

Perception of Mobile Health Maternal Healthcare Services among Pregnant Women in Nigeria

Mpho Chaka¹, Gloria A. Ishiwu² & Chinwe Okpoko^{1,2}

¹ Faculty of Humanities, North-West University, Mafikeng, South Africa

² Department of Mass Communication, University of Nigeria, Nsukka, Nigeria

Correspondence: Chinwe Okpoko, Department of Mass Communication, University of Nigeria, Nsukka, Enugu State Nigeria. Tel: 234-806-573-8520. E-mail: chinwe.okpoko@unn.edu.ng

Received: April 15, 2020 Accepted: May 30, 2020 Online Published: June 30, 2020

doi:10.5539/gjhs.v12n8p196

URL: <https://doi.org/10.5539/gjhs.v12n8p196>

Abstract

The daunting challenge of maternal deaths resulting from preventable causes has remained a major public health issue in the developing countries of Africa and it is yet to be fully tackled. Empirical knowledge of the awareness of mobile health (m-health) maternal healthcare services among pregnant women in these parts, therefore, holds an important key to achieving success in reproductive health issues across the affected populations. Despite the introduction of mobile health services, the desirable state of reduced maternal mortality figures is yet to be achieved. This study sought to ascertain the level of awareness, extent of adoption and the challenges of m-health maternal services in southeast Nigeria. Our analysis of questionnaire-survey data on pregnant women from three states of Nigeria shows that 89.7% of respondents were aware of m-health in the study areas. However, awareness of the existence of m-health for maternal healthcare is different from usage of m-health in maternal healthcare delivery. The major challenges to its use are network failure from service providers and lack of funds for subscription, which may also mean that mobile phone ownership alone does not determine the success of m-health maternal health services in these parts. This leads to one of the recommendations that those who design mobile health application should consider offline mechanism as an alternative to the recurring network failure, for ease of use of such technology.

Keywords: awareness, communication, maternal health, mobile health, perception

1. Introduction

1.1 Background

Across the globe, 830 women die daily from preventable problems related to pregnancy and childbirth (WHO, 2018). Nigeria accounts for approximately 14% of pregnancy-related deaths globally, despite government's continued efforts to address the problem (WHO, 2012). These consistently high rates result mainly from poor quality antenatal care, lack of access to antenatal care, and underutilization of care (Bowser et al., 2018). Statistical data reveal that Nigeria contributes 10% of world maternal deaths (WHO, 2015), translates to 83 maternal-related deaths per day, making Nigeria one of the first two countries with rampant maternal-related deaths. The high rate of maternal mortality among Nigerian women and those in other parts of the world has set relevant authorities, like Federal Governments and World Health Organizations, on their toes to find ways to deal with this issue, given the fact that maternal mortality and morbidity can be reduced to the barest minimum and even prevented by early and timely access to quality maternal healthcare services. This is because delays in seeking healthcare or reaching a facility and receiving healthcare have been said to be the major reasons for the huge maternal deaths in sub-Saharan Africa (Oyeyemi & Wynn, 2014). Attempts at granting access to quality maternal healthcare services have been made by governments through the provision of more healthcare centres and registration of pregnant women for the services. These efforts, however, have not yielded the desired results, thus necessitating a more operational and pragmatic strategy. This explains the need for health professionals to tap into the potentials offered by information and communications technology (ICT) in achieving the desired health outcomes. One of such tools of ICT is the mobile phone.

It is instructive to note that information and communications technology (ICT) with its sophisticated tools has been instrumental in changing and shaping how things are done in the world today. In order to find lasting solutions to

health issues, ICT-based solutions are being employed to improve and provide efficient health services to humanity (Okuboyejo & Eyesan, 2014). The adoption of ICT tools for health purposes has resulted in the invention and creation of mobile health or m-Health for short. Mobile health technology is seen as the use of telecommunication networks and equipment for transfer of healthcare information between participants at different locations (Odetola & Okanlawon, 2014). The wide availability of mobile phones and their ease of use have increased their application in the health industry as mobile health devices, where mobile phones and tablets are being used to support medical and public health practice (Sondaal et al., 2016). Furthermore, the use of m-Health for maternal health in low and middle income countries (LMIC) like Nigeria could reduce the time, distance and cost of information delivery, thereby overcoming the challenges of poor and/or delayed access to information, inadequate financing, distance to healthcare facility and limited health personnel for pregnant women and other healthcare consumers (Sondaal et al, 2016). Applying mobile phones in healthcare is increasingly being prioritised to strengthen maternal healthcare systems and reduce the number of deaths related to pregnancy and childbirth (Oyeyemi & Wynn, 2014; Odetola & Okanlawon, 2014).

1.2 Review of Some Previous Related Studies

A number of studies on the adoption of mobile technology for health issues by health workers as well as maternal health consumers have been reported by scholars. A worldwide survey on mobile health among over 100 countries was conducted and the findings revealed that 48% of member states made use of mobile devices for emergency and disaster situations (WHO, 2011). Further findings showed that SMS was very prevalent among the users of mobile health initiatives than other forms of mobile health intervention (WHO, 2011).

In a study to ascertain audience members' awareness and use of m-Health in England, a cross section of the general public, pharmacists and diabetic patients were surveyed and interviewed. The results showed that the level of awareness and utilisation were still low among the respondents (Kayyali, Peletidi, Ismail, Hashim, Bandeira, & Bonnah, 2017). However, 60% of the pharmacists would recommend the usage of mobile health to others. This indicates that the enlightened medical elites group prefer m-Health. Furthermore, a study was carried out in India to evaluate m-Health awareness, perception and attitude to healthcare among providers in Himachal Pradesh. The findings from the study revealed that 58.8% of the respondents would easily recommend m-Health (Ganapathy, Kanwar, Bhatnagar, & Uthayakumaran, 2016). This shows that more than half of the respondents had positive perception of mobile health usage. The authors recommended that increased connectivity, awareness and full commencement of mobile health services should be encouraged. In a related study which sought to synthesize current knowledge of the factors that influence healthcare professionals' adoption of mobile health applications, (Gagnon, Ngangue, Payne-Gagnon, & Desmarts, 2016) discovered from their explicit review of articles, that there was a positive perception of m-Health among professionals as they mostly said that it was a technology that can reach anyone at anywhere. They also found that ease of use, usefulness and familiarity with technology were the major factors that promoted the adoption of m-Health. Further study by Hoque (2016) revealed that perceived ease of use and perceived usefulness were major factors that enhanced the adoption of m-Health among young people in Bangladesh. Consequently, it was recommended that app developers should design apps that would be easy to use, so that adoption can be faster based on the ideals of the technology acceptance model. In a study carried out on the factors affecting consumer acceptance of e-Health initiative in Bangladesh, only 21% of the respondents had their own experience of usage with mobile health platforms, despite the fact that 40% of the respondents had the idea of using ICT for health (Hossain, Okajima, Kiataoka, & Ahmed, 2017). This signifies a low level of usage even where the services are available.

A survey research conducted in Zimbabwe by Marufu and Maboe (2017) found that 50% of respondents lack the knowledge and awareness of use of mobile health to support chronically ill patients. Similarly, the study which sought to ascertain the knowledge of m-Health among nurses in Oyo State, Nigeria revealed that 75% of the nurses had not heard about m-Health prior to the study, hence the poor level of awareness recorded by the study (Odetola & Okanlawon, 2014). However, this is not surprising given the fact that the study was carried out among rural community health workers. But the study which evaluated the knowledge level of medical doctors in Ekiti State on m-Health, showed that 85% were knowledgeable about m-Health and its benefits. Their status as medical personnel must have enhanced their knowledge base on mHealth (Adebara, Adebara, Olaide, Emmanuel, & Olanrewaju, 2014). Using focus group discussion (FGD) and interviews, a related study was carried out in Enugu State to determine the perception of health workers towards the adoption of an m-Health application which was in its trial stage at the time in Nigeria. They discovered that respondents were positive towards the adoption of the tested mobile health innovation as many showed willingness to make use of the innovation (Kenny, O'Connor, Eze, Ndibuagu, & Heavin, 2017). Further study on the effectiveness of m-Health maternal health programme in Ondo State, which attempted to analyse the impact of cell phones following the state government's distribution of

m-Health materials to aid maternal health across some health centres in the state, discovered that providing cell phones to pregnant women could increase their utilization of primary healthcare system (Oyeyemi & Wynn, 2014). Thus, m-health is recognised as a valuable way to improve healthcare delivery, particularly if effective public health reporting becomes an integral part of the process.

1.3 Statement of the Problem

The Nigerian figures for maternal mortality have remained a major health challenge despite the quick-service delivery and other opportunities inherent in the m-Health services offered and launched in some parts of the country. It is estimated that “10 percent of the world’s 287,000 maternal fatalities occur annually in Nigeria” (Oyeyemi & Wynn, 2014, p. 2). It is also recorded that “Nigeria bore 14% of the global burden of maternal mortality in 2008” (Meh et al., 2019, p. 2). Therefore, the daunting challenge of increasing maternal deaths resulting from preventable causes has remained a major public health issue which is yet to be fully tackled. In other words, the desirable state of reduced maternal mortality figures is yet to be attained. It still looks like a long term goal in Nigeria. It must be noted that UN’s SDG 3.1 for year 2030 seeks to reduce maternal mortality ratio to 70 per 100,000. Nevertheless, Nigeria is still lagging behind with a very low ratio of 840 deaths per 100,000 live births (WHO, 2010). It is saddening that getting pregnant seem to be a death sentence in Nigeria. The rising figures have raised salient questions that require a critical empirical enquiry to answer in so far as the perception of audience on mobile health in maternal healthcare is concerned. Although the rate of adoption of these technologies is not fully known empirically, this study will help find relevant answers that can improve the application of mobile health innovation in maternal health, and bring us close to attaining the goal of maintaining a healthy society. Thus, this study sought to ascertain the level of awareness, extent of adoption and the challenges of m-Health maternal services in southeast Nigeria.

1.4 Research Question

Indeed, the study attempts to provide answers to the following questions:

1. What is the level of awareness of mobile health in maternal services among the audience?
2. To what extent has mobile health been adopted for maternal health services among audience members?
3. What are the challenges encountered by audience members in using mobile health in maternal services?

1.5 Theoretical Framework

This study is anchored on Technological Acceptance Model (TAM), an information systems theory which evolved from the theory of reasoned action (TRA). The model x-rays the factors that encourage the intention to adopt or reject a particular form of technology seeing that it is not so easy to change from the norm to accepting ‘new things’. The major essence of the technology acceptance model (TAM) is to predict the acceptability and consequent usage of interventions. It is specifically tailored for modelling users’ acceptance of information systems or technologies (Lai, 2017). Technology acceptance model was re-modified to fit the realities of the time, after the main finding of both perceived usefulness (PU) and perceived ease of use (PEOU) were found to have a direct influence on behaviour intention, thus eliminating the need for the attitude construct. The prospect’s perception of the innovation’s usefulness helps to influence his/her attitude towards the adoption of the system and indirectly influences behavioural intention to use (Asemah, Nwammuo, & Nkwam-Uwaoma, 2017).

In summary, an application or innovation will eventually be used (even if it is useful) only if it is easy to use and its benefits outweigh the effort expended in using it. This model is applicable to all technological innovations in that acceptance to use is only guaranteed when there is a positive perception of such innovation. The theory is apt for this study given its focus on audience perception and adoption of mobile health. Mobile health is a ‘new’ technological innovation especially in developing countries which requires acceptance among users. This theory helps to explain the factors that determine the acceptability of this new technology by prospective users and its subsequent adoption. It helps to elucidate the perception and adoption processes of mobile health in maternal health by stakeholders (health workers and health customers).

2. Method

2.1 Setting

The study was conducted in three states - Anambra, Ebonyi and Enugu of southeast Nigeria. Southeast Nigeria is one of the six geopolitical zones in Nigeria, and it is made up of five states. Six Local Government Areas (LGAs), two from each of the states were studied. They are Awka South and Onitsha South (for Anambra), Abakaliki and Afikpo North (for Ebonyi) and Enugu North and Nsukka (for Enugu). The National Population Commission in 2006 census represented the female population of the LGAs studied as follows: 92,752, 65,843; 77,165, 76,017;

123,245, 160,030 (National Bureau of Statistics, 2011, Pp. 25-37), respectively. These figures were projected to 137,820, 97,836; 114,659, 112,954; 154,941, 237,789 in 2018 using a population growth rate of 3.3%. The study population is, therefore, 855,999.

2.2 Study Design and Participants

Descriptive survey design was used in the research and is said to be well suited for studies on health and health services (Kelly, Clark, Brown, & Sitzia, 2003). The questionnaire, administered directly by the interviewer was the instrument used for data collection. The participants were pregnant women who gave consent to participate in the study during the hospital ante-natal clinic days. Two researchers and four research assistants went to the hospitals in the study areas and secured their consent and voluntary participation through verbal communication.

2.3 Sampling Technique and Sample Size

Multistage sampling procedure was adopted for this study. The first is simple random sampling with which we selected three out of the five states that make up southeast geopolitical zone of Nigeria. In the second stage, the cluster sampling technique was used to select the six LGAs, two representing each of the states that were studied. They are Awka South and Onitsha South (for Anambra), Abakaliki and Afikpo North (for Ebonyi) and Enugu South and Nsukka (for Enugu) states. One of each of these LGAs is a state capital. A total of 384 respondents were sampled from the study population of 855,999 women. This figure was arrived at using online Sample Size calculator (Sample Size Calculator, 2012), with a confidence level of 95% and error margin of 5. To get a proportional representation of the respondents in the LGs, the following figures were arrived at: Anambra - (27.6%) 106, Ebonyi - (26.5%) 102 and Enugu - (45.9%) 176. Finally, printed copies of questionnaire were administered to respondents through face-to-face channel, using accidental sampling technique. The use of hospital settings for the research provided easy access to the respondents, who attended ante-natal care on specified days of the week.

2.4 Data Analysis

Descriptive and simple summary statistics like frequency and percentages along with means and standard deviation were used to answer research questions. A four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was adopted for research question 3. Standard deviation was used to determine the level of variation between the responses. The researchers set a benchmark for the analysis of the results for Research Question 3. Here, 'limit of real numbers' was used as a basis for determining the decision of the mean scores of each of the responses. Below is a run-down of the limit of real numbers for each scale of measurement.

- Strong Agree (SA) = 4.00 - 3.45 (4points)
- Agree (A) = 3.44-2.45 (3points)
- Disagree (D) = 2.44-1.45 (2points)
- Strongly Disagree (SD) = 1.44-0.45 (1point)

3. Results

Of 384 copies of questionnaire distributed for the study, 379 copies were returned giving a return rate of 98.7%. The results of their bio-data revealed that 48% were between 31 and 40 years, 31% between 20 and 30 years and 21% between 41 and 50 years. The study also showed that the respondents were educated, with 79% and 14% respectively holding Bachelors and Master degrees. Seven percent are secondary school leavers.

Table 1. Awareness of mobile health (m-Health) among respondents (N=379)

Variable	Frequency	Percentage	
Aware of the m-Health system used by patients in m-Health service			
Yes	340	89.7	
No	39	10.3	
Sources of information on m-Health system			
Friends	116	34.0	
Family members	12	3.5	
Radio	44	13.0	
Health workers	156	46.0	
Others	12	3.5	
Areas of awareness of m-Health service		Responses	
Are you aware of m-Health usage in maternal healthcare delivery in Nigeria?	Yes	296	87
	No	44	13
Are you aware of the existence of any m-Health in maternal healthcare service in Nigeria?	Yes	303	89
	No	37	11
Are you aware of any training on how to use m-Health for maternal health issue?	Yes	187	55
	No	153	45
Have you attended any training on how to use m-Health system for maternal health?	Yes	105	31
	No	235	69

The above Table revealed that majority of the respondents (89.7%) are aware of the mobile health system used in maternal health services in Southeast Nigeria. Only a few (10.3%) indicated that they are not aware of any such services. Health workers constituted the main sources of information on the m-Health system used. This is because pregnant women usually come in contact with health workers during their ante-natal visits or other health-related needs that take them to the hospitals or primary health centres. However, 34% of the respondents said that they first got the information about mobile health maternal health services through their friends; while 13% heard it over the radio for the first time. A few knew about mobile health maternal services through their family members and "others" with 3.5% each. The "others" referred to in the Table include: billboards, posters, seminars, women health forum, etc.

The awareness of mobile health system available was found to be highest (89%) in the areas that host m-Health maternal healthcare services. This was closely followed by mobile phone usage in which 87% of the respondents indicated that they are aware of how to use mobile health to access maternal healthcare delivery services in Southeast Nigeria. Furthermore, although 55% of the respondents noted that they were aware of the training carried out on how to use m-Health to access maternal healthcare delivery services among pregnant women, only 31% attended the training.

Table 2. Extent of adoption of m-Health for maternal services among the audience (N=379)

Variable		Frequency	Percentage
Extent of adoption of m-Health			
Responses			
I have Internet on my phone	Yes	102	30
	No	238	70
I make use of my phone to access information on how to prepare for pregnancy	Yes	102	30
	No	238	70
I make use of my phone to interact with a doctor online	Yes	128	37.5
	No	212	62.5
I get adequate health related information in the Internet through my phone	Yes	102	30
	No	238	70
I get information on how to maintain personal hygiene as a pregnant through the phone	Yes	282	83
	No	58	17
I get information on the suitable diet of a pregnant woman through my phone	Yes	365	96
	No	14	4
I get information on how to care for a new born through my phone	Yes	326	96
	No	14	4
Types of m-Health service used preferred by respondents			
Internet		34	10
Phone calls		129	38
Text message/SMS		177	52
Type of m-Health information respondents get via phone			
Hello mama		17	17
Information on how to care for new born		14	3.5
Causes, symptoms and treatment of pregnancy-related illnesses		14	3.5
Unspecified/undecided		287	76

On the extent of adoption of m-Health services, the items: 'getting suitable diet for a pregnant woman' via the mobile health system (online) and 'how to care for a new-born' (see Table 2) were ticked by 96% of the respondents. The findings also showed that 83% get information on how to maintain personal hygiene via the m-Health system. With respect to: 'having Internet on the phone', 'using it to access m-Health information', 'using phone to interact with a doctor online' and 'getting adequate health-related information on phone through the Internet', the responses in the affirmative were low as they rated 30%, 30%, 37.5% and 30%, respectively. However, the m-Health services used mostly by respondents are text messaging, calls and Internet.

Additionally, results in the Table above showed that 'Hello Mama' ranked highest (17%) among the type of mobile health services or information received by respondents. The remaining 3.5% of the respondents received information on 'how to care for the new-born' and 'causes and symptoms of pregnancy-related illnesses and how to treat them' respectively. Nevertheless, 76% were either undecided or not specific on the open-ended question on their choices.

Table 3. Challenges encountered in using m-Health maternal service

Variables	SA	AD	SD	Mean	St.D	
m-Health system is difficult to use due to the technical nature of the applications in the phone	14	131	170	64	2.25	0.775
There is not always power supply to charge my phone	28	173	153	25	2.54	0.728
The m-Health system is time-consuming	-	134	195	50	2.22	0.661
Phone discussions may be forgotten easily	14	220	106	50	2.55	0.727
Health workers are needed to interpret some messages and they are not always available	-	237	142	-	2.63	0.485
There is a network problem sometimes arising from the network providers	64	251	25	39	2.90	0.798
I don't know how to operate my phone in order to access health related information from it	-	131	145	103	2.07	0.783
I don't have money for subscription	64	187	103	25	2.77	0.807
m-Health is for the more literate	28	170	92	89	2.36	0.922
m-Health is for the rich	-	92	159	100	1.91	0.757
Cultural barriers	-	120	159	100	2.05	0.761

Five out of the 11 responses in the Table had mean scores which fall within the limit of real numbers for “Agree” decision (i.e. 3.44 - 2.45), while six fall within the limit of real numbers for ‘Disagree’ decision (i.e. 2.44 - 1.45).

These responses include:

- ‘There is network problem sometimes arising from the network providers’ (Mean = 2.90)
- ‘I don't have money for subscription’ (mean = 2.77)
- ‘Health workers are needed to interpret some messages and they are not always available’ (mean = 2.63)
- ‘Phone discussions may be forgotten easily’ (mean = 2.55)
- ‘There is not always power supply to charge my phone’ (mean = 2.54)

The two major challenges affirmed by the respondents are ‘network problem’ and ‘No money for subscription’.

4. Discussion

The study reveals that awareness (89%) of m-health services is high among the educated, 93% of who hold Bachelors and Masters degrees. The high educational qualification of the respondents and their desire for pregnancy-related information, may account for the increased level of awareness. In other words, the more one is educated, the more one is exposed to and/or be aware of new technologies that meet one's needs. Some scholars (Hoque, 2016; Odetola & Okanlawon, 2014; Hossain, Okajima, Kiataoka, & Ahmed, 2017; Oyeyemi & Wynn, 2014) argue that the adoption of a new technology begins with awareness, knowledge and acceptance. As espoused by the proponents of the Technology Acceptance Model (TAM), the ‘Perceived Ease of Use’ (PEOU) and ‘Perceived Usefulness’ (PU) are the primary considerations for the adoption of a new technology. Impliedly, awareness of the existence of a new technology precedes knowledge of its use. It is even possible for one to have knowledge of the existence of a given technology without knowing how to use such technology. Nevertheless, while curiosity may have spurred those who sought to know how to use the technology to seek knowledge of its use, the need for m-Health technology and knowledge of its use are contributory factors to the increased awareness about the training on how to use such technology. One would not seek to be trained on how to use a new technology if one has not seen the need for it.

As seen from the lenses of the research, the adoption of mobile health among pregnant women in the study locations revolved around two major themes: ‘to get information on suitable diet’ and ‘how to care for the new-born’. Another area of priority was ‘how they could maintain personal hygiene as pregnant women’. Indeed, most of them were also found to use mobile health to get information on how to prepare for pregnancy, majority of who used the technology to run pregnancy tests on themselves. This implies that pregnant women in these parts placed high premium on their personal care, healthy living and childcare. However, the type of mobile health

mostly used were SMS, which ranked highest.

'Hello Mama' ranked highest among the types of programme or information respondents received using m-Health maternal services. 'Hello Mama' is a mobile health package that pregnant women have nick-named 'Doctors at a distance,' because it bridges the gap between them and medical experts whose services may not easily be accessed given their distant locations. The programme uses a particular code in the phones and communication is done via text messaging, except on the occasions that one may request to speak with a doctor. Thus, one's perception of a given technology can influence his/her decision or otherwise to adopt such technology. This is in tandem with Technology Acceptance Model (TAM).

The major challenge faced by the users of mobile health in maternal healthcare services in the study locations is network problem from service providers, which has a mean score of 2.90. Despite the multiple network providers like MTN, GLO, 9mobile and Airtel in Nigeria, its supply is not only epileptic and unwholesome, but also compounded by the fact that charges are made for failed service delivery. Such network problems are not only worrisome, but also hinder users' access to health information via the mobile health system. The next challenge is the lack of funds for subscription (Mean=2.77) occasioned by the stringent economic situation in Nigeria. Other challenges include lack of health workers or health personnel in the immediate neighbourhood to interpret some of the health-related messages that come to pregnant women via mobile health, respondents' inability to remember some health-related discussions held with a medical expert via calls and lack of regular power supply to charge their mobile phones.

5. Conclusion

The strength of this research lies in its global application. Mobile phone is handy and easy to use and, therefore, will provide a veritable platform for quick and timely access to maternal healthcare services. Given the findings that emanated from this research, we posit that: (1) Demographic variables like educational qualifications and membership of a social group were strong determinants of the high level of awareness of m-Health system in Nigeria. (2) The positive perception recorded among respondents about the technology correlated with their perceived ease of use as well as perceived usefulness of such technology to the individual. (3) Owning a mobile phone was not a precondition for its use for mobile health maternal services, since there are other intervening factors. It is therefore recommended that those who design mobile health application should consider offline mechanism as a recipe to the recurring network failure and lack of funds that majorly challenge the research subjects.

Funding Acknowledgement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions

Authors contributed equally in all aspect of this research.

Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

References

- Adebara, O. V., Adebara, I. O., Olaide, R., Emmanuel, G. O., & Olanrewaju, O. (2017). Knowledge, Attitude and Willingness to Use mHealth Technology among Doctors at a Semi Urban Tertiary Hospital in Nigeria. *Journal of Advances in Medicine and Medical Research*, 22(8), 1-10. <https://doi.org/10.9734/JAMMR/2017/33232>
- Asemah, E. S., Nwammuo, A. N., & Nkwam-Uwaoma, A. O. A. (2017). *Theories and Models of Communication*. Jos: University Press.
- Bowser, D. M., Shepard D.S., Nandakumar, A., Okunogbe, A, Morrill, T., Halasa-Rappell, Y., ... & Erhunmwunse, O. A. (2018). Cost Effectiveness of Mobile Health for Antenatal Care and Facility Births in Nigeria. *Annals of Global Health*. 84(4), 592-602. <https://doi.org/10.29024/aogh.2364>
- Gagnon, M. P., Ngangue, P., Payne-Gagnon, J., & Desmartis, M. (2016). M-Health adoption by healthcare professionals: a systematic review. *J Am Med Inform Assoc.*, 23(1), 212-220. <https://doi.org/10.1093/jamia/ocv052>
- Ganapathy, K., Kanwar, V., Bhatnagar, T., & Uthayakumaran, N. (2016). m-Health: A critical analysis of awareness, perception and attitude of healthcare among providers in Himachal Pradesh, North India.

- Telemedicine and e-Health*, 22(8), 675-688. <https://doi.org/10.1089/tmj.2015.0198>
- Hoque, M. R. (2016). An empirical study of mHealth adoption in a developing country: the moderating effect of gender concern. *BMC Medical Informatics and Decision Making*. <https://doi.org/10.1186/s12911-016-0289-0>
- Hossain, N., Okajima, H., Kiataoka, H., & Ahmed, A. (2017). Consumer acceptance of eHealth among rural inhabitants in developing countries (A study on portable health clinic in Bangladesh). *Procedia Computer Science*, 111, 471-478. <https://doi.org/10.1016/j.procs.2017.06.049>
- Kayyali, R., Peletidi, A., Ismail, M., Hashim, Z., Bandeira, P., & Bonnah, J. (2017). *Awareness and use of mHealth App: A study from England*. <https://doi.org/10.3390/pharmacy5020033>
- Kelly, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care*, 15(3), 26 1-6. <https://doi.org/10.1093/intqhc/mzg031>
- Kenny, G., O'Connor, Y., Eze, E., Ndibuagu, E., & Heavin, C. (2017). A ground-up approach to Mhealth in Nigeria: A study of primary healthcare workers' attitude to Mhealth adoption. *Procedia Computer Science*, 121, 809-816. <https://doi.org/10.1016/j.procs.2017.11.105>
- Lai, P. C. (2017). The literature review of technology adoption models and theories for the novelty technology. *Journal of Information Systems and Technology Management*, 14(1), 21-38. <https://doi.org/10.4301/S1807-17752017000100002>
- Marufu, C., & Mabo, K. A. (2017). Utilization of mobile health by medical doctors in a Zimbabwean health care facility. *Health SA Gesondheid*, 22, 228-234. <https://doi.org/10.1016/j.hsag.2017.03.002>
- Meh, C., Thind, A., Ryan, B., & Terry, A. (2019). Levels and determinants of maternal mortality in northern and southern Nigeria. *BMC Pregnancy Childbirth*, 19, 417. <https://doi.org/10.1186/s12884-019-2471-8>
- National Bureau of Statistics. (2011). Annual abstract of statistics, 2011. Retrieved from [istmat.info > files > annual_abstract_of_statistics_2011](http://istmat.info/files/annual_abstract_of_statistics_2011)
- Odinka, J. I., Nwoke, M., Chukwuorji, J. B. C., et al. (2018). Post-partum depression, anxiety and marital satisfaction: A perspective from Southeastern Nigeria. *S Afr J Psychiat.*, 24(0), a1109. <https://doi.org/10.4102/sajpsy.2018.24i0.1109>
- Odetola, T. D., & Okanlawon, F. A. (2014). Assessment of Mobile Health Nursing Intervention Knowledge among Community Health Nurses in Oyo State, Nigeria. *African Journal of Med Med Sciences*, 43(1), 147-155.
- Odetola, T. D. (2015). Conceptual Model for M-Health Utilization: A Nigerian Adaptation. *Connected Health Symposium*. <https://doi.org/10.2196/iproc.4645>
- Okuboyejo, S., & Eyesan, O. (2014). mHealth: Using Mobile Technology to Support Healthcare. *Online J Public Health Inform*, 5(3), 233. <https://doi.org/10.5210/ojphi.v5i3.4865>
- Oyeyemi, S. O., & Wynn, R. (2014). Giving cell phones to pregnant women and improving services may increase primary health facility utilization: a case-control study of a Nigerian project. *Reproductive Health Journal*, 11(8). <https://doi.org/10.1186/1742-4755-11-8>
- Sondaal, S. F. V., Browne, J. L., Amoakoh-Coleman, M., Borgstein, A., Miltenburg, A. S., Verwijs, M., & Klipstein-Grobusch, K. (2016). Assessing the Effect of mHealth Interventions in Improving Maternal and Neonatal Care in Low and Middle Income Countries: A Systematic Review. *PLoS ONE*, 11(5). <https://doi.org/10.1371/journal.pone.0154664>
- The Survey System. Sample Size Calculator. (2012). [document on the internet]. Retrieved from <https://www.surveysystem.com/sscalc.htm>
- The Survey System. Sample Size Formulas for our Sample Size Calculator. (2016). [document on the internet]. Retrieved from <https://www.surveysystem.com/sample-size-formula.htm>
- WHO. (2010). Trends in maternal mortality: 1990 to 2008. Geneva: Estimates developed by WHO, UNICEF, UNFPA and World Bank.
- WHO. (2011). M-Health: New Horizons for Health Through Mobile Technologies. Second Global Survey on eHealth. [document on the internet]. Available from: https://www.who.int/goe/publications/goe_mhealth_web.pdf
- WHO. (2012). Trends in Maternal Mortality: 1990 to 2010. Geneva, Switzerland: World Health Organization.
- WHO, HRP, UNICEF, UNFPA, USAID, Family care international, International confederation of midwives, et al.

(2015). Strategies Toward Ending Preventable Maternal Mortality. [WHO document on the internet]. Retrieved from https://www.everywomaneverychild.org/images/EPMM_final_report_2015.pdf

WHO Maternal mortality. (2018). [document on the internet]. Retrieved from <https://www.who.int/en/news-room/fact-sheets/detail/maternal-mortality>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).