, educational and religious institutions perform. Parsons further stated that:

A social system consists in a plurality of individual actors interacting with each other in a situation which has at least a physical or environmental aspects, actors who are motivated in terms of a tendency to the ‘optimization of gratification’ and whose relation to their situations, including each other is defined and mediated in terms of a system of culturally structured and shared symbols (Parsons, 1951: 5-6).

This theory is applicable in explaining the roles of ICT in combating medical errors in JUTH, thus; the primary function role of every healthcare system is the adaptation to the environment through the organization of people (health workers),

institutions, and resources in order to ensure the provision of quality healthcare services to the patient and public. As noted by the World Health Organization (2016) hospitals need to be organized around people's needs, working closely with other health and social care services and contributing to strengthening primary health care and public health services, to substantially contribute to universal health coverage. As such, the health sector helps society to adapt the environment to its own needs. Consequently, healthcare providers must adapt to their environment through effective utilization of all available facilities (including ICT equipments) that will enhance quality healthcare delivery.

The theory is also applicable to this study as it argued that for quality healthcare to be achieved in JUTH, the hospital management must provide adequate facilities for effective service delivery and if ICT is integrated into the mainstream of healthcare, it well not only enhance effectiveness in healthcare delivery but will led to economic development in JUTH.

The theory also identified manifest and latent functions, in applying this to ICT utilization in healthcare delivery in JUTH. While the manifest functions of ICT utilization is to enhance health professionals in providing efficient and effective of healthcare delivery, the latent consequences are the challenges with the use of ICT equipments in healthcare delivery such as diagnostic errors, misinterpretation of data, etc.

Generally, functionalism is criticized for being unable to account for social change, or for structural contradictions and conflicts since it hold that changes occur through consensus. Giddens (2009) argues that functionalist explanations may all be rewritten as historical account of individual human actions and consequences.

Furthermore, the AGIL scheme did not provide explanation on how the challenges with the utilization of ICT in healthcare delivery can be addressed. Critics including C. Wright Mills also argued that the four functions of the AGIL scheme are intuitive and many social systems can be described according to the paradigm of Parsons structural functionalism, one can question the utility that such an inspection brings to a scientific sociological study. However, the theory has been able to explain and establish a relationship between ICT and healthcare delivery in Jos University Teaching Hospital.

Research Methodology

For this study, the necessary data were collected using quantitative and qualitative methods, as the study is concerned with a relatively large population. The qualitative data for this study were collected using a self-administered questionnaire, which was administered to healthcare professionals through face-to-face distribution. Some questionnaires were administered indirectly through the unit heads in the institution. The answered questionnaires were returned to the researcher through hand-to-hand collection with the assistance of the department/unit heads. The questionnaire contains both open-ended and close-ended questions on the roles of ICT in healthcare delivery in combating medical errors JUTH.

The qualitative technique of data collection in this study was the in-depth interview and non-participant observation. The IDI guide contains a set of questions, which was directed to eight health workers and two patients in JUTH.

Population of Study: The study population comprises of all health workers; doctors, nurses, medical laboratory scientists, pharmacists, health record officers, radiologists, physiotherapists, ICT workers and medical social workers in the JUTH.

Inclusion and Exclusion Criteria: In this study, the hospital workers that were included are the medical doctors, nurses, pharmacists, physiotherapists, radiologists, medical laboratory scientists, medical social workers, ICT staff, and health records workers. In addition, health workers who have consented or agreed to participate in the study were included.However, health workers who do not consent or disagreed to participate in the study were excluded.

Sampling: The study used both the probability and non-probability sampling techniques. For probability sampling technique, the stratified random sampling method was used, while the non-probability sampling technique was availability and purposive sampling. Stratified sampling is a form of random sampling in which the population is divided into two or more groups/strata according to one or more common attributes. This method was considered more appropriate because it gives every member of the population equal chance of being selected and also, opinion of different groups of health workers was required for the study. In applying the stratified sampling technique, health professionals in JUTH were stratified into their various areas of profession as presented in table.

Table 1: the Population and Sample Size of Different Healthcare Professionals in JUTH

S/no	Staff Profession	No. of Staff	Sampling Size (23%)
1	Doctors	467	107
2	Nurses	529	122
3	Pharmacist	30	7
4	Lab. Scientist	163	38
5	ICT Workers	7	2
6	Medical Social Workers	16	4
7	Radiologist	20	5
8	Health Record Workers	84	19
9	Physiotherapist	19	4
	Total	**1335**	**308**

To select doctors and nurses for this study since this particular group of health professionals were distributed across all departments, units and wards in JUTH. Simple random sampling technique, which is a probability sampling technique, was adopted to select 10 departments from the 20 departments in JUTH, five(5) wards were selected from the 12 wards and 2 clinics were selected from the 7 clinics by balloting respectively.

Availability sampling technique was used to finally select respondents for the study. Although, this is not a probability sampling technique, but due to the fact that the hospital system and the nature of the job of the respondents which include shifting, call duty, and posting as a result, those who the researcher meets and are willing to participate in the study were used. Hence, the questionnaire was administered in the morning to those who were in morning shift and in the afternoon to those who were in afternoon shift.

For the qualitative method (in-depth interview), purposive sampling technique was adopted to elicit information from eight key informant. These key informants however included head of departments or health workers assign by the HOD (who were doctors, nurses, health record workers, medical laboratory scientists, physiotherapists, radiologists, ICT staff, medical social workers and pharmacist from JUTH). This category of health professionals were selected because of their knowledge and experience on the utilization of ICT in healthcare delivery in JUTH.

Methods of Data Analysis: Data collected from the field through survey questionnaire went through the process of data cleaning in order to minimize errors, coding was done. Inspection of the coded data was done to ensure coding accuracy after which the data was analyzed using Statistical Packages for Social Sciences version 21. Findings were presented in tables, frequencies and percentages. Furthermore, a bivariate analysis of the variables involve were done specifically, the independent variable (ICT utilization) was cross tablulated against the main dependent variable (healthcare delivery) in other to ascertain the effect of one upon the other.

For the qualitative components of the study, data from the in-depth interview and observation were presented in narrative form after it was transcribed from tape recorder and camera to a written format. Furthermore, data from the qualitative method was synergize with data obtain from quantitative method in the area where necessary, with the aim of identifying the point of convergence or divergence of the two methods.

Ethical Clearance: Approval for carrying out the research was obtained from Research and Ethics Committee of JUTH

Results

Socio-Demographic Profile

Table 2 below shows that among the participants, 135 (46.1%) were male and 158 (53.9%) were females. This implies that both male and female health worker were fully represented in the study. However, there were more female respondents than the male respondents. Regarding the age distribution of respondents, majority of the respondents 155 (52.9%) were forty-one years and above, followed by 69 (23.5%) were between thirty six to forty years of age, 41 (14%) of the respondents were between thirty-one and thirty-five years, 26 (8.9%) were twenty six and thirty years, while 2 (0.7%) were below twenty five years. The table also shows that majority of the respondents who participated in the study, 201 (68.6%) were married, while 73 (24.9%) were

single, 18 (6.1%) of the respondents were widows/widower and one person (0.3%) was divorced. This can be attributed to the fact that majority of the respondents were within the age range 36-41years and above and it is believed that most people of this age categories were usually married. Also, regarding the religious affiliation of respondents, 266 (90.8%) of the respondents were of the Christian faith, while 26 (8.9%) practiced Islam, and only 1 (0.3%) was identified as a Traditionalist.

Concerning the academic qualification of the respondents, the table (4.2.1) shows that 193 (65.9%) of the respondents were MBBS, B.Sc. or HND graduates, 26 (8.9%) were masters degree holders, 37 (12.6%) were PGD holders, while 24 (8.2%) of the respondents posses other qualifications relevant to their areas of specialty which include PhD. The table also indicates that significant number of the health professionals who participated in the study were 113 (38.6%) nurses, closely followed were 104 (35.5%) doctors, while 34 (11.6%) were laboratory scientists, 7 (2.4%) were pharmacists, while other health professionals that are radiographers, physiotherapist, health record officers, ICT workers, and medical social workers constitute 11.9% of the participants. This can be attributed to the fact that it is expected that majority of the health professionals in JUTH as at the time of this study were doctors and nurses.

Table 2 Socio-Demographic Characteristics of Respondents

SEX	**Frequency**	**Percentage (%)**
Male	135	46.1%
Female	158	53.9%
Total	**293**	**100%**
AGE		
Below 25 years	2	0.7%
26-30	26	8.9%
31-35	41	14%
36-40	69	23.5%
41 and above	155	52.9%
Total	**293**	**100%**
MARITAL STATUS		
Single	73	24.9%
Married	201	68.6%
Widow/widower	18	6.1%
Divorce	1	0.3%
Total	**293**	**100%**
RELIGION		
Christianity	266	90.8%
Islam	26	8.9%
Traditional	1	0.3%
Total	**293**	**100%**
HIGHEST QUALIFICATION ACQUIRED		
No response	1	0.3%
OND	12	4.1%
MBBS/B.Sc./HND	193	65.9%
Masters	26	8.9%
PGD and above	37	12.6%
Others	24	8.2%
Total	**293**	**100%**
PROFESSION		
Doctors	104	35.5%
Nurses	113	38.6%
Laboratory Scientist	34	11.6%

Pharmacist	7	2.4%
Others	35	11.9%
Total	**293**	**100%**

The Availability of ICT facilities in JUTH

Results of this study show that 96.1% of the respondents agreed that ICT facilities were available in JUTH. It was also observed during the study that virtually all units, clinics, departments, wards and offices in the hospital were equipped with different types of ICT facilities including computers, telephones, anesthetic machine, computerized tomography (CT) scan, magnetic resonance imaging (MRI), endoscopy, ultrasound machine, and most health workers were seen using different types of mobile phones etc.

Further investigation on the working condition of the available facilities shows that 63.4% of the respondents agreed that the ICT facilities in the hospital were in proper working condition. Supporting this claim, Assistant Director Physiotherapy during IDI insisted that virtually all ICT facilities *"electronic stimulator, X-ray machine, ECG, CT scan, etc."* in the hospital were in good working condition. He stated:

> I am confident that all the equipments in this department and the hospital are in good working condition and we make use of these facilities when the need arise. Although we do not have internet connectivity here, but we use our mobile devices to communicate with fellow professionals either through social media or we make calls. We sometimes call our clients (patients) or their guidance when the need arise.

A Consultant, a Chief Nursing Officer and a Pharmacist also shared similar view of the facilities being in a good working condition stating, *"All equipments available to us are in good working condition".* The Consultant further stated that:

> Although power supply (electricity) is a problem but we have generator in the hospital. Aside that, all other facilities available to us are perfectly working, and we use them when the need arise without stress.

However, 32.7% of the respondents objected that the available ICT facilities in JUTH were not in a proper working condition. During IDI, a Chief Radiologist reluctantly responded to the working condition of ICT equipments in the hospital. He stated

> As you can see, I keep all the ICT gadgets aside (a desktop computer and a telephone) because they are blocking my space, the facilities are only for decoration. He lamented on the poor state of some of the facilities and emphasized that: The poor state of these facilities is because of poor maintenance culture and lack of vision.

> How can you make use of a computer without internet connections.

Supporting this claim, A Health Record Officer also insisted that the ICT facilities in the hospital were not in a proper working condition. She stated that:

> I don't know for other departments, but here in records, ICT facilities are not working at all... yes, my mobile phone and all these laptop computers are working. But proper working condition is when you can at least make 60% use of the equipments, and honestly we don't make up to 30% use of ICT here.

This view was also supported by an observation where some ICT equipments were not used due to reasons ranging from lack of internet access and lack of maintenance. The implication of this finding is that the effective utilization of ICT equipments to enhance quality healthcare delivery in JUTH cannot be achieved since some of the facilities were not in proper working condition.

Table 4: Profession by How Often Respondents Utilized ICT Equipments in Healthcare Delivery in JUTH

Profession	How Often Respondents Utilize ICT Facilities for Healthcare Delivery in JUTH				
	No response	Always	Sometimes	Not at all	Total
Doctors	9 (3.1%)	44 (15.0%)	39 (13.3%)	12 (4.0%)	**104 (35.4%)**
Nurses	2 (0.7%)	42 (14.3%)	41 (13.9%)	28 (9.6%)	**113 (38.5%)**
Lab. Scientist	5 (1.7%)	8 (2.7%)	4 (1.4%)	17 (5.8%)	**34 (11.6%)**
Pharmacists	0	7 (2.4%)	0	0	**7 (2.4%)**
Others	9 (3.1%)	10 (3.4%)	3 (1.0%)	13 (4.4%)	**35 (11.9%)**
Total					**293 (100%)**

Table 4: indicated the cross tabulation of respondents profession by how often they utilized ICT facilities in healthcare delivery found that the nurses used ICT equipments for healthcare delivery more than other health professionals in JUTH, followed by doctors. This can be attributed to the fact that both the nurses and doctors frequently interact with patients more than other professionals in the hospital and the nature of their profession involves the use of ICT gadgets such as anesthetic machine, ultrasounds machine, cardiac monitor, electronic stimulator, defibrillators, computers, mobile phones, etc. for diagnoses, treatment and consultations.

In-depth interview further shows that all respondents who were Consultant, Chief Nursing Officer, Assistant Director Physiotherapy, Chief Radiologist and a Pharmacist admitted that they always utilized ICT equipments for healthcare delivery. The Assistant Director Physiotherapy further stated that:

> I always used electronic devices for diagnoses, research on current health issues and I always used my phone to communicate with clients (patients) and other health professionals. Although we do not utilize these facilities as we ought to. Because when you talk of electronic health, it means all aspects of healthcare is involved and not only diagnoses and phone calls with few patients and health workers who are your friends.

While other health workers interviewed during IDI claimed that, they have never used ICT for health delivery purpose. A Medical Social Worker stated,

> I sometimes use my mobile phone to communicate with colleagues. But I have never used the computer or any ICT equipment for healthcare delivery purpose.

In the same vein, a Chief Lab Scientist stated that:

> I have never used ICT facilities to communicate with patients or other health professionals in this hospital for health purpose. Although I sometimes used electronic devices for diagnoses but my results were reported on paper.

The above findings show that not all the health professionals in JUTH utilized ICT facilities for healthcare delivery. This can be attributed to the fact that most of the ICT facilities were available to some specific health professionals that are doctors, nurses, radiologists, physiotherapists and ICT workers in JUTH, while other health workers including Medical Social Workers, Lab. Scientist, Health Record Officers, Pharmacists, etc. have limited availability of ICT facilities in JUTH. The implication of this finding is that effective utilization of ICT in healthcare delivery cannot be achieved in JUTH when some health professionals were not utilizing the facilities. This is because for efficiency to be achieved, every health worker in the hospital must always utilize the ICT facilities in other to enhance quality healthcare delivery.

Table 5: Frequency of ICT Utilization at Various Stages of Patient Care in JUTH

Response	Frequent	Not frequent	Not at all	No response	Total
Diagnoses	252(86.0%)	31(10.6%)	0	10(3.4%)	**293(100%)**
Treatment	236(80.5%)	52(17.7%)	4(1.4%)	1(0.3%)	**293(100%)**
Prescription	143(48.8%)	91(31.1%)	59(20.1%)	0	**293(100%)**
Patient record	27(9.2%)	28(9.6%)	238(81.2%)	0	**293(100%)**
Track/monitor Patients	244(83.3%)	36(12.3%)	12(4.1%)	1(0.3%)	**293(100%)**
Disease surveillance	235(80.2%)	45(15.4%)	11(3.7%)	2(0.7%)	**293(100%)**
Rehabilitation	150(51.2%)	84(28.6%)	55(18.8%)	4(1.4%)	**293(100%)**
Others (collaboration/referral)	197(67.2%)	50(17.1%)	37(12.6%)	9(3.1%)	**293(100%)**

Table 5: shows that 252 (86.0%) respondents indicated that they frequently used ICT facilities for diagnoses in JUTH. A Chief Radiologist also supported this view stating that: *"we frequently used ICT gadget (ultra sound machine, ECG, MRI, CR, CT scan, etc.) for diagnoses.* Assistant Director Physiotherapy also stated that:

> We frequently utilized these facilities (electronic stimulator, etc.) for diagnoses and almost all our equipments here are electronic devices.

Also, 143 (48.8%) of the respondents indicated that ICT facilities were frequently utilized for prescription in the hospital and 91 (31.1%) respondents indicated that ICT equipments were not frequently used for prescription in the hospital. Reports from IDI shows that most respondents stated that ICT facilities were used for prescription on special cases and not all patients enjoyed such services in the hospital. Supporting this view, Pharmacist stated that:

> We use ICTs for certain patients with particular or special case, especially for HIV patients. We have such patient's details in our systems, and with their patients ID they can access us and we make prescription for them anywhere they are.

It was also observed during the study that all patients seen at the pharmacy unit were with paper based prescription and no pharmacist was seen attending to patients using the computer or any ICT gadget, although there were three desktop computers and a laptop present in the unit as at the time of this study.

Table 5 also shows that 238 (81.2%) of the respondents agreed that ICT facilities were frequently used in the hospital for patient records. 28 (9.6%) respondents agreed that ICT facilities were used in patient record but not frequent. This finding implies that most respondents claimed that ICT facilities were used for patient records in JUTH. However, report from IDI shows some disagreements on the utilization of ICT facilities for patient health records in JUTH. While the Consultant, Chief Nursing Officer, Physiotherapist, and a Chief Radiologist claimed that ICT facilities were used in recording patient's health information in the hospital. A Chief Radiologist further stated that:

> We have all details of our patient's saved in our systems here and this information can be accessed anywhere in the hospital, we also have results of patient's diagnoses on CD plates which the patient presents to the consultants for further treatment.

This view was however, rejected by other IDI respondents including the HOD ICT Unit, Medical Social Worker, Chief Lab. Scientist and Health Record Officer who stated that the hospital frequently used the traditional paper based health record system because there is no internet connection in the hospital that will enhance sharing of patient's health information between departments. The Health Record Officer also affirmed this view stating that:

> The utilization of ICT in patient record is called 'electronic health records' something that most record officers here do not know... we actually started using the electronic records system when we newly moved to this permanent site, but due to issues here and there including lack of internet connectivity we resolved to continue with our traditional paper-based records. Although we still document some cases in our computers but majority of

patient's records in this hospital are written on papers for safe keeping and reference purpose.

Regarding this view, it was observed that only four laptop computers were present in the health record unit that was used to document patient's health information and seven desktop computers were abandoned at the health records library. While a significant number of the record officers were seen at the record's library searching for patients files and others were seen at different card collection units within the hospital issuing cards, test results and also informing the patients/significant others on how to receive care in the hospital. Although the process was observed to be very slow, as patients have to queue and wait for a very long period before the records officers could attend to them. It was also observed some cases of missing cards and misinterpretation of patient's information.

Table 5 further indicated that 244 (83.3%) of the respondent indicated that ICT facilities were frequently utilized to track and monitor patients in JUTH. 36 (12.3%) of the respondents indicated that ICT facilities were not frequently used in tracking and monitoring of patient's in the hospital. While 12 (4.1%) respondents indicated that ICT facilities were not utilized in track and monitoring patients in the hospital.

The study also revealed that 235 (80.2%) participants responded that ICT facilities were frequently utilized in disease surveillance JUTH. The result also indicated that 150 (51.2%) of the respondents indicates that ICT facilities were frequently utilized in patients rehabilitation in JUTH. The finding further indicated that 197 (67.2%) of the respondents indicates that ICT facilities were frequently utilized in other patient's patients care in the hospital including collaboration and referrals.

From the above findings, a significant number of respondents indicated that ICT facilities were frequently utilized at different stages of patients care in JUTH. However, the study also found that the ICT equipments were used only for certain special health conditions or patients. In addition, it was found that lack of internet connection hinder sharing of patients health records between departments and health professionals in the hospital. The implication of this finding is that effective and efficient utilization of ICT in healthcare delivery cannot be achieved in JUTH because electronic healthcare delivery entails that all health professionals have access to ICT equipments and the patients as well are expected to have access to ICT facilities regardless of their health conditions or socio-economic status.

Table 6: Respondents Perceptions on ICT Utilization and Reduction of Clinical Errors in JUTH

Response	Frequency	Percentage (%)
ICT facilitates accurate diagnoses	88	30.0%
Human errors are reduce to minimal with the use of ICT	54	18.4%
ICT help confirm the healthcare providers guess or direct the care provider	28	9.6%
ICT help to reduce time wastage	59	20.1%

Proper documentation reduce the likelihood of errors	52	17.7%
No response	12	4.1%
Total	**293**	**100%**

Table 6 shows that 88 (30.0%) respondents were of the view that ICT utilization can reduce clinical errors as it facilitates accurate diagnose. 54 (18.4%) respondents were of the view that human errors are reduced to minimal with the use of ICT. Also, 28 (9.6%) of the respondents were of the perceived that ICT help confirm the healthcare providers guess or direct the healthcare provider. The table further revealed that 59 (20.1%) of the respondents perceived that ICT help in reducing time wastage. This view was supported by a Consultant who stated that:

> Patient care is our primary goal and to be honest, there is mixed feeling among the patient due to the services that are being rendered by the hospitals. Patient has to go through long queues, some even travel from one hospital to another, which is a problem for the patient because their medical records are unmovable so they waste time and resource to conduct several tests. But you see with ICT a patient can access health care anywhere and at anytime. In fact many problems will be solved, the chance of survival will be high and there will be better service for the patient.

Table 7 also indicated that 52 (17.7%) respondents were of the view that enhances proper documentation and proper documentation reduces the likelihood of errors. A Chief Nursing Officer stated that:

> Most patients complain about time spent on waiting for their turn, some complain about missing cards and files, others complain about lack of information and so on. However, this challenge can be reduced to the minimal when ICT equipments are effectively utilized.

A Health Record Officer further stated that:

> Patients information at the moment is written on papers for safe keeping and reference purpose. It is a lot of work to access that kind of information because there are many of patient's files, and due to human errors, the files can be missing. There is a lot of risk involved in keeping vital information like that, although patient information is handled as discretely as possible and can only be shared if the patient permits the doctor. But with electronic health records only a tab on a

button you can get the information you want.

The above finding shows that effective ICT utilization can help in reducing clinical errors. This is no doubt because clinical support tools such as electronic health records, mobile health (m-health), e-radiology has helped in reducing clinical challenges and errors as well

Table 8: Extent to which Respondents Agreed that ICT Utilization in Healthcare Delivery can Reduce Medical Challenges in JUTH

Response	A F (%)	SA F (%)	D F (%)	SD F (%)	UN F (%)	Total
Clinical errors	133(45.4%)	150(51.2%)	5(1.7%)	2(0.7%)	3(1.0%)	**293(100%)**
Waiting times and wastage	108(36.9%)	182(62.1%)	2(0.7%)	0	1(0.3%)	**293(100%)**
Loss of patient's medical record	124(42.3%)	167(57.0%)	1(0.3%)	1(0.3%)	0	**293(100%)**
Physical barriers (location)	181(61.8%)	108(36.9%)	3(1.0%)	1(0.3%)	0	**293(100%)**
Others (Referral)	217(74.0%)	33(11.3%)	19(6.5 %)	17(5.8 %)	7(2.4%)	**293(100%)**

Table 8 shows that 133 (45.4%) of the respondents agreed and 150 (51.2%) strongly agreed that ICT utilization can reduce clinical errors in JUTH. Clinical errors have been identified as one of the major challenges facing healthcare delivery worldwide however, effective utilization ICT facilities has over the years helped healthcare professionals to prevent some of these errors such as wrong diagnoses, wrong treatment procedures, undue waiting times for non-emergency cases, etc. Report from IDI further shows that all participants strongly agreed that ICT utilization would reduce clinical errors in the hospital. A Health Record Officer stated that:

> We currently have a case where two consultants were attending to a single patient because of improper documentation of the patient information. ICT utilization can help reduce this kind of challenge. There are also errors in waste disposal, errors in the diagnoses and interpretation of patient results.

Table 8 shows that 182 (62.1%) of the respondents strongly agreed that ICT utilization will reduce patient's waiting time and wastage. It is a fact that prompt medical attention and care is an indicator of quality healthcare delivery of any health sector. It is also a fact that patients waiting time and wastage for non-emergency cases is among the major challenges facing healthcare delivery in Nigerian hospitals. Report from IDI revealed that most patients died because of this challenge. A Consultant further stated that:

> Every patient needs urgent care. People die of headache, you might think headache is a common sickness but in reality, what the

> patient might be surfing from is different. It is unfortunate that many sick people come to the hospital for help but end up dead because they could not access immediate care. We are not happy about this, but the truth is that the hospital lacks most of the facilities that will ensure quick response to both emergency and non-emergency cases.

Also, 167 (57.0%) of the respondents strongly agreed that ICT utilization can reduce loss of patient's medical records in JUTH. The table indicated that 181 (61.8%) respondents agreed that ICT utilization will reduced the challenges of physical barriers (location). The finding further shows that majority of the respondents agreed that ICT utilization will address other challenges including referrals, collaboration and communication in JUTH.

Table 9: Distribution of Respondents views on Some Errors with the Utilization of ICT in Healthcare Delivery in JUTH

Response	**Frequency**	**Percentage (%)**
Poor knowledge of equipments	166	56.6%
When faulty, records and results can be missing (equipment failure)	43	14.7%
Misinterpretation of data	40	13.7%
Human errors	26	8.9%
No response	18	6.1%
Total	**293**	**100%**

Table 9 shows some errors with the utilization of ICT equipments in healthcare delivery in JUTH. 56.6% of the respondents perceived poor knowledge of ICT equipments by health professionals is one of the errors with ICT utilization in JUTH. 14.7% respondents identified equipment failure as another error with the utilization of ICT equipments in healthcare delivery. Equipment failure usually occurred when ICT equipments were faulty. Supporting this finding, a Chief Radiologist further stated that:

> Clinical mistakes do occur when using ICT especially when they develop faults. Most of the ICT gadgets here don't have back-ups (uninterruptible power supply), so when there is power outage, information that was not saved can be missing. When these equipments are faulty, records and results can also be missing.

Table 9 also shows that 40 (13.7%) of the respondents identified that errors occurred due to misinterpretation of data. When patient health information is misinterpreted, it leads to wrong treatment procedures and consequently endanger the life of the patient. Again, 26 (8.9%) of the respondents identified human errors as also problem with the utilization of ICT in the hospital. A Chief Nursing Officer stated:

> We are not immune to mistakes because we are normal human beings, so as long as human beings will be the ones to operate

this equipments, errors are bound to occur except that the errors might be minimal compared to when the gadgets were not utilized.

From the findings above, it was revealed that there are a number of errors with the utilization of ICT in healthcare delivery. It is also evident that patient's health information using electronic health records is not safe as they can be hacked by cyber criminals. Health information can be missing due to system failure. Studies have also proved that the utilization of electronic health systems have many health hazards to both the patient and the caregiver. However, the utilization of electronic health system has helped in reducing clinical errors and enhancing evidence based medicine.

Discussions of Results

This study found that information and communication technology play a pivotal role in enhancing quality and effective healthcare delivery in Jos University Teaching Hospital. There is no doubt that ICT utilization is significant in any sector of the economy. Evident is the fact that since the last half of the 20^{th} century, that ICT have been incorporated in the field of engineering, banking, military, transportation, agriculture and education, etc. was able to raise efficiency and effectiveness in those fields. In healthcare delivery, ICT utilization has been able to reduce patient waiting time, reduce some clinical challenges and errors as well.

Findings on the availability of ICT in Jos University Teaching Hospital indicated that majority of the respondents (94.2%) agreed that ICT facilities were available in the hospital. Some of the facilities available in JUTH include computers, mobile phones, electronic stimulator, computerized tomography, magnetic resonance imaging, etc. This aligned the assessment finding by (WHO/ITU, 2015), which found out that basic ICT infrastructure and working computers were in place at all the federal teaching hospital, including state general hospitals. However, 32.7% respondents revealed that the available ICT facilities in JUTH were not in a proper working condition. This view was supported by IDI report where almost all participants stated that some of the ICT equipments in JUTH were not adequately utilized because of their bad condition. Observation during the study also confirmed that ICT facilities were present in JUTH but most of the equipment were not utilized due to poor maintenance and there was no internet connection in the hospital to enhance effective communication using these gadgets. To buttress this finding, Idowu *et al*, (2003), reported that ICT capabilities (computers, mobile phones etc) were available in Nigerian teaching hospitals but not much internet connectivity was available, as such most of the professionals used external (non-hospital) internet services such as cybercafés, for even rudimentary internet access, such as email. The implication is that when some ICT facilities (internet for example) are not available, there will be inefficiency, which was the case of Jos University Teaching Hospital where some basic ICT capabilities (internet) were reported not sufficiently available in the hospital and the available ones were in poor working condition. Consequently, the insufficient availability of ICT facilities in JUTH also affects the primary goal of the institution, which is provision of quality and

timely healthcare services to the public. According to UNESCO Report (2002), the primary responsibility of every health sector is the provision of quality healthcare to the public and ICT-based solutions can improve the quality, access and efficiency of healthcare provision. This finding further reiterate the theoretical postulation of the structural functionalism, which established that for equilibrium to be maintained, all facilities (including ICT), units/wards and health professionals must contribute their functions for effective service delivery and absence of one of these (e.g. internet) affects the whole.

On the utilization of ICT in healthcare delivery in JUTH, this study revealed that there were several types of challenges and errors with utilization of ICT facilities in JUTH. Some of the errors identified were misinterpretation of data, poor knowledge of the equipments by health professionals, and health information can be missing due to equipment failure, which can seriously harm the patient and sometimes the caregiver as well. Other studies including that of Gorber and John (2005), Bowman (2013), Koide and Edward (2005), also identified some challenges and errors with the utilization of ICT in healthcare delivery.

The result of this study identified low level of computer literacy, inadequate utilization of e-health equipments; poor policy implementation, erratic power supply, high maintenance and service cost were obstacles to the utilization of ICT in healthcare delivery in JUTH. Supporting this finding, Moyo and Chukwuka (2013), stated that Nigeria fall short of several health indicators with common occurrences of disrespect towards patients during treatment and unduly long waiting times for non-emergency treatment among others, these factors are among the reason why most influential Nigerians seek medical care abroad.

Conclusion

Sickness is not desirable and the responsibility of the patient is to seek for competent help, hence it is the obligation of the federal government and the hospital management to provide functional and well-equipped health facilities to meet the health needs of the people. Finding revealed that to achieve quality healthcare services, healthcare must be safe, effective, timely, efficient, equitable, affordable and people-centered and this can only be achieved through effective utilization of ICT facilities.

This study revealed that there is no effective communication between health professionals and patients. Also, there is no effective collaboration among health professionals, as well as poor referrals in Jos University Teaching Hospital due to lack of internet connectivity to enhance efficient utilization of e-health facilities. The study revealed that ICT literacy among health professionals alone cannot enhance effective utilization of ICT equipments, rather, the equipments needs to be available in the hospital and should be in proper working condition. It is evident that poor communication among professionals is a serious problem with the Nigerian health institution. Hence, the government, hospital management, health professionals, and the public should take advantage of prospects of ICT usage for quality healthcare delivery.

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