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ASSESSMENT OF IMPLEMENTATION OF ICT-BASED INNOVATIONS IN PRIMARY HEALTHCARE CENTERS IN SOUTHWESTERN NIGERIA

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ABSTRACT

This study examined the extent of use and factors influencing continued usage of recently adopted ICT-based innovations in the primary healthcare sector in Southwestern Nigeria. The study covered 30 registered primary healthcare centres selected from Lagos, Ogun and Oyo States in Southwestern Nigeria using multistage sampling technique. Data were obtained using two sets of questionnaire along with interviews. The results showed 12 distinct types of ICT-based innovations recently adopted for use. These are; computer, phone and tracker, digital weight scale, centrifuge, nebulizer machine, digital blood pressure apparatus, digital thermometer, solar refrigerator, oxygen concentrator, digital microscope, Electronic Contraceptives App and DBS Fax result printer. Challenges of power supply and lack of technical skills by the healthcare professionals limited the use of some of the ICT-based innovations. Furthermore, the results showed that academic ($F = 10.113$, $p<0.05$) and professional qualifications ($f = 0.698$, $p<0.05$) were factors that influenced the implementation of the adopted ICT-based innovations. The study concludes that academic and professional training expose healthcare professionals to continued implementation of ICT-based innovations. Thus, healthcare professionals with higher professional qualifications should be given preference for employment. Otherwise, staff should be encouraged to acquire higher academic and professional qualifications. In addition, alternative sources of power should be provided to primary health Care centers.

Keywords: ICT-Based Innovations, Primary healthcare centres, Implementation Strategy, Nigeria healthcare delivery.

1.0. BACKGROUND TO THE STUDY

Highly effective primary healthcare is known to keep individuals, families and communities healthy. However, in Nigeria, primary healthcare is in a state of evolution. Policy makers who were preoccupied with cost containment in the early 1990s are now faced with the challenge of providing more effective healthcare services to the public. Concerns about access, particularly with respect to primary healthcare, are compounded by an aging healthcare workforce, the increased prevalence of chronic diseases and the complexities of team-based contemporary practice.

As Africa's largest economy and most populous nation, Nigeria is experiencing substantial economic expansion and yet the Country's healthcare system is strained. The Country's economy is growing at an average annual rate of 7% and is expected to be among the ten largest economies by 2050 (World Bank, 2015). Despite the Country's economic gains, over 46% of the population continues to live in poverty (World Bank, 2015) and the overall health status of the Nigerian population is poor as defined by the 2013 Nigeria Demographic and Health Survey. Infectious and non-communicable diseases remain among the leading causes of morbidity and mortality (World Bank, 2015; National Populations Commission, 2013; Centre for Disease Control and Prevention, 2014; WHO, 2014); and health coverage and financing remain low (WHO, 2013; NHIS, 2015; Jenna *et al*., 2013).

Poor performance in primary healthcare (PHC) service delivery may be due to the way innovation is handled in the system. Innovations are the keys to growth, employment, prosperity and quality of life. The significance of technology in healthcare delivery cannot be overstated. Healthcare, for many years, has been characterised by innovation concerning treatments, medications and healthcare information systems. In order to meet the requirements that are placed on healthcare, more innovative solutions are needed (Bessant, Kunne and Möslein, 2012). Innovative technologies are highly needed in healthcare delivery because of new challenges that are now facing healthcare service providers. Some of these challenges are extremely complex and are characterised by rising demand, increasing costs and insufficient funding.

According to Ogbaisi and Asenuga (2018), the key element of economic accounting is to ensure that public resources are spent according to the electoral and administrative mandate; that funds are distributed in consistence with stated objectives. An organisation may decide to develop a new product, process or method of doing things; or decide to acquire a technology developed elsewhere for use in its operations. When one of the two occurs in an organisation, the innovation has to be used in the organisation's day-to-day activities. When a decision is taken and innovation is used, this is referred to as implementation (Klein and Sorra, 1996; Dong *et al*., 2008; Ika, 2009). Implementation involves a series of activities undertaken to ensure an idea or product has been put to productive use.

The use of ICT-based tools has had a high impact on enhancing work performance that makes project outcomes better than plans (Asenuga *et al.*, 2019). Studies have further revealed that the adoption of ICT-based innovations in healthcare delivery is seen as a solution to improving the efficiency and quality of delivery (Chaudhry, 2006; Kuperman & Gibson, 2003; McCullough, Casey, Moscovice, & Prasad, 2010). Yet, the adoption of ICT-based innovations in healthcare is relatively low (Jha *et al*., 2009). However, Gross improvements in healthcare service quality have been achieved by the adoption of ICT-based innovations such as computed tomography scanners, electronic transfer of care communication tools, shared medical appointments (SMA), and bar-coded medication administration technology among others (Olaposi, 2017). For healthcare delivery to be effective, ICT-based innovations have to be available and also properly implemented in organisations (Paulussen, 1994; Fleuren, Wiefferink, and Paulussen, 2004)

Nigeria, with its relative abundance of PHC centres ranks low when compared with other African countries on nearly all PHC performance indicators. Different scholars have attributed

the poor performance of PHC to poor implementation of ICT-based innovations among other factors (Okoli, *et al*., 2016; Chinawa, 2015; Azu and Chinedu, 2014; Kurfi, *et al*., 2013 and Anie, 2011). One of the main problems with the introduction of ICT-based innovations in general is that professionals do not automatically use them as intended by developers. In Nigeria, most ICT-based innovations are adopted, not developed and are not used as intended by the developer. Therefore, this study, having perceived this gap, is designed to examine the extent of usage and factors influencing the continued usage of adopted ICT-based innovations in primary healthcare delivery in Southwestern Nigeria.

2.0. Literature Review

2.1.What is innovation?

Innovation according to Rogers (2003) is the process of translating an idea or invention into a product/service that creates value or for which customers will pay. To be called an innovation, an idea must be replicable and must satisfy a specific need. Innovation involves deliberate application of information, imagination and initiative in deriving greater or different values from resources, and includes all processes by which new ideas are generated and converted into useful products. Ng'ethe (2003) viewed innovation as meaning a change in the way of doing things and/or doing different things. Other definitions view innovation as introducing something new to the world; that is, something that has never existed before. This is where the term 'innovation' and 'invention' are synonymous. Ng'ethe (2003) noted that an innovation might be new to one institution or person but might be practiced elsewhere. In this case then, the primary healthcare center would be copying best practice from elsewhere. Nge'the's (2003) argument was supported by Klein and Knight (2005), who further contended that an innovation need not actually be new but might simply be perceived as new by the adopters.

Innovation in healthcare organizations are typically new services, new ways of working and/or new technologies (Lansisalmi, *et al.*, 2006). From the patient's point of view, the intended benefits are either improved health or reduced suffering due to illness (Faulkner and Kent, 2001). Varkey, *et al.*, (2008) define innovation as the successful implementation of a novel idea in a way that creates compelling value for some or all of the stakeholders. According to Moore (2004) cited in EXPH (2016), innovation can be categorised by its impact on stakeholders as non-disruptive (or sustaining) or disruptive as shown in Table 1. Nondisruptive innovations, also referred to as incremental (Hamel, 2000; Harvard Business Essentials, 2003), evolutionary, (Govindarajan, 2007), linear, (Hamel, 2000), or sustaining, (VHA Health Foundation, 2006), improve on something that already exists but in a way that allows expanded opportunities to be met, or existing problems to be solved, (Harvard Business Essentials, 2003). A sustaining innovation does not create new markets or value networks but rather especially evolves existing ones with better value, allowing the firms within to compete against each other's sustaining improvements. Sustaining innovations may be either "continuous" or "discontinuous". In contrast to sustaining innovations, disruptive innovations refer to innovations that disorder old systems, create new players and serve new groups of people, or the same groups of people with new products while marginalizing old ones and deliver value to stakeholders who successfully implement and adapt to the innovation (see Figure 1).

Table 1: Categorisation of Innovation

Sustaining	An innovation that does not affect existing markets.	
	Continuous	An innovation that improves a product in an existing market in ways that customers are expecting.
	Discontinuous	An innovation that is unexpected, but nevertheless does not affect existing markets.
Disruptive	An innovation that creates a new market or expands an existing market by applying a different set of values, which ultimately (and unexpectedly) overtakes an existing market. Main features are: a) improved health outcomes b) create new professional culture c) serve new groups or have new products/services ("create new markets") d) create new players e) disorders old systems	

Source: EXPH (2016)

2.2. Types of innovation

UNESCO Institute for Statistics (2005) makes the distinction among four types of innovation as follows:

a. Product innovation: introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user-friendliness or other functional characteristics.

b. Process innovation: implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. The customer does not usually pay directly for process innovations, but it is required to deliver a product or service or manage the relationship among various stakeholders.

c. Marketing innovation: implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

d. Organizational innovation: implementation of a new organizational method in the firm's business practices, workplace organization or external relations.

Innovations in healthcare are related to product, process, or structure (Varkey, *et al.*, 2008). The product is what the customer pays for and typically consists of goods or services (for example, clinical procedures). Process innovation entails innovations in the production or delivery method. A process innovation therefore, would be a novel change to the act of producing or delivering the product that allows for a significant increase in the value delivered to one or more stakeholders. Structural innovation usually affects the internal and external infrastructure and creates new business models.

However, it should be noted that many disruptive innovations result from the combination of one or more sustaining innovations and their application (for example through innovative

business models) to opportunities which were not originally conceptualized by the investors and developers of the innovations (Christensen *et al.*, 2015).

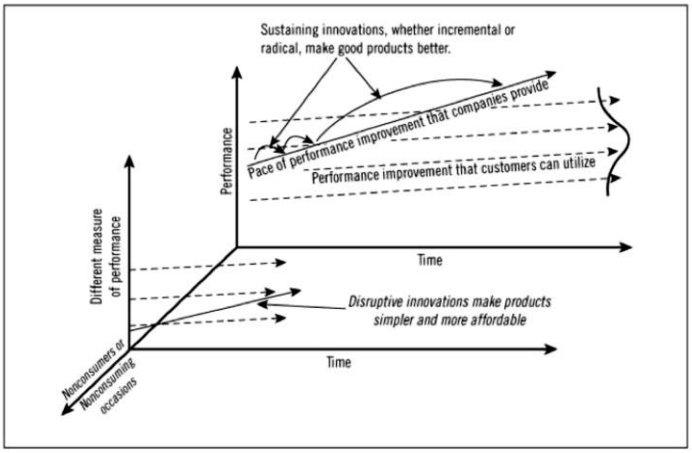

Figure 1: Model of a Disruptive Innovation
Source: Christensen *et al*. (2008) in EXPH (2016).

2.3.Effective ICT-based innovation implementation

Weiner (2009) opined that there are two processes/phases in the innovation adoption process. The first process/ phase is the adoption of the innovation when the management accepts the introduction of the ICT-based innovation to be adopted, while the second process/phase is when the ICT-based innovation is implemented in a routine. This second phase known as the phase of implementation might not be successful if the adopter in the initial process discards the innovation. That is, he/she declines to buy into the process when introduced to the innovation. Several authors have argued that the implementation process starts immediately a decision to use an innovation is taken (Klein and Sorra, 1996; Dong *et al.*, 2008; Ika, 2009, Damanpour and Marguerite, 2009). This means that the implementation of an innovation is only possible when the innovation is adopted. The implementation process undertakes and follows a series of activities that ensures a new product or an innovation is used.

An innovation can be said to be successful/effective only when the adopter acquires the necessary skills to use the innovation, and thereafter integrates the innovation into their routine work activities. Innovation adopters become part of the system and their role is acknowledged in information technology systems. Weiner *et al.* (2009) argued that the phase of implementation does not start when a decision is made to use the innovation. Rather, the phase is when the decision has been made to adopt and institutionalize an innovation. This means the adopter accepts the innovation and begins to use it routinely. Thus, implementation can be said to be a predetermined set of sequential activities directed towards ensuring an adopted proposal or invention or innovation is successful and/or effective.

Innovation implementation effectiveness is defined according to Peng and Kurnia (2010) “as the perceived benefits that an organization realizes from an innovation”. Although, when it

comes to successful implementation of Information Systems, this is not sacrosanct. Citing Klein *et al.* (2001), Peng and Kurnia (2010) argued that "effective innovation implementation

is overall, pooled or aggregate consistency and quality of innovation use in an organization". According to Klein and Sorra (1996), implementing an innovation effectively is a measure of the quality and consistent use of the innovation by an organization. Therefore, effective implementation can be defined as the degree of accepting intra-organisation and using an innovation productively over a particular period. Sawang and Unsworth (2011) argued further that initial or early use of an innovation is the immediate outcome of interest during implementation. The Effective Implementation definition was adopted for the current research study.

3.0.Research Methods

This study employed multi-stage sampling technique. The first stage involved the selection of three States; Lagos, Ogun and Oyo in Southwestern Nigeria. The second stage is the selection of ten registered Primary Healthcare Centres in each state. The third stage is the selection of the centre's Apex head (Medical Officer of Health) and six heads of department (these are Chief Nursing Officers, Nursing Officers, Community Health Extension Workers, Community Health Officers, Health Officers and Community Doctors) per centre for every State. Thus, a total of 210 respondents participated in the study. Lagos State was chosen due to the high number (57) of Local Council Development Areas (LCDA) in the State thus leading to many primary healthcare centres as one is located in each LCDA as registered with the State's primary healthcare board. This is supported by Eshofonie (2008) who stated that Lagos is a relatively built – up environment with infrastructure like government establishments, and all kinds of private developments, such as schools, hospitals, and primary healthcare centres to mention a few. This same structure exists in Ogun and Oyo state and because of the creation of LCDAs in the States, it has also influenced the number of primary healthcare centres located in each LCDA in the States. Another factor is that the government invests more budgetary resources to these selected States.

Data were obtained using two sets of questionnaire as well as interviews. The first set of questionnaire was administered on the heads of the primary healthcare centres while the second set was administered on the heads of departments. The first set elicited information on ICT-based innovations introduced in the past three years. The second set of questionnaire elicited information on the extent of usage and level of adoption of the ICT-based innovations in the primary healthcare centres. Secondary data such as the directory showing number and location of primary healthcare centres were sourced from the reports of Primary healthcare Board. Data obtained were analysed using frequency counts, percentages and Binary logistic Regression.

4.0. Results and Discussion

In Table 2, 198 survey responses which represent 94.3% out of the expected 210 survey respondents were retrieved and used for the study. Achieving a response rate of 50% is the minimum acceptable threshold (Gendall, 2000). This position by Gendall (2000) was supported by Nulty (2008), Net (2009) and Schmid *et al*. (2012) who argued that although a 60% rate of response is ideal and can be achieved in survey research, a 50% rate of response was acceptable. Therefore the 94.3% rate of response in this study can be considered as acceptable since it met the minimum threshold set.

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Table 2: Primary Healthcare Centres and Respondents' Statistics.

State	No. of Primary Healthcare Centres (%)	Number of respondents					
		Head of Centres		Health Workers		Total	
		Distributed (%)	Retrieved (%)	Distributed (%)	Retrieved (%)	Distributed (%)	Retrieved (%)
Lagos	10 (33.3)	10 (4.7)	10 (4.7)	60 (28.6)	54 (25.8)	70 (33.3)	64 (30.5)
Ogun	10 (33.3)	10 (4.7)	10 (4.7)	60 (28.6)	57 (27.2)	70 (33.3)	67 (31.9)
Oyo	10 (33.3)	10 (4.7)	10 (4.7)	60 (28.6)	57 (27.2)	70 (33.3)	67 (31.9)
Total	30 (100)	30 (14.1)	30 (14.1)	180 (85.8)	168 (80.2)	210 (100)	198 (94.3)

Note: *Figures in parentheses are row percentages.*

4.1. Social and economic characteristics of respondents

The survey in Table 3 revealed that 85.4% of the respondents were female while only 14.6% were male. This revealed that females participate more in the healthcare delivery profession than males in Southwestern Nigeria. This result may be attributed to the persistence of stereotypical gender roles in Nigeria which assigns certain jobs for women (Kolawole and Fasina, 2009). The Healthcare delivery profession may be one of those professions.

Table 3: Demographic Characteristics of the Respondents

Characteristics	Respondents	
	Frequency	Percentage
1. Gender		
Male	29	14.6
Female	169	85.4
2. Age		
19-29	58	29.3
30-39	64	32.3
40-49	54	27.3
>50	22	11.1
3. Academic Qualification		
MPH and MSc	22	11.1
MBBS	7	3.5
B.Sc.	117	59.1
Diploma	51	25.8
Certificate	1	0.5
4. Work Experience in years		
<2	28	14.1
2-5	37	18.7
6-10	39	19.7
11-15	72	36.4
>15	22	11.1

Table 4.2 further revealed that 32.3% of the respondents were in the 30-39 years of age group, while 29.3%, 27.3%, and 11.1% were in the 20-29, 40-49, and 50 years and above age categories, respectively. This implies that 71% of the respondents were between 30-50 years of age. The high concentration of respondents in this group, which can be considered to be the most active segment of the population, may imply that younger people up to middle age are favourably disposed to the primary healthcare profession.

About 59.1% of the respondents possess Bachelors (B.Sc) degree in health related fields as presented in Table 3, while 25.8% possess diploma as their highest academic qualification. About 11.1% have Masters degrees, 3.5% have medical science degrees and 0.5% have only medical training certificates as their highest academic qualification. This implies that about 73.7% of the respondents have at least bachelor's degrees as their highest academic qualification. This high number of respondents with bachelor's degrees could have a positive effect on how the respondents are further exposed to strategies of better implementing ICT-based innovations in the primary healthcare sector. Higher levels of education imply a larger pool of technical skills, knowledge and competence which have all been found to enhance innovative capability (Akerele, 2000; Adegbite, 2009; Adejuwon, 2014).

About 36.4% of the respondents in Table 3 had been in the healthcare profession for between 11-15 years, 14.1% had less than 2 years of work experience, while 18.7% had 2-5 years of work experience. About 19.7% had between 6-10 years of work experience, while 11.1% had 15 and above years of work experience. These results indicate that about 67.2% of the respondents have been in the primary healthcare delivery profession for over 10 years.

4.2. Most recently adopted ICT-based innovation in the primary healthcare centers

The ICT-based innovations identified by the respondents were grouped in eight (8) distinct types as presented in Table 4. The grouped ICT-based innovations identified were further classified into different categories based on Christensen *et al*., (2008) classification in Table 5. Table 4 shows that 22.7% of the respondents identified Digital weight scale as the most recently adopted ICT-based innovations, while 22.2% of the respondents identified computer, phone and tracker as the most recent ICT-based innovation adopted, 11.1%, 14.7%, 15.7%, and 7.6 identified digital centrifuge and Nebulizer machine, digital blood pressure apparatus, digital thermometer and solar refrigerator and oxygen concentrator respectively as most recently adopted ICT-based innovations. About 5% and 1% of the respondents identified digital microscope and Electronic Contraceptives App and DBS Fax result printer respectively as most recently adopted ICT-based innovations. About 1% of the respondents claimed that all the identified ICT-based innovations were recently adopted.

Interviews revealed that pregnant women on antenatal care and mothers who brought their babies for immunization were the most frequent visitors to the primary healthcare centres. This suggests the need for the digitalization of the weighing babies and mothers and its introduction to the primary healthcare centres. Interviews further revealed that the head of primary healthcare centres are more familiar with more recently adopted ICT-based innovation in the Nigeria health sector than health workers. This may be due to the rotational postings and constant retraining of the heads by agencies of government through the primary healthcare board, thus, exposing them to different ICT-based innovations for use in the Nigeria primary healthcare sector.

Table 4: Most Recently Adopted ICT-Based Innovation in Southwestern Nigerian Primary Healthcare Sector

ICT-based Innovation	Respondents	
	Frequency	Percentage
1. Computer, Phone and Tracker	44	22.2
2. Digital Thermometer	31	15.7
3. Digital Weight Scale	45	22.7
4. Solar Refrigerator and Oxygen Concentrator	15	7.6
5. Digital Blood Pressure Apparatus	29	14.7
6. Digital Centrifuge and Nebulizer Machine	22	11.1
7. DBS Fax Result Printer	2	1.0
8. Digital Microscope and Electronic Contraceptives App	9	4.6
9. All	1	0.5
Total	198	100

Interviews also revealed that the head of primary healthcare centres have more knowledge of ICT-based innovation than the health workers. Some healthcare workers do not know that some ICT-based innovations exist in the Nigeria healthcare sector. This further suggests that Digital weight scale might not be new in Nigeria but was recently adopted for use within the last three years in the Nigerian health sector. During implementation of new ICT-based innovations, the immediate outcome of interest or major goal would be to put the innovation into initial or early use (Weiner *et al.,* 2009; Sawang and Unsworth, 2011; Shea, Pickett and Li, 2005). However, Ng'ethe (2003) noted that an innovation might be new to one institution or person but may have been practiced or adopted elsewhere.

Based on Christensen *et al*. (2008) classification cited in EXPH (2016), Table 5 shows that ICT-based innovations, such as computer, phone and tracker along with the digital centrifuge and nebulizer machine were categorized as disruptive innovations. While the digital thermometer, digital weight scale, digital microscopes and Electronic Contraceptives App were classified into the continuous sub-category of sustaining innovations, solar refrigerator and oxygen concentrator were classified into the discontinuous sub-category of sustaining innovations. This infers that the disruptive ICT-based innovation has disordered the old manual systems, creating new players to serve new groups of people, or the same groups of people with new products while marginalizing old ones and delivering value to stakeholders who successfully implement and adapt to the innovation. This agrees with Dzau *et al,* (2010) and Christensen *et al,* (2008) cited in EXPH (2016) who stated that probably the most disruptive innovation in healthcare in the past 10 years across the globe is the change of the position of the patient from a rather passive actor undergoing medical procedures and trying to comply with therapeutic regimens to an active participant formulating goals, monitoring indicators, and contributing to his/her care plan.

Table 5: Classification of ICT-Based Innovation Adopted in the Nigerian Health Sector

Categories of Innovation		Types of ICT-based Innovations
1. Sustaining	a. Continuous	Digital Thermometer, Digital weight scale, Digital Microscope and Electronic Contraceptives App
	b. Discontinuous	Solar refrigerator and oxygen concentrator
2. Disruptive		Computer, phone and tracker, Digital Centrifuge and Nebulizer Machine

4.3. Extent of use of Adopted ICT-Based Innovation

The results in Table 9 indicates that the DBs fax result printer was rarely used (2.4). Interviews revealed that not all primary healthcare centres have access to digitalised connection which is required for this ICT-innovation. The result further shows that Digital microscope and Electronic Contraceptives App was moderately used (2.80) in primary healthcare centres. This suggest that not all primary healthcare centres have laboratories that will require the use of the adopted ICT-based innovation, hence the reason why only those who have it usually use it and those who do not have it do not. Interviews also revealed that the primary healthcare centres that have laboratories witness lower patronage. This may be because some primary healthcare moderately and rarely used the adopted ICT-based innovations.

Furthermore, digital centrifuge and nebulizer machine was rarely used (2.4) in primary healthcare centres. Interview reveals that the digital centrifuge and nebulizer machine requires electricity to work and due to epileptic supply of electricity, primary healthcare centres with digital centrifuge and nebulizer machine cannot use the ICT-innovation as expected. This might inform the reason for the high rate of respondents not using the adopted ICT-based innovation.

Digital blood pressure apparatus was indicated by respondent to be frequently used (3.5) in primary healthcare centres. Interview reveals that the major visitors to the primary healthcare centres are pregnant and nursing mothers who regularly need to check their blood pressure. Interviews further revealed that the adopted ICT-based innovation does not require electricity, but rather requires batteries which can be found everywhere. This might suggest why there is a high number of primary healthcare users using the innovation.

Table 9 further shows that that Digital thermometer was always used (4.3) in the surveyed primary healthcare centres in the study area. Interviews further reveals that thermometer is one of the important tools in the centres because it is used to first check the temperature of the nursing mothers, pregnant females as well as other visitors to the primary healthcare centre.

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Table 9: Extent of use of Adopted ICT-Based Innovation in Primary Healthcare Delivery

	Ratings						
ICT-based Innovation	**5**	**4**	**3**	**2**	**1**	**Mean**	**SD**
DBS Fax Result Printer	0(0)	0(0)	4(2.0)	2(1.0)	1(0.5)	2.4286	.78680
Digital Microscope and Electronic Contraceptives App	1(0.5)	1(0.5)	3(1.5)	5(2.5)	1(0.5)	2.8000	1.03280
Digital Centrifuge and Nebulizer Machine	0(0.0)	3(1.5)	1(0.5)	6(3.0)	4(2.0)	2.4286	1.50457
Digital Blood Pressure Apparatus	6(3.0)	14(7.1)	5(2.5)	8(4.0)	0(0.0)	3.5455	1.06334
Solar Refrigerator and Oxygen Concentrator	0(0.0)	3(1.5)	2(1.0)	0(0.0)	3(1.5)	2.0000	.92582
Digital Weight Scale	30(15.2)	21(10.6)	15(7.6)	2(1.0)	2(1.0)	4.0714	1.01183
Digital Thermometer	17(8.6)	3(1.5)	1(0.5)	3(1.5)	1(0.5)	4.2800	1.24231
Computer, Phone and Tracker	12(6.1)	15(7.6)	2(1.0)	0(0.0)	1(0.5)	4.1667	.98553

5 – Always Used, 4 – Frequently Used, 3 – Moderately Used, 2 – Rarely Used,
1 – Not Used

Note: *Figures in parentheses are row percentages.*

Computer, Phone and Tracker was indicated by the respondents to be always used (4.2) in the primary healthcare centres. This might be due to the need to effectively communicate with one another within and outside the primary healthcare centres in the study area.

Digital weight scale was indicated by the respondent to be always used (4.1) in the primary healthcare centres. This high rate of using the adopted ICT-based innovation always could be due to the high rate of visitors to the primary healthcare centre. This supports the study of Limthongchai and Speece (2003) and De Veer, Fleuren, Bekkema, and Francke (2011), that opined that implementation of new ICT-based innovation is believed to be easy if it is relevant to application area of users.

4.4. Decision on the continued usage of adopted ICT-based innovation

In Table 10, Majority (93.4%) of the respondents agreed that they will continue to use the adopted ICT-based innovations while few (6.6%) indicated that they will not continue using the innovation. These results contradict the study of Anderson (2006) and Jha *et al*. (2009) and supported by HIMSS Analytics (2015) that state that ICT-based innovation adoption in healthcare is still low. Interviews revealed that due to power supply challenges in some locations, some ICT-based innovations that require electricity will not work and will not be useful. Interviews further revealed that the health workers not trained on the technical use of the ICT-based innovations would not be able to use it until a worker with the capability to use the innovation arrives. This may cause redundancy and slowness to attend to patients. This suggests why few respondents indicated that they will not continue to use some ICT-based innovations.

Table 10: Decision on Continued usage of the adopted ICT-based innovation

	Decision	
ICT-based Innovations	to use	not to use
1. computer, phone and tracker	42(21.2)	2(1.0)
2. digital thermometer	29(14.6)	2(1.0)
3. digital weight scale	41(20.7)	4(2.0)
4. solar refrigerator and oxygen concentractor	14(7.1)	1(0.5)
5. blood pressure apparatus	28(14.1)	1(0.5)
6. centrifuge and nebulizer machine	21(10.6)	1(0.5)
7. dbs fax result printer	1(0.5)	1(0.5)
8. Microscope and Contraceptives	8(4.0)	1(0.5)
All	1(0.5)	0(0)
Total	185(93,4)	13(6.6)

Note: *Figures in parentheses are row percentages.*

4.5. Factors influencing the continued usage of adopted ICT-based Innovation

Analysis was conducted to know what might influence the decision of the respondents to continue to use the innovation. This is reported in Table 10. Since the dependent variable is dichotomous (Yes or No) in nature, a binary Logistic regression was used to predict the relationship between predictors (independent variables) and a predicted variable (dependent variable). The predictor variables were respondents' state, age, sex, marital status, highest academic qualification, professional qualification, and years of work experience.

Table 11 shows the logistic regression coefficient, Wald test, and odds ratio for each of the predictors. Employing a 0.05 criterion of statistical significance, academic qualification and professional qualification had significant effects with probability of 0.032 and 0.044 respectively. The odds ratio for academic qualification indicates that when holding all other variables constant, academic qualification is 10.113 times more likely to influence the decision to continue to use the adopted ICT-based innovation in the healthcare centres. Also, professional qualification is 0.698 times more likely to influence the decision to continue to use the adopted ICT-based innovation in the centres. However, the odds ratio of years of work experience and age were almost the same (1.055 and 1.769 respectively) though not significant. marital status has the least effect with an odd ratio of 0.138. This means that only academic and professional qualifications with P values of 0.032 and 0.044 respectively are statistically significant on the decision to continue to use the adopted ICT-based innovation. It is therefore concluded that the addition of state, age, sex, marital status, years of work experience to the model is not statistically significant. In other words, the variables age, sex, marital status and years of work experience does not explain variations in decision to continue to use or not to use the adopted ICT-based innovation. This is because these variables do not impact the healthcare professionals' decision to use the adopted IT-Based innovation or not. Rather, the higher the academic qualification of the respondent, the greater the likelihood to continue to use the adopted ICT-based innovation. This may be because the academic training they undergo exposes the respondents to the benefits of continued usage of the different ICT-based innovations.

Table 11: Binary Logistic Regression Predicting Decision

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	State	-.494	.377	1.724	1	.189	.610
	Age	.054	.628	.007	1	.932	1.055
	Sex	1.273	1.140	1.248	1	.264	3.573
	Marital Status	-1.980	1.297	2.332	1	.127	.138
	Academic Qualification	2.314	1.284	3.245	1	.032	10.113
	Professional Qualification	-.359	.667	.291	1	.044	.698
	Years of Work Experience	.570	.561	1.035	1	.309	1.769
	Constant	-1.103	3.089	.127	1	.721	.332

5.0. Conclusion

The study shows that the challenges of power supply and lack of technical skills has prevented some healthcare professionals to optimally use some ICT-based innovations. Furthermore, academic qualification and professional training by healthcare professionals influences the decision to continue to use adopted ICT-based innovation. Academic training and other training they undergo exposes healthcare professionals to different ICT-based innovation which may further enhance healthcare delivery in Southwestern Nigeria.

6.0. Policy Recommendations

Healthcare professionals with higher professional qualifications should be given preference for employment. Employees can also be encouraged to acquire higher academic and professional qualification so as to get exposed to the tenets of emerging ICT-based innovations. Furthermore, alternative sources of power supply should be provided and introduced to power some of the ICT-based innovations that are not working optimally due to the challenges of epileptic power supply. The primary healthcare board should ensure continuous training of all professionals to equip them with novel as well as emerging skills needed to optimally use emerging ICT-based innovations.

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