

## **Assessment of mobile health nursing intervention knowledge among community health nurses in Oyo State, Nigeria**

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### **Abstract**

**Background:** Maternal mortality is high in Nigeria especially in rural areas due to knowledge deficit about expected care and labour process, socio-cultural belief, health care workers' attitude, physical and financial barriers to quality health care access. Mobile health (m- health) technology which is the use of mobile telecommunication devices in health care delivery reduces costs, improves care access, removes time and distance barriers and facilitates patient-provider communications needed to make appropriate health decisions. Previous studies empowering nurses with m- health knowledge resulted in improved uptake of health care services. There exists a literature dearth about knowledge and perception of nurses in Nigeria. This study became expedient to empower nurses working at the grassroots with the knowledge of m-health and assess the impact of educational training on their perception of its effectiveness.

**Method:** This quasi-experimental study carried out in four randomly selected LGAs across Oyo South Senatorial district involved participants at experimental (21 nurses) and control levels (26 nurses). A validated 25- item questionnaire explored nurses' perception, knowledge and perceived effectiveness of m-health in improving uptake of maternal health services in Nigeria among both groups before intervention. Intervention group nurses had a training equipping them with knowledge of m-health nursing intervention (MHNI) for a period of one week. Their perception, knowledge and perceived effectiveness were re-assessed at three-months and six-months after MHNI. Data were analyzed using Chi-square and repeated measures ANOVA at 5% significance level.

**Result:** In the EG, knowledge score significantly increased from  $21.9 \pm 4.5$  at baseline to  $23.6 \pm 4.6$  and  $23.2 \pm 5.6$  at three-month and six-month respectively while there was no significant difference in knowledge score among CG over the study period. A very significant difference was shown in the knowledge and perception of mobile health and its effectiveness at P1 ( $p= 0.012$  and  $0.017$ ) but this significance faded away 6 months

after ( $p=0.312$  and  $0.598$ ) respectively.

**Conclusion:** The study was effective as it improved the knowledge and perceived effectiveness of m-health among PHC nurses. However, the improvement dwindled after 6 months. Thus, similar training and retraining should be conducted periodically to update nurses' knowledge and improve clients' access to quality health information, education and therapeutic communication.

**Keywords:** *Community Health Nurses, m- health nursing, knowledge, perception*

### **Résumé**

**Contexte:** La mortalité maternelle est élevée au Nigeria en particulier dans les milieux ruraux en raison du déficit de connaissances sur les soins prévus et processus de labour d'accouchement, la croyance socioculturelle, l'attitude des agents de santé, barrières physiques et financières à l'accès aux soins de santé de qualité. La technologie de santé mobilière (santé-m) qui est l'utilisation de dispositifs de télécommunications mobiles dans la provision des soins de santé réduit les coûts, améliore l'accès aux soins, élimine les obstacles de temps et de distance et facilite les communications patient-pourvoyeur de soins nécessaires pour faire des décisions de santé appropriées. Les études précédentes équipant les infirmiers avec les connaissances de santé-m a permis à améliorer l'utilisation des services de soins de santé. Il y a une pénurie de littérature sur la connaissance et la perception des infirmières au Nigeria. Cette étude est devenue expédiente pour équiper les infirmières travaillant en campagne avec connaissance de santé-m et d'évaluer l'impact de la formation pédagogique sur leur perception de son efficacité.

**Méthodes:** Cette étude quasi-expérimentale effectuée dans quatre communes choisies au hasard à travers le district sénatorial d'Oyo Sud a impliqué des participants au niveau expérimental (20 infirmières) et de contrôle (27 infirmières). Un questionnaire de 25-articles validé a exploré la perception, la connaissance et l'efficacité perçue de la santé-m, des infirmières, dans l'amélioration de l'utilisation des services de santé maternelle au Nigeria entre les deux groupes avant l'intervention. Les infirmières du groupe d'intervention avaient une formation dotant de connaissances sur l'intervention des soins infirmiers de santé-m

(MNHI) pour une période d'une semaine. Leur perception, connaissance et efficacité perçue ont été réévalués à trois mois et six mois après le MNHI. Les données ont été analysées à l'aide du chi carré et mesures répétées d'ANOVA au niveau significatif de 5%.

*Résultats:* Dans le groupe expérimental, le score de la connaissance a sensiblement augmenté, passant de  $21,9 \pm 4,5$  au commencement de l'étude à  $23,6 \pm 4,6$  et  $23,2 \pm 5,6$  à trois mois et six mois respectivement, tandis que il n'y avait pas de différence significative du score de connaissances parmi le groupe de contrôle au cours de la période d'étude. Une différence très importante a été montrée dans la connaissance et la perception de la santé mobilière et son efficacité à P1 ( $p = 0,012$  et  $0,017$ ) mais cette importance disparu 6 mois après ( $p = 0,312$  et  $0,598$ ) respectivement.

*Conclusion:* L'étude a été efficace puisqu'elle a amélioré les connaissances et l'efficacité perçue de la santé-m chez les infirmières de SSP. Cependant, l'amélioration a diminué après 6 mois. Ainsi, des formations et reformatons similaires devraient être menées périodiquement pour mettre à jour les connaissances des infirmiers et d'améliorer l'accès des clients à l'information de santé de qualité, l'éducation et la communication thérapeutique.

**Mots clé:** *infirmiers en santé communautaire, infirmerie de santé-m, connaissance, perception*

## Introduction

Every two minutes of the day, one woman dies somewhere in the world from complications of pregnancy and childbirth. One third of these maternal deaths take place in just two countries: India with 20% of the global total (56,000 deaths) and Nigeria with about 14% (40,000 deaths). Globally, the maternal mortality ratio is 400 per 100,000 live births. However in Nigeria, the figure was about 1,500 per 100,000 in 2006 [1] and currently 804 per 100,000 [2]. By implication, one woman dies approximately every 3 minutes from childbirth in Nigeria. Available data from Oyo State revealed an average of 450 per 100,000 live births maternal mortality. Oyo South Senatorial district recorded an average of 248 per 100,000 in 2008, 439 per 100,000 in 2009 and 462 per 100,000 live births in 2010 [3]. Global advocacy groups have described maternal mortality as "avoidable" and "preventable" when clients are equipped with information necessary to make informed decisions [4].

The researchers identified that provision of concise information to clients especially during pregnancy was lacking because there is presently a serious dearth of facilities and skilled workers like

nurses and midwives especially at the rural level in Nigeria thus predisposing women to the risk of not adopting healthy peri-natal behaviors. Adoption of mobile health (m-health) technology would in no small measure, contribute to provide health care consumers with the opportunity to obtain, process, and understand the basic health information and services they need to make appropriate health decisions given the fact that mobile phones are now readily available and affordable for an average citizen and with more than 88 million active mobile phone subscribers in Nigeria [5].

Mobile health technology is the use of telecommunication networks and equipment for transfer of health care information between participants at different locations. Applying mobile phones in healthcare is increasingly prioritized to strengthen healthcare systems [6]. M-health interventions provides a means for providing individual level support to health care consumers which improves accessibility to antenatal care by equipping them with health promotion and disease preventing health message empowering them to make better informed health decisions thereby uptake of available health care services [7]. Mobile health (m-Health) is emerging as a useful tool to improve access to health especially in areas with a limited health care workforce, limited financial resources, and a high burden of disease such as the developing world [8].

The knowledge and perception of nurses working in PHCs who are meant to be the first contact with clients on the implementation of mobile health nursing services will help to identify any gaps in their knowledge, training and in the management of resources, equipments and facilities. It also gives an insight to challenges faced by the clients who are meant to utilize these services because besides the clinical efficacy of the interventions, the effectiveness of these interventions depends on the attitudes and behaviors of clients and the wider community, which are shaped by social and cultural factors. When these gaps are identified, it will be possible for all the stakeholders to attend to them in order to strengthen and improve the quality of services to health care consumers.

In some developed and developing countries, providers and consumers of health care services accepted the model as an effective way of providing comprehensive, individualized and active reminders of best practice for health management [9-11]. However in Nigeria, there is a dearth of literature to explore the knowledge and perceptions of nurses about m-health nursing intervention' effectiveness and this served as the broad objective for this study. It was on this premise that the researchers were out to explore these

among nurses working in primary health care facilities in a selected senatorial district in Oyo State. A hypothesis stating that there would not be any significant difference in the level of knowledge and perception of m-health's effectiveness was formulated for testing.

### Research Design

This was a descriptive study targeted at exploring nurses' experience and perception of m-health. The study findings are a part of a larger study which involved all registered nurses/ midwives (47) working at the Primary Health Care centers in Ibadan South West, Ibadan South East, Ibarapa North and Ido Local Government Areas of Oyo State after gaining their consent. A thoroughly validated self-developed 25-item questionnaire was pre-tested and validated at Cronbach's Coefficient of 0.8. It consists of four sections: Section A: professional background containing five questions; Section B: knowledge about mobile health technology containing six questions; Section C: perception about the applicability/ adaptability of mobile health to improvement of maternal health and reduction of maternal mortality containing eight questions; Section D: perceived barriers to the successful implementation of m-health technology.

The data was collected over a period of 11 months (January- November, 2013) among nurses who were randomly assigned into experimental and control groups. The pre-intervention data (P0) was collected before the mobile health nursing

educational training, while data were collected three (P1) and six (P2) months after the educational training. Nurses in the experimental group benefited from mobile health nursing educational training targeted at equipping them with relevant knowledge of using the intervention in improving the health care service delivery to their clients. Nurses in the control group had no training done during the period of data collection but were trained in line with ethical protocol after the research was concluded.

The calculated level of knowledge about m-health nursing intervention was compared statistically using chi-square at baseline, P1 and P2. Mean values were computed in both experimental and control groups with  $p < 0.05$ . Also, nurses' professional background's influence was explored on the variables to determine any significant relationship.

### Results

Table 1 showed the professional qualification background of the 47 nurses within the study. It revealed that most of them (88.9%) had basic nursing diploma education and mostly (61.7%) belong to top hierarchical order of decision making (ACNO/ CNO). Majority of them have been in service for 21- 30 years. There was no significant difference in the professional background between the intervention and control groups.

**Table 1:** Nurse's Professional Background

Variable	Intervention N (%)	Control N (%)	Total N (%)	X <sup>2</sup>	p- value
<i>Age (years)</i>					
20- 30	3	2	5	1.544	0.672
31- 40	6	5	11		
41- 50	6	8	14		
51- 60	6	10	17		
<i>Professional Qualification</i>					
RN, RM, RPHN	17 (80)	25 (96)	42(88.9)	4.09	0.129
B.Sc	3 (15)	0 (0)	3 (6.7)		
M.Sc(merge)	1 (5)	1 (4)	2 (4.4)		
<i>Current Professional Rank</i>					
CNO/ ACNO	11 (52.4)	21 (79.2)	30 (66.7)	4.73	0.094
PNO/ SNO	5 (23.8)	4 (16.7)	9 (20.0)		
NO1/ NO II	5 (23.8)	1 (4.2)	6 (13.3)		
<i>No. of Years in Service</i>					
1-10	5 (20)	3 (8)	8 (13.3)	1.97	0.579
11-20	6 (30)	7 (28)	13 (28.9)		
21-30	5 (25)	10 (40)	15 (33.3)		
31-40	5 (25)	6 (24)	11 (24.4)		

Findings revealed that most nurses (almost 75%) had neither heard about nor seen m- health nursing intervention in use prior to this study. The few that had heard mostly got their information from seminars attended previously and thus did not know how it might influence quality care accorded clients at all levels of care.

Table 2 revealed the level of nurse's knowledge about m-health before and after the nursing educational training provided by the researchers. It also explored their perception about the applicability of mobile health nursing in improving maternal health in Nigeria. Findings revealed a poor level of knowledge of both variables at baseline with m-health and perception about mobile health effectiveness at 42.9% among the experimental group with a similar trend among the control group as well.

However, findings 3 months after the nursing intervention (P1) revealed an appreciable improvement in the level of knowledge with mobile health nursing (76.2%) and perception about mobile health effectiveness all at 71.4% among the experimental group with a similar trend among the control group as well revealing high level of

significance for mobile health nursing and perception of mobile health at  $p < 0.05$ .

Findings after six months of the initial mobile health nursing education (P2) showed a decline in the level of knowledge of mobile health nursing and their perception compared with P1 though still higher than the baseline data in both the experimental and control groups.

In Table 3, Analysis using Repeated measures ANOVA was done which also showed a significant difference in the mean scores in knowledge of m-health ( $F = 2.469$  df (2.000- 90.000)  $p = 0.012$ ); perception about m-health applicability ( $F = 2.409$  df (2.000- 90.000)  $p = 0.016$ ) among intervention and control groups at different points in time.

In summary, the formulated hypothesis stating that there would not be any significant difference in knowledge was failed to be accepted at P1 but accepted at P2. The decline showed in knowledge after six months reiterated the fact that there is a need to train and re-train nurses at regular intervals of close range (every 3 months) about this innovative use of technology in our locality because being a relatively new concept.

**Table 2:** Comparison of Knowledge about m-health among nurses in intervention and control groups at P0, P1 and P2.

Variables	Interv. N(%)	control N (%)	X <sup>2</sup> :P value	Interv. N(%)	control N (%)	X <sup>2</sup> :P value	Interventn. N(%)	Control N(%)	X <sup>2</sup> : P value
knowledge about telehealth technology									
Poor	12(57.1)	13(50.0)	3.37;0.666	5(23.8)	9(34.6)	2.97;0.012	12(57.1)	11(42.3)	1.02;0.312
Good	9(42.9)	13(50.0)		16(76.2)	17(65.4)	SIG	9(42.9)	15(57.7)	
perception about applicability of mobile health in improving maternal health									
Poor	12(57.1)	10(38.5)	0.51;0.085	6(28.6)	6(23.1)	5.71; 0.017	8(38.1)	8(30.8)	0.27; 598
Good	9(42.9)	16(61.5)		15(71.4)	20(76.9)	SIG	13(61.9)	18(69.2)	

Barriers to the effectiveness of mobile health's implementation as perceived by nurses were explored. Major findings thematically revealed network/service failure (61.7%), inconsistent financial support by the government (63.8%), and policy instability (53.2%). Others include poor attitudes from health care workers, lack of appropriate knowledge and skills health care workers, electricity instability at baseline, P1 and P2. Though attended with slight variations at P1 and P2, the barrier themes were sustained.

Table 4: The table revealed no significant relationship between all nurses' professional backgrounds and their knowledge of m-health ( $p > 0.05$ ) at baseline, P1 and P2 levels.

Table 5: The table below revealed no

significant relationship between all nurses' professional backgrounds and their perception of effectiveness of mobile health intervention ( $p > 0.05$ ) at baseline, P1 and P2 levels.

### Discussion

Study findings revealed that there was a very significant difference shown in the knowledge and perception of mobile health and its effectiveness at P1 ( $p = 0.012$  and  $0.017$ ) but this significance faded away 6 months after ( $p = 0.312$  and  $0.598$ ) respectively.

#### Professional Background

The professional background information revealed that all nurses in the study possessed in

**Table 3:** Comparison of Mean Scores of Intervention and Control groups at P0, P1 and P2 to detect the effect of m-health intervention using Repeated ANOVA

Variables of assessment	Study group/No	Assessment type	Group means	SD	Chi-square P value	Repeated ANOVA
knowledge about m-health technology	Intervention(21)	BL	21.90	4.48		
		3months	23.62	4.62	0.666	
		6 months	23.19	5.57	0.012	F=2.469df(2.000-90.000)p=0.012
	Control(26)	BL	21.46	4.15		
		3months	21.98	5.256	0.297	
		6 months	22.00	4.000	0.312	
perception about applicability of mobile health in improving maternal health	Intervention(21)	BL	6.91	1.445		
		3months	6.61	1.745	0.510	
		6 months	6.81	1.650	0.570	F=2.409df(2.00-90.000)p=0.016
	Control(26)	BL	6.23	2.355		
		3months	5.57	2.731	0.076	
		6 months	5.71	2.512	0.270	

**Table 4:** Relationship between Nurse's Professional Background and Knowledge of Telehealth

Variables	Baseline		X <sup>2</sup>	P value	Post Intervention 1		X <sup>2</sup>	P value	Post Intervention 2		X <sup>2</sup>	P value
	Poor N (%)	good N (%)			Poor N(%)	good N (%)			Poor N(%)	Good N (%)		
<i>Professional qualifications</i>												
RN,RM,RPHN	16(94.1)	24(85.7)	2.03	0.362	19(90.5)	21(87.5)	0.23	0.889	19(90.5)	21(87.5)	0.23	0.889
B.Sc	0(0)	3(10.7)			1(4.8)	2(8.3)		Insig	1(4.8)	2(8.3)		
M.Sc	1(5.9)	1(3.6)			1(4.8)	1(4.2)			1(4.8)	1(4.2)		
<i>Current Professional rank</i>												
CNO/ACNO	12(70.6)	18(64.3)	1.37	0.504	15(71.4)	15(62.5)	0.804	0.669	14(63.6)	16(69.6)	0.89	0.641
PNO/SNO	4(23.5)	5(17.9)			3(14.3)	6(25)		Insig	4(18.2)	5(21.7)		
NOI/NOII	1(5.9)	5(17.9)			3(14.3)	3(12.5)			4(18.2)	2(8.7)		
<i>No. of Years of Practice</i>												
1-10	1(5.9)	5(17.9)	2.55	0.467	3(15)	3(12)	3.41	0.332	4(17.4)	2(9.1)	4.91	0.179
11-20	6(35.3)	7(25)			3(15)	10(40)		Insig	4(17.4)	9(40.9)		
21-30	7(41.2)	8(28.6)			8(40)	7(28)			7(30.4)	8(36.4)		
31-40	3(17.6)	8(28.6)			6(30)	5(20)			8(34.8)	3(13.6)		

addition to their basic RN, RM qualifications, the public health nursing diploma which equipped them as frontline workers in providing both preventive and curative services in the rural communities. This is beneficial to pregnant women in that the nursing officers and midwives have more skills like application of the nursing process and using diverse birth attendance skills in handling various health patterns of pregnant women. The study done in Sudan and Zambia [12] reported that nurses and midwives are the key providers of nursing and midwifery services in many countries and when the skills and experience of nursing and midwifery personnel are maximized, they can contribute significantly to positive health outcomes. However, there is an urgent need to employ more nurses at a higher level of educational preparations like M.Sc (Community Health Nursing) in order to deploy the use of nursing theories and models as a guide to their interventions as there appears to be a dearth of these at the Primary Health Care levels

as revealed by the study. This would also ensure personnel that could play both the leadership and collaborative roles with the various communities and other health care workers to assess, diagnose and intervene appropriately.

The findings from the study showed that most of the nurses were at the verge of retirement. The fact of being top-heavy with CNO's and ACNO's with more than half of them (55.3%) having spent more than 20 years in service portrays that though there are many nurses at the decision-making level of health matters in their various LGAs, the actual nursing care and services are left in the hands of a few young and often inexperienced nurses thus creating a ripple effect of transferring most nursing interventions to non-nursing personnel with its dire consequences. The study conducted by Mulcahy in New Zealand stated that experience mediates every aspect of what we understand as reality and it reveals the variety of ways in which we process information [13]. This indicates that experience is part and

**Table 5:** Relationship between nurse's Professional Background and Perception of Applicability of Mobile Health Intervention

Variables	Baseline		X <sup>2</sup>	P value	Post Intervention 1		X <sup>2</sup>	P value	Post Intervention 2		X <sup>2</sup>	P value
	Poor N(%)	good N (%)			Poor N(%)	good N (%)			Poor N(%)	Good N (%)		
<i>Professional qualifications</i>												
RN, RM, RPHN	13(86.7)	27(90)	0.26	0.877	12(66.7)	18(66.7)	0.154	0.926	13(86.7)	27(90)	5.51	0.064
B Sc	1(6.7)	2(6.7)			3(16.7)	66(22.2)		Insig	0(0)	3(10)		
M.Sc	1(6.7)	1(3.3)			3(16.7)	3(11.1)			2(13.3)	0(0)		
<i>Current Professional rank</i>												
CNO/ACNO	11(68.8)	19(65.5)	1.26	0.532	15(88.2)	25(89.3)	0.15	0.926	9(60)	21(70)	0.90	0.638
PNO/SNO	2(12.5)	7(24.1)			1(5.9)	2(7.1)		Insig	3(20)	6(20)		
NOI/NOII	3(18.8)	3(10.3)			1(5.9)	1(3.6)			3(20)	3(10)		
<i>No. of Years of Practice</i>												
1-10	3(18.8)	3(10.3)	3.67	0.300	3(17.6)	3(10.7)	0.69	0.876	3(18.8)	3(10.3)	1.02	0.312
11-20	2(12.5)	11(37.9)			4(23.5)	9(32.1)		Insig	3(18.8)	10(34.5)		
21-30	7(43.8)	8(27.6)			6(35.3)	9(32.1)			6(37.5)	9(31)		
31-40	4(25)	7(24.1)			4(23.5)	7(25.9)			4(25)	7(24.1)		

parcel of a human being and is influenced by environmental factors which may have a good or bad health outcome or influence.

#### *Knowledge and Perceived Effectiveness of Telehealth/mobile health nursing intervention*

At baseline, there was an indication of a poor knowledge of tele/mobile health nursing which has been adjudged appropriate to facilitate health assessment, diagnosis, intervention, consultation, supervision, education and the conveyance of health information via analogue and digital media. Persons who live hours from basic medical services can directly access high quality medical expertise without leaving their community [14]. Mobile health application is therefore an important tool for enhancing healthcare delivery particularly in rural and remote areas where health care resources and expertise are often scarce or non-existent like Nigeria. Most nurses claimed not to have heard about or seen mobile health in use before the nursing intervention.

These findings were in agreement in a study which also revealed 82% of the respondents with poor knowledge of mobile health and only 21% of them being aware that mobile health is currently being pilot-tested in Nigeria [11]. However, many of the respondents were optimistic of their willingness to use mobile health services if and when fully integrated into health care system and recommend its use to others (70.5%); this is because 81% of the respondents were positive on the relevance and benefits of mobile health's introduction to the Nigerian health system. Although, almost seventy percent (67%) of the respondents believed it should be included in the three tier health system, however some (57%) thought it should be a special programme on its own.

These study findings come with profound implications for community health nurses as primary care providers who should utilize this technology most [15]. Nurses working in Primary health care centers need to be adequately trained on how mobile health technology works in general and how mobile health nursing, a cost effective and unique among other technologies, provides clients with portable voice communication (particularly of value among illiterate individuals), quick and short text transfer, and signaling capabilities. Mobile phones are now readily available and affordable for an average citizen and with about 88 million active mobile phone subscribers in Nigeria and can be used as a medium to deliver health care interventions especially as it relates to maternal and child health irrespective of geographic, religious and economic boundaries. It can also be delivered directly to people at their convenience and preferred languages. This stance has also been reiterated [7]. Although ethico-legal implications need to be explored, however, there is therefore an urgent need to equip nurses especially at the Primary Health care settings about this important global care delivery model in order to acquire the necessary knowledge and skills needed in utilizing the current technology in reaching out to their clients for information, education and enhanced communication.

Findings from the study revealed that though there was a poor level of knowledge at the baseline before nursing educational training, a significant improvement was recorded immediately after the training signifying an appreciable acquisition of the knowledge and skills of mobile health nursing intervention and focused antenatal care. The decline in knowledge after six months reiterated the fact that there is a need to train and re-train nurses at

regular intervals of close range (every 3 months) about this innovative use of technology in our locality being a relatively new concept in Nigeria. According to the Diffusion of Innovation theory, there are different levels of knowledge and skill adoptions. Nurses using this new model could be duly remunerated as it encourages them to reach out more to their clients for health promotion and disease prevention information. There is a need to overcome the lack of required computer and mobile health nursing skills identified in the study which was also reiterated by [2,16-18] in their various studies.

For mobile health to be successful, it has to be designed, implemented supported and sustained in the proper manner by the stakeholders especially the government, health care workers and the prospective clients [19]. Various studies have indicated that though there is general satisfaction with the experience of using m-health globally [20-22], health professionals have concerns about the negative effect on the consultation, establishing the infrastructure and adopting telemedicine systems into existing organizational systems.

#### *Perceived barriers to successful implementation of mobile health nursing intervention*

Using mobile phones as a medium to deliver health care interventions has distinct advantages in that it reaches across geographic, religious and economic boundaries, could be delivered directly to people and is easy to use [23-26]. Topmost among other barriers as identified by nurses under study was the poor level of literacy among the general population In Nigeria, illiteracy level stands at 62% [27] and this especially among girls who eventually become mothers. The use of mobile health though could be in voice or SMS modes, it is highly expedient to work towards achieving the 2<sup>nd</sup> MDG of improving access to basic education so that women are not limited in their communication and since SMS use is not limiting in that it could still be delivered some hours after sending it.

The issue of network failures by telecommunication networks leaves so much to be desired especially in Nigeria. This stance was supported in different studies [13-15]. Drop calls and non- delivery of SMS are often experienced even after being charged for them resulting in frustration sometimes experienced. Though the Nigeria Communication Commission (NCC) has

charged telecommunication companies to be effective and efficient, the services truly still leave much to be desired.

Unstable financial support from the government has been identified as a potential barrier to the success of mobile health nursing in Nigeria. This is as a result of the high start- up cost of purchasing functional mobile phones and computer for use, on- going voice call and SMS maintenance fees, and training and re-training health practitioners. This also supported previous findings [6] For this barrier to be overcome, there is a need for commitment at the policy level and funds allocation to sustain the intervention even when there is a change in government.

All other barriers like policy and electrical instability would need to be addressed as well. These have been identified previously in a Nigerian study [11]. The importance of this cannot be over-emphasized considering the fact that study respondents (nurse and pregnant women) and indeed the general populace have expressed keen interest in adopting this care delivery model even if they have to pay for such services. It is a useful model to remind people of their clinic appointments [6], provide health education and promote unhindered access to their primary nurses irrespective of where they are. It helps in ensuring prompt management of clients in case of emergencies.

Though various studies have identified this as an indicator, it is high time all stakeholders came together to address the identified factors responsible for poor utilization of facilities close to them. This was one of the major thrust of this research as mobile health nursing intervention had profound benefits in that clients do not always had to come all the way every time they need to get vital information or make enquiries about issues that borders on their health. This was made possible because they had direct contacts with their primary providers hot- lines at no cost to them at all.

#### *Implication for Nursing*

Orientation to m-health has become evident due to improved level of knowledge and perception of its effectiveness due to the educational training among Community Health Nurses.

Therefore, if this is sustained, it will go a long way in improving provision of quality health care education and services to clients which would impact on making valuable informed choices

about their health with subsequent reduction in maternal and child mortality in Nigeria.

More importantly, nurses who are prepared at an advanced stage of education i.e. M.Sc (Community Health Nursing) need to be employed at Primary Health Care level as these have been empowered with adequate knowledge and skills of mobile- health nursing intervention.

### Recommendation

Based on the outcome of the study, the use of m-health should be embraced and extended to other areas of health care delivery and services apart from the Primary Health Care.

### Conclusion

Various literatures reviewed proved the effectiveness of m-health intervention in other parts of the world. This study has also confirmed its perceived effectiveness among the Community Health Nurses in our rural communities despite all the barriers identified. Therefore, m-health would be more effective in urban areas where all the barriers are controllable.

However, periodic training and retraining of Community Health Nurses would help in addressing the knowledge decline witnessed after a while among the study population.

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