An Investigation of the Factors Influencing the Adoption of E-Health Services:

The Case for Selected Hospitals in Lagos State, Nigeria

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SUMMARY

Research has identified a need for the improvement of the health situation in Nigeria. E-Health services are expected to make healthcare service delivery quicker and easier, covering a wider range of people. This research investigates the adoption level of e-Health in Nigerian health institutions, with focus on the use of the Electronic Medical Record (EMR). The SPSS (version 16.0) software was used to measure the variables with respect to the theories proposed and their individual items. For the purpose of this research, the theories adopted include the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB) and the Innovation Diffusion Theory. Using the elements of these theories, the research model developed postulated that Perceived Ease of Use (PEU), Perceived Social Influence (PSI) and Relative Advantage (RA) of the technology are what would determine the perceived usefulness (PU) which would in turn determine the intention to use (INT) the technology.

Keywords: Adoption, E-Health, Nigeria, TAM,

1. INTRODUCTION

According to the World Health Organization [WHO, 2010], Nigeria is estimated to have a total population of 151,212,000 with life expectancy at birth given as 49 for both males and females, healthy life expectancy at birth given as 42, and a maternal mortality ratio of 1100 per 100,000 live births. This is irrespective of the fact that Nigeria already has some of its health institutions working with one or more forms of e-Health services. It therefore becomes imperative to determine the lead causes of these poor statistics and take steps in changing the situation by testing the actual extent to which technology has been adopted and then to the level of acceptance in further studies.

The Technology Acceptance Model (TAM) is an information systems theory that models how users come to accept and use a technology. It was first created by Fred Davis in 1989. TAM has proven to be a theoretical model in helping to explain and predict user- behavior towards information technology [Legris et al., 2003]. TAM is considered an influential extension of theory of reasoned action (TRA), according to Ajzen and Fishbein (1980). TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. Two cognitive beliefs are posited by TAM: perceived usefulness and perceived ease of use.

According to TAM, one's actual use of a technology system is influenced directly or indirectly by the users' behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system [Park, 2009]. The Theory of Planned Behavior (TPB), the second theory adopted, suggests that all behavior is motivated by individual decisions that are based on an individual's intention to perform that behavior. Intention to perform a behavior, in turn, is influenced by the individual's perceived control over the performance of that behavior, his or her attitude toward performing the behavior and his or her perception of social norms (pressure or approval from important referent individuals to perform a behavior).

The development of the Theory of Planned Behavior (TPB) [Ajzen, 1985], which was developed from the theory of reasoned action (TRA), led researchers to consider the use of the TPB for predicting people's behavior towards technology use. Mathieson (1991) identified three unique features of TPB: TPB primarily explores beliefs that are specific to each situation and some beliefs may generalize to other contexts and others may not; TPB is detailed in determining social variables; and lastly, TPB has a stronger treatment of behavioral control.

Finally, the innovation diffusion theory (IDT) has the following technology-related elements; relative advantage, ease of use, image, visibility, compatibility, results, and voluntariness of use. The EMR is a form of e-health service which was selected for use in this research because it is a very basic health technology and the most easily deployed and adopted here in Nigeria.

2. THE NEED FOR EHEALTH IN NIGERIA

Wide regional disparities exist in the health sector in the health status, mode of service delivery, resource availability and workforce. Nigeria has about 45,000 medical doctors to a population of 150 million, according to the Nigerian Medical Association. Besides doctors, the country is also facing dearth of other health workers. The few that are available are unevenly distributed with most of them concentrated in the urban areas. Consequently, rural communities, where many Nigerians reside, find it difficult to access qualitative health care.

The distribution of these yardsticks favors the southern region over the northern region with the rural areas being the worst favored. Rural dwellers have limited access to the basic amenities which include education, good roads, good water and electricity. They have to travel long distances to get these resources or wait endlessly. The lack of good and standard infrastructures has inhibited the timely delivery of quality healthcare services [Labiran et. al., 2008].

In bid to serve the rural communities better, the government adopted the Primary healthcare delivery system. This is healthcare delivery at the grassroots. This forms an integral part of the National Health Policy. This policy entails the delivery of a full-packaged health care system. This package includes health education, maternal, newborn and child healthcare, nutrition and immunization. Effective management of healthcare at the grassroots requires record keeping and data storage and availability of medical personnel and health workforce.

Massive Data storage and availability of such data on-demand have been sources of concern to health institutions. Lack of storage facilities and media have brought about a slow rate in hospital-to-hospital collaboration. Also, secure information exchange between and across institutions poses as a great challenge to medical practitioners. This does not enhance collaboration (also referrals) among such institutions. The challenges cited above have brought about a lack of proper accountability in the health sector.

3. RESEARCH METHODOLOGY

A survey was carried out in a number of medical centers in Lagos, Nigeria with visits made to over 20 of them on the Lagos Island and its environs. The survey attended to only those medical centers that had already begun using the Electronic Medical Records (EMR) or some form of it. Out of these centers visited, only 6 were well aware of and already adopting the EMR in the delivery of healthcare services, showing the low adoption level of e-health services in these parts.

The results presented in this study are as provided by 19 respondents from 19 medical centers who work directly with the EMR in these medical centers, also showing the low level of acceptance in this region. Each of these respondents was required to show their agreement or disagreement with the 36 questions asked (divided under the headings of the 3 models used) in the two-page questionnaire used in this study.

The research model for this study is to investigate the factors that influence the adoption of E-Health services in Nigeria. For the purpose of this study, Behavioral Intention to Use (INT), Perceived Usefulness (PU), Perceived Ease of Use (PEU), Perceived Social Influence (PSI) and Relative Advantage (RA), which are the major parts of the Technology Acceptance Model and Innovation Diffusion Theory respectively, have been adopted for the development of the hypotheses. From their practical operations as drawn from the questionnaires retrieved, the following hypotheses are brought forward:

H_1:   *Perceived ease of use has a positive effect on the perceived usefulness of the EMR.*

H_2:   *Perceived social influence has an effect on the perceived usefulness of the EMR.*

H_3:   *Relative advantage is significantly related to the perceived usefulness of the EMR.*

H_4:   *Perceived usefulness has a strong significant effect on the intention to use the EMR.*

The proposed model for this construct of E-Health adoption in Nigeria is portrayed in Figure 1.
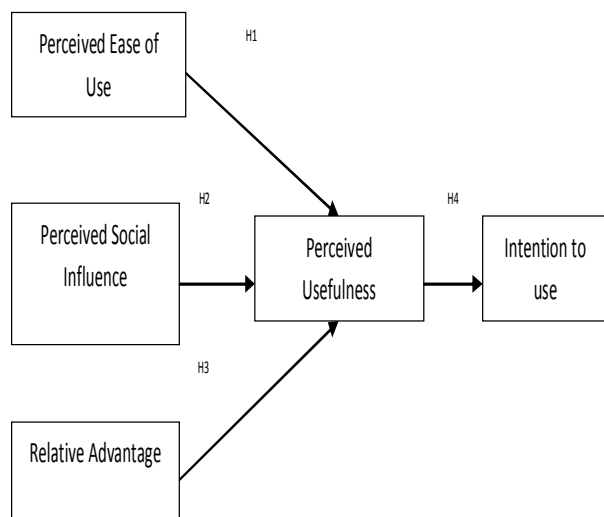

Figure 1: Proposed Research Model

4. DISCUSSIONS

Using the SPSS version 16.0 software, the hypotheses represented in the research model developed were tested. Correlations between the adopted variables are as shown in Table 1. PU correlates significantly with each of the other variables providing a strong possibility for the positivity of the hypotheses developed.

Table 1: Correlations between Items for Hypotheses

Correlations		PEU	PU	INT	PSI	RA
PEU	Pearson Correlation					
	Sig. (2-tailed)	—				
	N					
PU	Pearson Correlation	.811**				
	Sig. (2-tailed)	.000	—			
	N	17				
INT	Pearson Correlation	.442	.696**			
	Sig. (2-tailed)	.058	.002	—		
	N	19	17			
PSI	Pearson Correlation	.322	.485*	.391		
	Sig. (2-tailed)	.179	.049	.098	—	
	N	19	17	19		
RA	Pearson Correlation	.475*	.734**	.422	.436	
	Sig. (2-tailed)	.046	.001	.081	.071	—
	N	18	17	18	18	

**. Correlation is significant at the 0.01level.

*. Correlation is significant at the 0.05 level.

4.1 Testing
Evaluation of the items used for each variable was carried out in order to measure their validity in terms of reliability and validity of the construct. The Cronbach alpha coefficient and factor loadings for the variables were extracted to ensure the internal validity and consistency of their items. A Cronbach alpha of more than 0.7 as recommended by Hair et al. (1998), would indicate that the items are homogeneous and measuring the same constant. Also, the generally accepted Cronbach value of 0.60 and above and the recommended factor loadings for each of the variable items of over 0.5 as the boundaries for qualification as reliable was met as shown in Table 2 below. This therefore demonstrates that the questionnaire is a reliable measurement instrument.

Table 2: Cronbach's Alpha and Factor Loadings for the Items

Scale Items	Cronbach's Alpha	Factor Loadings	
Perceived Usefulness (5)	0.914	1	0.864
		2	0.956
		3	0.882
		4	0.879
		5	0.729
Perceived Ease of Use (6)	0.856	1	0.698
		2	0.972
		3	0.615
		4	0.652
		5	0.805
		6	0.919
Perceived Social Influence (4)	0.814	1	0.899
		2	0.931
		3	0.763
		4	0.653
Relative Advantage (5)	0.915	1	0.744
		2	0.922
		3	0.935
		4	0.864
		5	0.907
Intention to Use (2)	0.783	1	0.907
		2	0.907

Linear regression analyses were individually conducted for each of the hypotheses based on the 19 completed questionnaires collected from the study.

For Hypothesis 1 (H1), a regression analysis was performed, with perceived ease of use as an independent variable and perceived usefulness as the dependent variable. Results from the analysis are as presented in Table 3.

Table 3: Regression Results for Hypothesis 1 (H1)

	β	Standard Error	t	p	df	B	R^2
Perceived ease of use	.117	1.080	.955	.018	6	1.031	.558

The table shows the significant influence of perceived ease of use on perceived usefulness at a level $p < 0.05$ and $β = 0.117$, supporting the hypothesis presented.

Hypothesis 2 (H2) was also tested separately also using linear regression, having perceived social influence as the independent variable and perceived usefulness as the dependent variable. Its significance is as shown from the results displayed in Table 4.

Table 4: Regression Results for Hypothesis 2 (H2)

	β	Standard Error	t	p	df	B	R^2
Perceived social influence	-.102	.646	4.360	.023	4	2.818	.614

With the results showing values $p < 0.05$ and $β = -0.102$, the hypothesis tested positive, supporting that perceived social influence does in fact have an effect on the perceived usefulness of the EMR. The third hypothesis (H3), which proposes that relative advantage (as the independent variable) also has an effect on perceived usefulness (serving as the dependent variable) was tested using linear regression. The results are as depicted in Table 5, showing that the hypothesis is fully supported with influence significant at values of $p < 0.05$ and $β = 0.026$.

Table 5: Regression Results for Hypothesis 3 (H3)

	β	Standard Error	t	p	df	B	R^2
Relative advantage	.026	.674	2.520	.028	5	1.697	.208

Finally, Hypothesis 4 (H4) was tested to confirm if indeed perceived usefulness has any significant influence on the intention to use the EMR. Using the linear regression analysis, with perceived usefulness as the independent variable and intention to use as the dependent variable, the test was carried out and the results shown in Table 6 prove that the hypothesis is supported with $p < 0.001$ and $β = -0.709$.

Table 6: Regression Results for Hypothesis 4 (H4)

	β	Standard Error	t	p	df	B	R^2
Perceived usefulness	-.709	.134	8.245	0.000	5	1.108	.909

5. CONCLUSION

During the course of this research, majority of the hospitals visited didn't have prior knowledge of EMR. There is little or no awareness of the use of computers for record management. Much still needs to be done to create awareness of the application of ICT to this area of healthcare. Hospitals that have embraced it have only implemented part functionality of the EMR system. This investigation has validated the proposed model and hypotheses. Perceived ease of use, perceived social influence and relative advantage have been found to directly influence the perceived usefulness of EMR.

The user's perceived usefulness of the EMR directly affects the behavioral intention to use the EMR. It is imperative to note that this work is not all encompassing but only provides a platform for further research to be carried out on. The intended aim was to ascertain the fundamental elements necessary for adopting the EMR, leaving plenty of room for research in other areas: we employed the use of TAM for our study to understand the underlying factors; we intend to make use of UTAUT for more comprehensive study. Also, TAM is a causal model, so we will be employing causal methods such as PLS and EQS for further data analysis.

A comparison of the present result and the future result will be done as a means of evaluation. This study will aid organizations, sectors and the Nigerian government at large to know what areas should be given attention to when deploying the health technology. IT professionals especially have a role to play in determining the extent to which technology would be adopted. More attention should be paid into the design of EMR applications that are user-friendly and easy to use. Trainings should be conducted and IT support should be provided to potential users. Areas such as ease of use and usefulness of the technology should be focused on in proposals and during training, seeing as they are key factors in determining whether the technology would be accepted or turned down.

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