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Assessment of Knowledge and Availability of Information and Communications Technology (ICT) in the Delivery of Healthcare Services Among Nurses in a Tertiary Health Institution of Northern Nigeria

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Abstract
Background: Information has been considered the most important asset of an organization and without a proper and sufficient amount of information, an organization will not be able to make the right decision; therefore, Information, Communications, and Technology (ICT) enable an organization to access a large amount of information in a bid to communicate at a very rapid rate.
Aim: The study aimed to assess the Knowledge and availability of ICT services in Plateau Specialist Hospital Jos, Nigeria. **Methods:** A descriptive survey design was adopted and the population for the study was 189 nurses. Out of which, 128 nurses were sampled. A questionnaire consisting of 37 items was used to collect data. Analysis was by descriptive and inferential statistics.
Results: The results showed that the majority (91.2%) among the respondents had good knowledge of ICT, while some of the equipment (53.8%) were functioning and available for use, others (46.2%) were not available. The factors that affected the use of ICT include inadequate infrastructure, inefficient government policies, and limited fund allocation for infrastructure and health projects. The hypothesis projects no significant association between the knowledge of ICT and availability of ICT services in the delivery of health care (X^2 = 0.66 P < 0.05). **Conclusion:** The study concluded that Nurses in Plateau specialist Hospital have good ICT knowledge and there are various ICT equipment/facilities such as computers, projectors, email, electronic health records to render health care, however, factors such as inadequate infrastructure and inappropriate government policies affect adequate usage of the equipment.

Keywords: *Availability, Communication, Healthcare Services, Information, Technology.*

Introduction

The way people think and carry out their duties has been affected by the global digital revolution, fired by the engines of Information Communications and Technologies (ICTs). It paves the way to create knowledge and educate people by virtue of disseminating information. 'It has restructured the way the world conducts economic and business practices and runs governments; which has provided for the speedy delivery of humanitarian aid and healthcare with a new vision for environmental protection' (World Summit on the Information Society, 2017).

The quality of services and peoples' lifestyle has been majorly affected by Information communications and technology and other associated web services. The implementation of ICT in the health sector, popularly known as e-health is an emerging area that is rapidly growing in our time (Srivastava, Pant, Abraham, & Agrawal, 2015). E-Health is

defined as 'the use of information communications and technologies (ICTs) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research' (Blaya, Fraser, & Holt, 2010). According to the authors, the greatest potential for e-health may lie in systems that improve communication between health care institutions, support medication ordering, and management which will help to monitor and improve patient compliance with care regimens. One of the reasons for the growing popularity of e-health is the awareness and advancement in communications technology geared towards health care information dissemination and services at a low cost globally (Srivastava et al, 2015).

ICT enables an organization or a society to access a large amount of information in a bid to communicate at a very rapid rate. Organizations or societies that do not respond to these changes will not be able to survive and prosper in the business realm as well as the health care environment; therefore, a proficient workforce that is computer-based with other management skills can motivate clinical systems that could enhance development in an institution. 'Clinical informatics aims to improve patient care by the intelligent application of information technology and hopes to increase the effectiveness and efficiency of care, as well as patient safety (Sparks, Celler, Okugami, Jayasena & Varnfield, 2015).

Due to increase awareness, professionals should take advantage of the information technology in a bid to enhance quality health care and to buttress this, the educational arrangement would be the bedrock for nurses to key into in order to strengthen the implementation of information technology tools in all aspects of their profession (Darvish, Bahramnezhad, Keyhanian, & Navidhamidi, 2014). A health sector where the health care providers are not knowledgeable about information communications and technology in the delivery of health care services is bound to deteriorate in the technological era and therefore delivery of services would be slow. Nursing is seen as an evolving and information-based discipline, and as such the provision of structured computers and Information Technology (IT) training for all members of the health team would equip them with the skills they need to practice up-to-date and evidence-based care. Against this backdrop, this study is set out to assess the knowledge and availability of information communications and technologies (ICTs) in the delivery of health care services among nurses in Plateau Specialist Hospital, Jos, Nigeria.

Methods and Materials

Research Design

The research design employed in this study was a descriptive cross-sectional design; hence, this research measures knowledge and availability of ICT in the delivery of health care services in Plateau State Specialist Hospital, Jos. Nigeria.

Research Setting

The research was conducted in Plateau State Specialist Hospital, Jos. The hospital is a secondary healthcare institution located along with House of Assembly Road, Jos, and situated in Jos north local government area. The hospital is bounded geographically in the North by Jos north local government area; South by Riyom local government area; East by Jos East local government area, and West by Barkin Ladi and Bassa local government areas. The hospital was established by British Expatriate Tin Miners between 1933 and 1935, formerly known as European hospital in 1958 and now known as Plateau State Specialist Hospital, established in 1999. It has 11 wards including an antenatal care clinic, family planning clinic, and infectious and disease control clinic among others. It has a bed capacity of 155 patients and a staff strength of 1000 workers of which 189 are staff nurses.

Study Population
The target population for the study was 189 registered nurses in Plateau state specialist hospital, Jos. (Nurses' Register in the Chief Nursing Officer's office, 2018).

Inclusion and Exclusion Criteria
Inclusion Criteria
The research participants included in the study fulfilled all the inclusion criteria;
1. Qualified nurses working in the hospital at the time of this study.
2. Nurses who consented to participate in the study.

Exclusion Criteria
1. Nurses on sick leave at the time of this study
2. Nurses on Annual/Maternity leave

Sampling Technique
A purposive sampling technique was adopted in the choice of the hospital and the nursing population and systematically, 128 nurses were picked out of the total population of 189 using Slovin's formula for calculation of sample size.

Sample Size Determination
An update of Slovin's formula by Ellen (2018) was used in determining the sample size.

Formula: $n = \frac{N}{1+N(e)^2}$ where

n = Number of samples
N = Total population
e = Error tolerance (this is obtained depending on what choice of confidence level is used e.g. 95% confidence level has error margin of 0.05)

If N = 189, e = 0.05, n =?

Applying the formula, $n = \frac{189}{1+189\,(0.05)^2}$

$$n = \frac{189}{1+189\,(0.0025)}$$

$$n = \frac{189}{1+(0.4725)}$$

$$n = \frac{189}{1.4725}$$

n = 128.4

n = 128 (approximately)

Therefore, the sample size used was 128.

Instrument For Data Collection
The questionnaire instrument was adapted from the University of Ilorin Information Communication Technology Sciences Research Repository tagged Information Technology Questionnaire (Afolayan & Oyekunle, 2014). The Questionnaire was modified according to Plateau State cultural context and work settings; same was subjected to face and content validity by research experts in the field of Nursing Informatics for scrutiny and vetting and the instrument was found to be valid. The structured questionnaire comprises four sections: Section A deals with Socio-demographic variable, Section B deals with the knowledge of ICT, Section C deals with the utilization if ICT in the delivery of healthcare services while Section D contains questions on challenges faced in the use of ICT services.

Method of Data Collection
Permission was sought from the hospital management after which informed consent was obtained from the participants. Data was collected via face-to-face administration of the copies of the questionnaires to the respondents by the researchers. Respondents were briefed on how to answer the questions, where assistance was required in completing the questions; it was accordingly provided by the researchers to ensure appropriate filling of the questionnaire. Same were collected and the questionnaire return rate was 100%.

Method of Data Analysis
Analysis was done by descriptive statistics to present the frequency tables while inferential analysis was done by the use of Chi-squared Test to show the significant association between selected independent and dependent variables.

Ethical Consideration
Permission to carry out the study was sought from the Department of Ethics and Research Committee, Plateau State Specialist Hospital,

Jos (REF. No. PSS/ADM/ETH.CO/2019/005). Informed consent was obtained from individual participants before distributing a questionnaire to them to complete it. Confidentiality and anonymity were maintained in the course of the research as pseudonyms were applied in a bid to hide individual identities. Participants were under no obligation to answer questions they were not comfortable with and ethical principles in collecting data from the participants were applied. There was no risk involved in the study, nor were there any monetary gains for the participants.

Results

Table 1: *A Table Showing the Background Information of the Nurses*

		Frequency	Percentage (%)
Age of Respondents	21 - 30years	52	40.6
	31 - 40years	42	32.8
	41years and above	34	26.6
	Total	128	100.0
Gender of Respondent	Male	54	42.2
	Female	74	57.8
	Total	128	100.0
Marital status	Single	44	34.4
	Married	79	61.7
	Separated	2	1.6
	Widowed	3	2.3
	Total	128	100.0
Religion	Christianity	125	97.7
	Islam	3	2.3
	Total	128	100.0
Level of Education	Registered Nurse	97	75.8
	BNSc	27	21.1
	MSc	4	3.1
	Total	128	100.0
Years of service at the organization	1 - 10years	91	71.1
	11 - 20years	23	18.0
	21years and above	14	10.9
	Total	128	100.0

The findings of the respondents' background information indicate that the majority of the nurses are married, female Christian nurses between the ages of 18 to age 30. Most of these nurses are registered nurses that have served the hospital for almost 10years and about 18% of the nurses have served for 11 to 20 years.

Table 2: *A Table Showing Nurses' Knowledge about ICT*

I have ICT knowledge….		Yes	No	Total
ICT majorly has to do with the dissemination of information as well as communication	Frequency	124	4	128
	Percentage	96.9	3.1	100.0
ICT is a more comprehensive list of all components related to computer and digital technology	Frequency	121	7	128
	Percentage	94.5	5.5	100.0
Electronic mail is an information dissemination technique	Frequency	123	5	128
	Percentage	96.1	3.9	100.0
ICT can aid in keeping data and information of a country's citizens	Frequency	126	2	128
	Percentage	98.4	1.6	100.0
Networks cannot allow different PCs to access the same files	Frequency	53	75	128
	Percentage	41.4	58.6	100.0
The global communication network is called the Internet	Frequency	127	1	128
	Percentage	99.2	.8	100.0
Message can be sent by email to every PC network instantly	Frequency	122	6	128
	Percentage	95.3	4.7	100.0
People who work at home cannot communicate with their office using the internet service	Frequency	12	116	128
	Percentage	9.4	90.6	100

The table above clearly shows that nearly all the respondents (96.9%) concur that ICT majorly has to do with the dissemination of information as well as communication; furthermore, (94.5%) assent that it is a more comprehensive list of all components related to the computer, digital technology and can aid keeping data and information of a country's citizens. The nurses (96.1%) accede that electronic mail is an information dissemination technique, 95.3% stating that message can be sent by email to every Personal Computer (PC) network instantly. The findings additionally indicate that the internet is a global communication network where people who work at home can communicate with their office using its service. But closely half of the nurses stated that networks cannot allow different Personal Computers (PCs) to access the same files.

Table 3: *A Table showing Availability of ICT Facilities/Equipment*

		Available & Functioning	Available but Not Functioning	Not Available	I don't know	Total
Projector	Frequency	95	11	13	9	128
	Percentage	74.2	8.6	10.2	7	100
PABX (Intercom)	Frequency	9	39	54	26	128
	Percentage	7	30.5	42.2	20.3	100
Electronic Report	Frequency	23	4	77	24	128
Writing Package	Percentage	18	3.1	60.2	18.8	100
Computer	Frequency	89	11	23	5	128
(Desktop/Laptop)	Percentage	69.5	8.6	18	3.9	100
Video Recorder	Frequency	25	8	55	40	128
	Percentage	19.5	6.3	43	31.3	100
Email	Frequency	94	8	13	13	128
	Percentage	73.4	6.3	10.2	10.2	100
Mobile	Frequency	108	5	8	7	128
Phone/Nitel						
Phone	Percentage	84.4	3.9	6.3	5.5	100
Scanners	Frequency	72	2	37	17	128
	Percentage	56.3	1.6	28.9	13.3	100
Video	Frequency	6	16	62	44	128
Conferencing	Percentage	4.7	12.5	48.4	34.4	100
Audio	Frequency	21	10	53	44	128
Conferencing	Percentage	16.4	7.8	41.4	34.4	100
Internet searches	Frequency	76	9	21	22	128
e.g. Google	Percentage	59.4	7	16.4	17.2	100
Patient Database	Frequency	57	12	45	14	128
(Electronic						
Health Record)	Percentage	44.5	9.4	35.2	10.9	100
Internet Service	Frequency	48	12	53	15	128
e.g. Wi-Fi, LAN,						
WLAN	Percentage	37.5	9.4	41.4	11.7	100

The findings above reflect that the hospital has a functioning projector as the majority (74.2%) of the nurses indicate the equipment is available and functioning. Furthermore, the nurses indicate that computers (desktops and laptops), electronic mails, mobile and Nitel phones, scanners, and internet searches like Google are available and functioning in the hospital. About 42% stated that Private Automatic Branch Exchange (PABX) is not available while about 31% stated that the equipment is available but not functioning, also about 45% and 38% among the nurses stated that patient database such as electronic health record and internet services such as Wi-Fi, LAN, WLAN is available and functioning while about 35% and 41% respectively stated they are not. Most of the nurses' indicated that there is no availability or utilization of facilities like electronic report writing packages, video recorder, video conferencing, audio conferencing in the hospital.

Table 4: *A Table Showing the Challenges Faced in using ICT To Provide Health Care Services*

I usually have challenges in using the ICT Equipment		SD	D	N	A	SA	Total
Inadequate ICT infrastructure in the organization hinders service delivery to the healthcare subscribers	Frequency	18	22	10	47	31	128
	Percentage	14.1	17.2	7.8	36.7	24.2	100
Inadequate ICT infrastructure among the subscribers hinders their access to the healthcare services	Frequency	13	37	17	38	23	128
	Percentage	10.2	28.9	13.3	29.7	18	100
The organization lack the technical expertise to support the use of ICT in the provision of healthcare services	Frequency	9	40	24	34	21	128
	Percentage	7	31.3	18.8	26.6	16.4	100
Most of the healthcare subscribers lack the technical know-how on the use of ICT in accessing the healthcare services	Frequency	13	30	30	37	18	128
	Percentage	10.2	23.4	23.4	28.9	14.1	100
Ineffective government policies in the use of ICT in the provision of healthcare services	Frequency	14	29	12	52	21	128
	Percentage	10.9	22.7	9.4	40.6	16.4	100
Legislation on the access to personal information limits the use of ICT in the provision of healthcare services	Frequency	15	30	20	50	13	128
	Percentage	11.7	23.4	15.6	39.1	10.2	100
The employees within the organization are resistant to change thus affecting the use of ICT in the provision of healthcare services	Frequency	16	47	22	28	15	128
	Percentage	12.5	36.7	17.2	21.9	11.7	100
The subscribers of the healthcare services have a negative attitude towards the use of ICT in accessing the services	Frequency	12	37	32	37	10	128
	Percentage	9.4	28.9	25	28.9	7.8	100
Allocation of limited funds for health projects in the organization limits the use of ICT in the provision of healthcare	Frequency	12	22	11	50	33	128
	Percentage	9.4	17.2	8.6	39.1	25.8	100
Limited funding is allocated to the construction of ICT infrastructure which hinders the provision of healthcare services	Frequency	16	18	9	50	35	128
	Percentage	12.5	14.1	7	39.1	27.3	100

From the findings above, the majority (60.9%) among the nurses agreed that inadequate ICT infrastructure in the hospital hinders service delivery to the healthcare subscribers, some (43%) noted that inadequate ICT infrastructure among the subscribers is what hinders their access to the healthcare services. Some of the nurses (43%) also concur that the organization lacks the technical expertise to support the use of ICT in the provision of healthcare services and that most of the healthcare subscribers lack the technical knowledge on the use of ICT in accessing the healthcare services. The majority (57%) also assent that ineffective government policies in the use of ICT in the provision of healthcare services is another barrier encountered and 49.3% also noted that legislation on the access to personal information limits the use of ICT in the provision of healthcare services. Most of the nurses (49.2%) disagree with the claim that employees within the organization are resistant to change as a result of affecting the use of ICT in the provision of healthcare services. Furthermore, the nurses agreeing or disagreeing with the claim that the subscribers of the healthcare services have a negative attitude towards the use of ICT in accessing the services is equivalent. Most of the nurses (64.9%) concurred that allocation of limited funds for health projects in the organization is one of the factors that limit the use of ICT in the provision of healthcare; the nurses (66.4%) furthermore, agree that limited funding is allocated to the construction of ICT infrastructure which hinders the provision of healthcare services.

Inferential Analysis

In testing the significant association between the knowledge of ICT and availability of ICT services in the delivery of health care in Plateau State Specialist Hospital, Chi-Squared Test of independence was adopted and the test was conducted at a 5% level of significance.

Hypothesis

H_o: There is no significant association between the knowledge of ICT and availability of ICT services in the delivery of health care in Plateau State Specialist Hospital.

Table 5: *Chi-squared test contingency table of knowledge of ICT and availability of ICT Equipment*

			Availability of ICT Equipment				Total
			Available & Functioning	Available but Not Functioning	Not Available	I don't know	
Knowledge of ICT among nurses	No	Observed Count	0	1	0	0	1
		Expected Count	.1	.6	.3	.0	1.0
	Yes	Observed Count	11	82	32	2	127
		Expected Count	10.9	82.4	31.8	2.0	127.0
TOTAL		Observed Count	11	83	32	2	128
		Expected Count	11.0	83.0	32.0	2.0	128.0

*χ^2 = 0.66, **DF** = 3, **Critical value** at 0.05 level of significance = 7.81*

Reject H_o if χ^2 calculated is greater than χ^2 critical value. **Decision: Since χ^2 calculated (0.66) is less than χ^2 critical value (7.81), therefore the H_o is accepted**.

This decision rule shows that the Chi-Squared value of 0.66 with a critical value of 7.81 at 5% level of significance with a degree of freedom of 3 indicates there is no significant association between knowledge of ICT and availability of ICT services in the delivery of health care in the hospital.

Discussion of Findings

The findings from the study show that almost all the respondents concur that ICT majorly has to do with the dissemination of information as well as communication and that it is a more comprehensive list of all components related to the computer, digital technology and can aid in keeping of data and information of a country's citizens. The nurses accede that electronic mail is an information dissemination technique, stating that messages can be sent by email to every Personal Computer network instantly. The findings additionally indicate that almost all of the nurses concede to the fact that the internet is a global communication network where people who work at home can communicate with their office using its service; all of which reflect knowledge of communication technology. This is in accordance with the study of Woreta, Kebede, & Zegeye, (2013) which projects that more than half of the respondents (51%) had knowledge on ICT and about 46% among the respondents used the available ICT services, but the study by Bello, Arogundade, & Sanusi, (2004) negates this fact as the findings of their study projected a few among the respondents (18.9%) demonstrating good knowledge of computers. This could be due to the fact that only 26% of the respondents owned computers which might be the reason for the deficient knowledge.

In determining the availability of ICT equipment for the provision of health care services, the findings above indicate that majority of the nurses were in the affirmative that the hospital has a functioning projector and that computers (desktops and laptops), electronic mails, mobile and Nitel phones, scanners and internet searches like googles are available and functioning in the hospital which corroborates the study of Adeleke, Salami, Achimbee, Anamah, Zakari & Wasagi (2015) which indicates that most of the participants were advanced in the use of electronic mail (51.8%) and the Internet (47.1%), mostly acquired via self-efforts (46.5%). It is also in accordance with the study of Umar, Lulah, Umar, Idris, Ruqaya & Khadija (2017) which projects a good knowledge of ICT and availability of services through with variation to the residence and family income.

Most of the nurses stated that there is no availability of facilities like electronic report writing packages, video recorder, video conferencing, audio conferencing in the hospital. This corresponds to a research conducted by Afolayan and Oyekunle (2014), which indicates that health professionals are handicapped because there are some core ICT-enabled services like video/audio conferencing that are not available for use within the hospital environment and which they cannot acquire by themselves. Even though the health professionals can afford to provide for themselves other ICT-enabled services like Internet searches, provision of ICT equipment and services by hospitals is very fundamental to achieving the desired impact of ICT in the health sector.

On the factors challenging the use of ICT for the provision of health care, the findings above indicate that inadequate ICT infrastructure in the organization, ineffective government policies in the use of ICT to provide health care, poor allocation of funds for health projects, and limited funds for ICT infrastructure were part of the factors responsible for inadequate use of ICT in the provision of health care. This also corroborates the findings of Asemahagn (2015) which projects that infrastructure, poor internet service access, budget restraints, and management style, were factors that affected the use of ICT services in health care settings. Afolayan and Oyekunle (2014) further purport unavailability of core ICT enabled services

within the hospital settings which hampered effective healthcare provisions.

Conclusion

The study concluded that the Nurses in Plateau state specialist Hospital have good knowledge about ICT and facilities such as computers, projectors, email, electronic health records were available and used to render health care to the clients, however, factors such as inadequate infrastructure and inappropriate government policies adversely affect adequate utilization of the available ICT services which might hamper effective service delivery. Further to this, the study projects no significant association between the knowledge of ICT and availability of ICT services in the delivery of health care within the hospital.

Recommendations

1. ICT will enhance efficiency in the delivery of nursing care services; therefore, nurses should endeavor to acquire more knowledge on the use of ICT in health care settings.
2. Hospitals should ensure proper utilization of the available ICT facilities to ensure growth and development in health care delivery.
3. Government should also provide more ICT equipment and other facilities in the hospital to make health care service delivery efficient for the clients.
4. Proper maintenance of ICT equipment should be done at all times to ensure that the available ICT tools are properly functioning.
5. Internet access within the hospital environment should be given a high priority; with internet access, health workers can collaborate with their colleagues and share experiences that will impact positively on their duties.
6. Appropriate policies should be put in place to monitor the utilization of ICT in the delivery of health care services.

Limitations of the Study

The research was carried out in a state specialist hospital which is a tertiary level of care. Other tertiary hospitals were not included; this is a limitation. The concept of ICT in the delivery of health care services is a new innovation in Plateau State Specialist Hospital, as a result, some nurses had a poor interest in the research; this is also a limitation.

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Conflict Of Interest

There is no conflict of interest to declare in this paper

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