ORIGINAL RESEARCH

Assessment of Information Communication Technology and eHealth Use Amongst Healthcare Providers in Selected Primary Health Centers in Kano, Nigeria

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ABSTRACT

Background: Today, information and communication technologies (ICT) for health (eHealth) is the cornerstone of quality healthcare services. Majority of primary healthcare centres (PHCs) in developing countries experience limited applications of ICT.
Objectives: This study aimed to evaluate the application of ICT and basic eHealth competency among PHC providers in Nigeria.
Methods: The study was a cross-sectional survey among primary healthcare providers across five major local government areas (LGAs) in Kano state, Nigeria. A previously validated questionnaire on eHealth competency was adapted and administered to the respondents using convenience sampling. Multivariable logistic regression was used to determine predictors of eHealth competency using SPSS version 26.0. Ethical approval was obtained prior to commencement of the study.
Results: A total of 420 healthcare providers from thirty PHCs participated in the study. The respondents were mostly female 228 (54.3%) with mean age±SD of 30.5±4.2. ICT devices were reported to be inadequate 157 (37.4%). Challenges to adopting eHealth include unstable power 381 (90.7%) and limited internet access 243 (57.9%). Predictors of eHealth competency found were male gender (aOR, 3.12; 95% CI, 1.28 – 1.87; p=0.001), and being a pharmacist (aOR, 2.49; 95% CI, 0.43 – 0.86; p=0.001). Increasing years of experience was associated with decreased eHealth competency (aOR, 0.80; 95% CI, 0.34 – 0.92; p=0.011).

Conclusion: ICT and eHealth applications were found to be inadequate in PHCs in Kano, Nigeria. The utilization of ICT facilities, particularly the internet, computers and phones to support quality care services were sub-optimal, necessitating timely facilities upgrade, funding and training.

Keywords: eHealth; ICTs; Computers; Internet; Primary healthcare; Nigeria

INTRODUCTION

Primary health centers (PHC) are the first point of contact addressing most of the community's health needs, including disease prevention and treatment, rehabilitation and health promotion. Therefore, the PHCs must be well-equipped with qualified healthcare providers (HP) and technology-driven facilities such as information and communication technology (ICT) and eHealth to ensure standardized healthcare services[1]. eHealth describes the application of ICT to improve the access, quality, and efficiency of the healthcare processes. The eHealth technology includes the collection, use and sharing of information to support the delivery of healthcare using communication networks, the internet, computing services, and other various forms of electronic services[2]. The application of ICT in healthcare is a powerful tool that significantly improves the healthcare process in developed and less developed countries[3-5].

Several available ICT and eHealth devices are used at different stages of the healthcare process, ranging from simple to highly sophisticated tools. Most importantly, mobile phones, computers, and related software applications have received wide applications in healthcare settings[6-8]. Healthcare information stored on electronic devices like computers are easier to retrieve and more secured than physical files that easily get missing, misplaced, or damaged. An electronic health record system allows for quick access to patient information and care, allowing for any required adjustments to be made seamlessly. Moreover, the internet facilitates finding useful information that complements proper diagnosis, prevention, and various diseases[7]. Therefore, eHealth empowers both the care provider and the patients to be more responsible in achieving the desired outcome[2,9]. Other technologies that have received wide applications in the healthcare systems include Telehealth[10], Telemedicine[11], mHealth[12], and Health Informatics[13]. However, the extent of ICT application in healthcare and its impact on care delivery varies depending on the type and quality of care needed[14].

The primary healthcare settings in developing countries like Nigeria are likely to experience limited application of ICT in delivering healthcare services. The federal and state ministries of health are saddled with managing, funding and empowering all healthcare facilities on behalf of the government. The government may preferentially allocate more resources to the tertiary and secondary facilities, mainly located in the cities, at the expense of primary healthcare facilities[15,16]. Even with the higher allocations, the higher-level healthcare facilities are still not adequately empowered on eHealth technologies[17], suggesting the need for an upgrade in technology-driven infrastructures across all levels of healthcare. There is a paucity of data in the literature documenting the positioning of ICT and eHealth in resource-limited healthcare settings. Therefore, this study aimed to evaluate the application of ICT and basic eHealth in primary healthcare centers of Kano State, Nigeria

METHODS

Study type

The study was a descriptive cross-sectional survey using printed self-administered questionnaire distributed among primary healthcare providers working in primary healthcare centres in Kano state, Nigeria. The respondents were sampled through convenience sampling, a non-probability method.

Study population

The study participants were primary healthcare providers aged 18 years and above including Doctors, Nurses, Pharmacists/Pharmacy Technicians, Community Health Officers, Records Officers, and Laboratory Officers, whom are employees of the Kano State Primary Healthcare Management Board. The participants were drawn from thirty primary healthcare centres across five major local government areas in Kano (Dala, Nassarawa, Fagge, Gwale, Tarauni). Kano is a state located in North-West Nigeria. All identified primary healthcare providers willing to participate in the study were included while non-healthcare and casual workers like cashiers, cleaners and technical staff were excluded from the study.

Questionnaire tool

A previously validated questionnaire on eHealth competency was adapted for the study[18]. The questionnaire consists of four (4) sections. The first section collected data on socio-demographic characteristics, like age, gender, and profession. The second section collected information on ICT applications, such as devices, the internet, and training. The third on perceived barriers to ICT implementation, such as unstable power supply, poor internet connectivity, and lack of funding while the last required information to be provided on eHealth competency and ICT application in healthcare.

The eHealth competency tool domains included health information management (searching, recording and storing health information in electronic systems), communication (interacting and sharing through digital technologies), professionalism (evidence-based practice, professional development, management and leadership), safety measures (protecting devices, personal data and privacy), health analytics (solving technical problems and quality improvement). The items were measured using a 5-point Likert scale ranging from strongly disagree to strongly agree (1 - 5 points). Participants could score from a minimum of 21 to a maximum of 105 points. Scores greater than or equal to the median were grouped as 'high competency', and values less than the median were grouped as 'low competency' due to the non-normal distribution of the scores.

Data presentation and analysis

Data collected were initially entered into MS Excel and then exported into the Statistical Package for Social Science, IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA) for analysis. Internal consistency of eHealth competency items was assessed using Cronbach alpha. A normality test was conducted on the continuous numerical variables using the histogram and Kolmogorov-Smirnov (KS) test. The continuous variables were presented as mean (standard deviation), while the categorical variables were presented as frequencies (percentages). A multivariable logistic regression (MLR) - Backward LR method was used to identify predictors of eHealth competency after conducting a simple logistic regression to screen all the independent variables for possible inclusion into the MLR. Multicollinearity and interaction between the variables were checked. Assumptions of model goodness-of-fit were checked using Hosmer-Lemeshow tests. The final regression model was presented as adjusted odds ratio (aOR), 95% confidence intervals (CIs) and *p*-values. Overall, p-values ≤ 0.05 were considered statistically significant. The survey was then reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[19].

Ethical considerations

Ethical approval was obtained from the Ethics Committee of the Kano State Primary Healthcare Management Board. All procedures performed in this study involving human participants complied with the institutional research committee ethical standards and the 1964 Helsinki declaration and subsequent amendments or equivalent ethical standards. All participants provided written consent prior to the study.

RESULTS

Socio-demographic characteristics of study participants

A total of 420 eligible participants were included in the study. Most of the participants were females 228 (54.3%), with a mean age (standard deviation, SD) of 30.5 (4.2) years, and the majority were less than 40 years 270 (64.3%). Among the study participants were Doctors 58 (13.8%), Nurses 85 (20.2%) and Pharmacists/Technicians 47 (11.2%). Most of the participants were Community Health Officers 98 (23.3%). The average years (SD) of working experience of the participants was 8.4 (3.8) years and primarily worked for less than ten years 342 (81.4%). The socio-demographic characteristics of the study participants are summarized in Table1.

Table 1: Socio-demographic characteristics of study participants

Variable	Frequency (%)
Gender	
Female	228 (54.3)
Male	192 (45.7)
Age (years)	
Mean (SD) = 30.5 (4.2)	
18 - 30	133 (31.7)
31 - 40	137 (32.6)
41 - 50	97 (23.1)
Above 50	53 (12.6)
Profession	
Doctors	58 (13.8)
Nurses	85 (20.2)
Pharmacists/Technicians	47 (11.2)
Community Health Officers	98 (23.3)
Laboratory Officers	46 (11.0)
Records Officers	86 (20.5)
Years of experience	
Mean (SD) = 8.4 (3.8)	
0 - 5	192 (45.7)
6 - 10	150 (35.7)
Above 10	78 (18.6)

Key: SD: standard deviation; N: total number of respondents; N=420

Availability and status of ICT at primary healthcare centres

Many participants reported that they do not have ICT devices at their workplace 157 (37.4%) and a majority lack internet facilities 243 (57.9%). Those that have ICT devices used mobile phones 98 (23.3%), computers 87 (20.7%) or both 78 (18.6%). Most participants have not attended training on ICT in the past 222 (52.9%) but are willing to utilize ICT at their workplace 235 (56.0%). The summary of responses on the availability and status of ICT at the primary healthcare centres is presented in Table 2.

Barriers to eHealth application

Most of the participants identified the barriers to ICT application to include power shortage 381 (90.7%), inadequate funding 375 (89.3%) and lack of ICT devices 368 (87.6%). Fewer participants were concerned about cyber security/privacy issues 202 (48.1%) and increased workload 187 (44.5%) as barriers. (Figure 1).

Table 2: Availability of ICT at primary healthcare centres

Variables	Frequency (%)
Availability of ICT devices	
None	157 (37.4)
Computers alone	87 (20.7)
Mobile phones alone	98 (23.3)
Computers and Mobile phones	78 (18.6)
Internet facilities	
None	243 (57.9)
Inadequate	161 (38.4)
Adequate	16 (3.8)
Previous training on ICT	
No	222 (52.9)
Yes	198 (47.1)
Agreed to use ICT	
No	185 (44.0)
Yes	235 (56.0)

Key: ICT = Information and communication technology; N=420

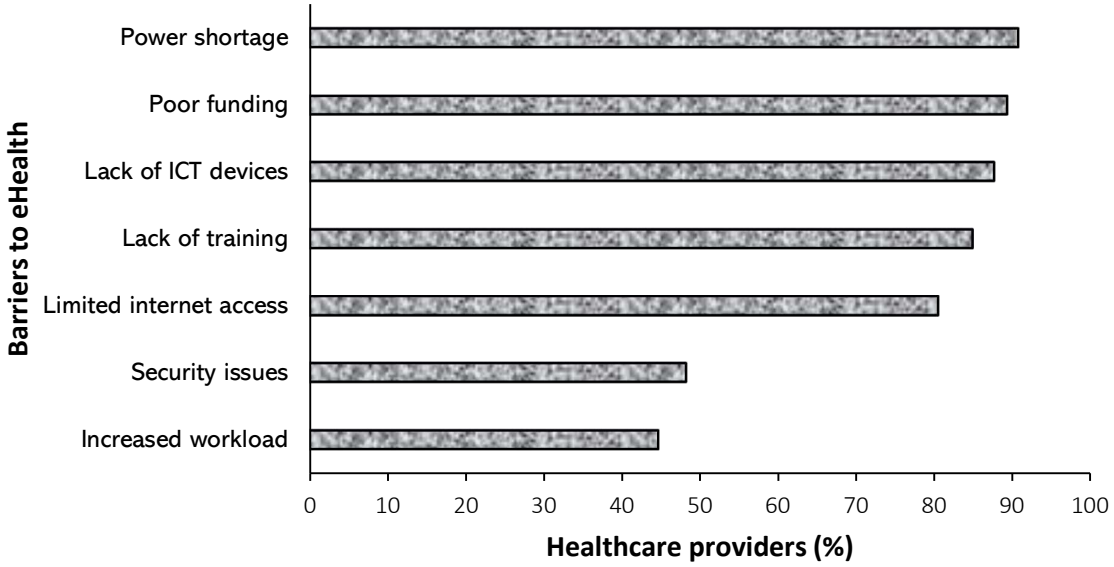

Figure 1: Barriers to eHealth application

e-Health competency assessment

The eHealth competency items showed an adequate internal consistency of 0.82. Most of the participants had low scores for all the eHealth competency items. Only 132 (31.4%) participants scored high on health information management and 125 (29.8%) on safety measures. Most participants scored low on health analytics 355 (84.5%) and professionalism 337 (80.2). Most of the participants had overall low eHealth competency, 320 (76.2) (Figure 2).

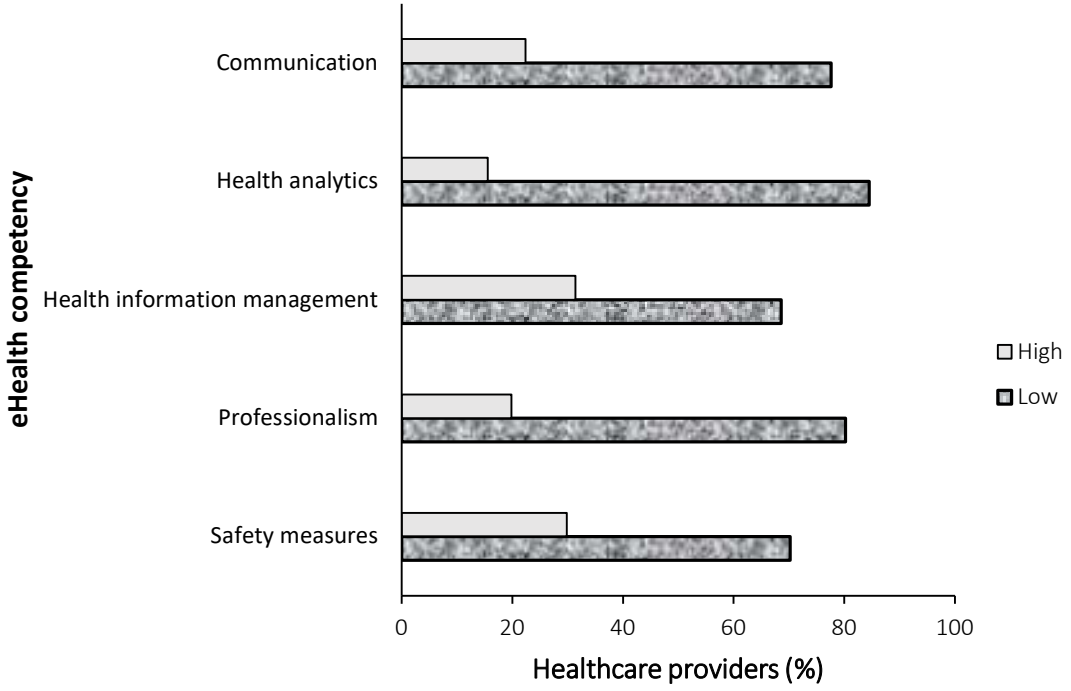

Figure 2: eHealth competency assessment

Determinants of eHealth competency

The model showed that factors independently associated with eHealth competency include male gender (aOR, 3.12; 95% CI, 1.28 - 1.87; *p*=0.001), and being pharmacist (aOR, 2.49; 95% CI, 0.43 - 0.86; *p*=0.001). However, increasing years of working experience (aOR, 0.80; 95% CI, 0.34 - 0.92; *p*=0.011) were associated with decreased eHealth competency. The summary of predictors of eHealth competency is presented in Table 3.

Table 3: Determinants of eHealth competency

Variables	Logistic regression models			
	Univariate analysis OR (95% CI)	*p*-value	Multivariate analysis aOR (95% CI)	*p*-value
Gender				
Female	1		1	
Male	1.04 (1.98 – 2.87)	0.032	3.12 (1.28 – 1.87)	0.001
Age (years)	2.05 (0.87 – 1.36)	0.234	1.05 (0.17 – 2.69)	0.134
Profession				
Doctors	1		1	
Nurses	0.96 (0.34 – 2.88)	0.383	0.55 (0.87 – 2.16)	0.244
Pharmacists/Technicians	2.11 (0.13 – 0.75)	0.011	2.49 (0.43 – 0.86)	0.001
CHOs	0.77 (0.65 – 1.83)	0.193	0.52 (0.87 – 2.16)	0.548
Laboratory Officers	0.85 (0.39 – 1.28)	0.780	0.78 (0.83 – 1.17)	0.570
Records Officers	0.59 (1.34 – 1.15)	0.036	0.54 (0.78 – 1.19)	0.116
Years of experience	0.23 (1.21 – 2.45)	0.046	0.80 (0.34 – 0.92)	0.011

Key: CHOs: community health officers; OR: odds ratio; aOR: adjusted odds ratio; CI: confidence interval

DISCUSSION

This study suggests that primary healthcare centres in Kano are challenged with inadequate information and communication technology facilities and training that drives eHealth adoption in the care delivery. Lack of funding, unstable power, and poor internet connection were common barriers that affect the eHealth application in the settings. The healthcare providers reported poor health analytics abilities, professionalism, and communication capabilities suggestive of an overall low eHealth competency.

Our study identified that most primary healthcare providers do not have access to ICT devices (including computers and mobile phones), internet connectivity and training in their workplaces. A similar study found healthcare providers to have limited access to computers and software[20]. Furthermore, providers expressed concerns about utilizing the electronic device rather than a paper-based approach during professional activities. The application of ICT in primary care has been a challenge compared to the most preferred manual methods, especially in the rural communities[21]. In contrast, a previous study from a developed country reported that over 65% of practitioners use ICT and software to provide healthcare services[22]. This finding suggests that advancement is associated with the widespread deployment of ICT to resolve the greater challenges of health systems. The rapid urbanization could also explain the difference in practices of ICT utilization across different countries led to technology advancement as against the slower urbanization in most developing countries like Nigeria. Despite the inherent deficiency in health technology devices and connectivity, our study showed general willingness to use basic eHealth at the workplace among the providers. This finding represents potential hope for the implementation of eHealth in primary healthcare in the region.

The prominence of ICTs in healthcare has prompted numerous studies to identify challenges and ways to improve eHealth in different care settings[23,24]. Studies have also defined the need to build human capacities in several ways, including continuous professional training for the care providers[25,26]. Participants in our study showed low basic competencies on eHealth, with the majority lacking basic ICT skills to solve routine clinical problems. The finding suggests that ICT training centred on enhancing routine medical problems could significantly improve the overall eHealth competency of the care providers. Male healthcare workers in this study were more likely to be ICT competent at eHealth compared to the female respondents. This suggests that more males are competent at eHealth, but doesn't tell us if males who were competent were likely to have scored higher than their females conterparts[27]. The possible reason for this disparity could be because of the work-related gender imbalance in most technical areas in the Northern part of Nigeria, where girls' child education could be challenging, possibly due to cultural, socioeconomic, and religious influences. This finding is common in other developing countries[28,29] but different in developed countries where both genders have an almost equal right[30-32].

This study identified a relationship between years of working experience and eHealth competency across all healthcare worker professions. This is in agreement with previous studies where long years of working experience were associated with lower digital competency[26,33,34]. The reasons could be due to older staff not embracing eHealth, resistance and inability to accept rapidly changing technologies. The finding suggests that the environment required for technology acceptance has not been sufficiently created to motivate development of ICT competencies and eHealth adoption. Thus, adequate resource allocation and training could improve ICT and eHealth application at the primary healthcare settings and could improve delivery of quality, safe and effective healthcare services.

CONCLUSION

Primary healthcare centres in Kano lack adequate information and communication facilities and training resulting in poor eHealth application in care delivery. Providers had low eHealth competency associated with gender, type of profession, and years of experience. Unstable power, lack of funding, and inadequate internet services were the most common barriers to eHealth application. Addressing this will likely contribute to improved quality of care services in primary healthcare centers in the state.

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