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# **Experiences of Health Care Providers Using Information and Communications Technology for Maternal and Child Health Care in Selected Health Facilities in Nigeria**

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## **Abstract**

### **Objective:**

Reducing maternal and infant mortality in the sub-Saharan Africa, especially Nigeria remains a serious health challenge. Information and communication technology (ICT) interventions offer an effective approach to alleviating the health challenge, as well as improving health outcomes. To harness the value of ICT and facilitate its practicability for maternal and child health (MCH) care, it is important to explore the experiences of health care providers' who are at the forefront of the Nigerian health system deploying ICT tools for MCH care.

**Methods:** The exploratory study design interviewed nine health care providers involved in ICT-based interventions for MCH in selected antenatal clinics in four states in Nigeria. Data collected was content analysed using Nvivo to identify themes relevant to the objective of the study.

**Results:** The average age of the participants was 45.6yrs. Participants reported using mobile phones, the Internet, television/digital video disk (DVD) and radio for MCH care. Other tools such as, laptops/projectors for Power-Point slides and public address system were used during antenatal classes for maternal health educations. The ICT tools were used for appointment reminders, communicating health tips and during emergencies. Participants encountered challenges such as unreliable powers supply, cost of associated with using ICT and irrelevant call. Using ICT to care for women during and after pregnancy increased the demand for health services and had a positive effect on infant deaths.

**Conclusions:** ICT is an important tool for improving maternal health care and outcome. Hence, it is important to replicate harmonized and integrated ICT-based projects that can be implemented nation-wide to harness the potential of ICT for improving MCH. Future research can examine similar projects in private health facilities, and impact of using ICT for MCH care on the disposition of health care providers to work and workload, as well as demand for their time.

**Keywords:** ICT, Maternal and Child Health, Healthcare providers, Nigeria

## **Introduction**

About 300,000 women die globally each year as a result of pregnancy or childbirth complications; many of these deaths (over 90%) occur in low-and-middle-income countries (LMIC), especially the sub-Saharan Africa<sup>1</sup>. Within the sub-Saharan Africa, Nigeria, the most populous country contributes a substantial proportion of the maternal deaths<sup>2</sup>. With a statistics of 917 deaths per 100,000 live births<sup>3</sup> in 2019, Nigeria remains amongst the 15 most dangerous countries for a woman to give birth<sup>1</sup> and a key contributor to world's neonatal and maternal death. This could get worse with the outbreak of the coronavirus pandemic. As acknowledged by WHO<sup>1</sup>, the maternal health crisis could be alleviated through the provision of adequate health information and better monitoring of pregnant women.

Information and communication technology (ICT) has proven to be efficient and valuable for disseminating information and delivering care services to pregnant women, mothers and infants in the underprivileged groups<sup>4</sup>. Information and Communication Technology (ICT), a diverse collection of electronic devices and software programmes, used for processing can be used as tools for clinical diagnosis and communicating information on safe health practices to promote maternal and child health (MCH). The adoption of the diverse collection of ICT tools for caring the vulnerable group are among initiatives that have been found to have positive outcomes for different MCH care concerns, such as improving antenatal attendance, nutritional status, reducing delay associated with health-seeking and skilled birth deliveries<sup>5,6</sup>. This is particularly important during this coronavirus pandemic, as it can minimize visits to antenatal clinics, thus limiting the exposure of mothers, infants and health workers to infection. Thus helping to accelerate the desired reduction in maternal and child mortality<sup>8</sup> in the low-and-middle-income countries(LMIC).

Some of the ICT tools that have been used in the high-income and a few low-income countries for MCH care included SMS (short message service), mobile applications, laptops video messaging, voice calls, portable devices and audio packages. For instance, of note, is the "Text4baby" initiative which was launched in 2010 in the USA, which employed text messages to deliver vital health tips to pregnant women and mothers who had infants that are less than 12 months. In addition to providing health information, it also sent messages to remind mothers about scheduled appointments, improved their access to health care and promoted safe health practices. A total of 450 participants registered for the Text4baby

service by sending a text messages with their baby's expected date of delivery. The registered women receive messages thrice a week offering credible health tips applicable to for different stages of pregnancy. The 'Text4baby' programme was set up by the Healthy Babies Coalition and National Healthy Mothers. The programme was also implemented in Russia<sup>9,10</sup>. Unlike the Text4baby which seeks to improve access to maternal and child health information, other projects like the Lady Health Worker's project and mCARE in Bangladesh focused on the efficient referral of serious cases and monitoring of pregnant women and new-born babies using mobile apps and electronic databases respectively<sup>11,12</sup>. The two projects (Lady Health Worker's project and mCARE) aimed to bridge the gap between health care providers and pregnant women to improve health monitoring, referrals during emergencies and health outcomes. While data from the Lady Health Worker's Project shows a distinct increase in the number of women who accessed antenatal care from skill health care providers (from 26% to 86% between 1991 and 2018), the mCARE project was highly cost-effective at a cost per DALY (Disability life adjusted Years) of \$31, averting 354 newborn deaths.

As reported by Musoke<sup>13</sup>, a notable early ICT intervention design to support women during pregnancy in Africa was the Rescuer Project funded by the World Bank in 1996. The project used 'Walkie Talkies' for prompt referrals and emergencies during labour, which helped in connecting women early to health care providers. Other authors have also highlighted the gains of mobile applications for MCH care. In Egypt, for example, mobile phones were also very useful for in reducing response time during obstetric emergencies, especially in the late stage of pregnancy<sup>14</sup>. Similarly, in Zanzibar, Tanzania, pregnant women tagged 'Wired Mothers' were linked early to health facilities through mobile phones to increase facility utilization and access to skilled attendance at delivery<sup>15</sup>.

Another prominent ICT project is the MomConnect in South Africa which provided the opportunity for pregnant women registered in public health facilities in South Africa to be able to enjoy live interaction with health professionals who can answer maternal and child health-related questions<sup>16</sup>; as a result, improving mothers' access to relevant health tips. Not only has the application of ICT improve access to MCH information, facility utilisation and mortality rates, ICT tools have also been used to reduce financial and transportation barriers to MCH care. To reduce financial barriers, the Changamka Microhealth – mPowerment initiative in Kenya provide women with mobile access to their savings and health insurance, weekly information and appointment reminders<sup>17</sup>.

In Nigeria, the Mailafiya project implemented in Abuja<sup>18</sup>, designed to improve MCH care provided health professionals with vehicles, simple tool kit for health care and laptops. The laptops were installed with an application for capturing medical records with the laptop. The teams used phones and other ICT tools to disseminate information, carry out computerized laboratory investigations for clinical diagnosis and treatment. The pilot project was successful in that patients attendance snowballed to over 200% and treatment reporting by 900%. Other projects like the ICT-based programme in the North (Gombe State) funded by Society for Family Health which adopted the use of call centres for the promotion of safe MCH practices<sup>19</sup>, and the SMART HIV/AIDS Project (involving CHAI, FMOH and Hewlett Packard ) in Abuja all underscores the relevance of ICT, indicating an improvement in access to health information and care, drug dispensing, treatment follow-up, facility utilization and referrals.

Although some studies conducted in Nigeria have confirmed the positive impact of ICT tools on access to health information and care, referrals and facility utilisation, yet little attention has been paid to exploring the effect of using ICT for MCH care from the perspective of the health care providers. The literature<sup>20,21</sup> also underscores the need for an in-depth understanding of the value of ICT tools, especially the mobile phones to facilitate practicability, acceptability and evaluation of such interventions. Understanding how ICT tools are being used can also provide more knowledge on how to augment existing health care models through ICT-based initiatives. This study, therefore, explores the experiences of health care providers' who are at the forefront of the Nigerian health system deploying ICT tools to understand how to improve the application of ICT and maximize its gains for MCH care.

## **Methodology**

### **Study Design**

The exploratory study design used an interview guide for data collection. Interview sessions were organised to prompt information from health care providers involved in ICT interventions for maternal health care from four states in Nigeria. The interview was used for data collection was suitable for this study because it provides an opportunity to gain more depth and meaning based on an individual's experiences. By exploring the views and experiences of health care providers who have been involved in ICT-based project for maternal health care, it was possible to obtain multiple perspectives of the value of ICT for

MCH care from health care providers understanding and the effect on maternal health information and services in Nigeria.

### **Study Setting**

The selection of health facilities and participants was purposive. Government owned health facilities with operational ICT programmes for maternal health during the period the study was carried out were selected. The facilities were identified through the Ministry of Health in each state. The projects implemented in the health facilities were the Safe motherhood project covering four health facilities in Ondo State in the Southwestern part of the country, mobile health intervention at a federal health institution in Owerri, Imo State in the East, the Society for Family Health Call Centre-based project for Maternal, Neonatal and Child Health (MNCH) in two health facilities in Gombe State and two primary health centres, in Zaria Local Government Area in Kaduna State in the North. All the projects were designed to adopt the public-private partnership model, but only two was effective in the implementation of the model. The four projects all adopted the use of ICT, especially the mobile phones for maternal and child health care. The projects and health facilities involved in the study were described in a previous study<sup>22</sup>.

### **Study Participants**

Participants who took part in the study were contacted through the Ministry of Health in each state. The researcher enrolled participants (healthcare providers) in the selected antenatal clinics who daily use ICT to maternal and child health care. The researcher and three research assistants interviewed participants in the health facilities who were part of the on-going ICT programmes using an interview guide. Nine health care providers who were anchoring the identified ICT programmes were interviewed. The sample size was limited due to the few operational ICT programmes for MCH care available in public health facilities at the time the study was conducted.

### **Data Collection and Analysis**

Data collection was initiated after the Ethical Review Committee serving the University of Ibadan and the University College Hospital at Ibadan approved the protocol for the study. Informed consent was also obtained by the researcher from the participants through a form signed by all the participants. The participants gave their consent and were informed using

the interview guide about the process and procedures for the interview at the point of data collection. The questions in the interview guide focused on the health care providers' demographic, ICT used for MCH care and how health care providers use ICT for MCH care, challenges/motivation for using ICT and the effect on maternal health care and outcomes. The interview guide was first developed in English Language and was translated into Yoruba, Hausa and Pidgin English by Language experts in the Department of Communications and Language Arts, University of Ibadan before it was used for data collection. The translation was done using a side-by-side procedure in which the researcher and language experts discuss the possible wordings for the items in the interview guide. The translation procedure produced three versions of the interview guide in Yoruba, Hausa and Pidgin English. The three versions were pre-tested before use. Thus, the interview was conducted in the three local dialects, namely: Yoruba, Hausa and Pidgin English. Each guide was used in the region where the local dialect is predominant.

The interview sessions were held in places convenient for the health care providers and each session lasted between 30-40 minutes and was audiotaped. The three research assistants involved in the data collection could speak fluently two out of the four local dialects (Yoruba, Igbo, Pidgin English and Hausa). While the interview sessions in the North was conducted by a Hausa speaking research assistant, the interview session in the East was handled by an assistant who could speak Pidgin English fluently. The researcher conducted the Yoruba interview sessions in the Southwest. In all, nine interview sessions was organised for the health care providers.

To reduce bias and increase credibility of the data collected, member checks technique was used during the interview sessions and after each session. The researcher summarized information collected and questioned each interviewee to confirm the correctness of the information recorded. The information from interview sessions collected by the researcher with the support of three research assistants was recorded with audiotape with the consent of all the participants.

The audiotapes were transcribed, translated into the English Language. After the transcription of the interview sessions, the researcher with the three assistants reviewed the content of the transcript for accuracy. To avoid loss of meanings during the translation, a side-by-side procedure in which the research team and language experts discuss the possible wordings for the content of the transcript was also used.

Afterwards, the information collected was loaded into NVivo. The researcher and two of the research assistants (a postgraduate student in sociology and information science) conducted a

qualitative thematic content analysis to find meaning to the data, identifying important concepts or themes relevant to the objective of the study.

## Results

### Profile of the health care providers

The interviewees were all females in the age range of 28-55 years. The mean age of the interviewees was 45.6yrs. The interviewees (health care providers) were enrolled for the study because they were involved in the ICT projects at the selected health facilities. Eight of them were registered with the Nursing and Midwifery Council of Nigeria, while two were community health extension officers (Table 1).

**Table 1: Distribution of the health care providers by state**

| State  | Nurse | Community health provider | Age           |
|--------|-------|---------------------------|---------------|
| Ondo   | 3     | 1                         | 52, 45, 65,37 |
| Gombe  | 2     | -                         | 35, 51        |
| Kaduna | 1     | 1                         | 55,28         |
| Imo    | 1     | -                         | 43            |
| Total  | 7     | 2                         |               |

### Results/Study Findings

The interview sessions conducted in the four states with nine health care providers revealed the ICT tools used for MCH care. The ICT tools used as indicated by health care providers were mobile phones, the Internet, television/, radio, projectors for Power-point slides and public address system during antenatal classes. Health care providers in the four states used the mobile phones for sending reminders on antenatal and postnatal visits, as well as immunisation to mothers. The mobile phone was also used for referrals and consultations during emergencies. The use of the Internet for sending MCH information was only reported in Imo and Ondo States. See Table 2 for more information.

**Table 2: ICT tools used by health care providers for MCH care in Nigeria**

| S/N | ICT channels used   | Ondo | Imo | Kaduna | Gombe | Total |
|-----|---|------|-----|--------|-------|-------|
| 1   | Mobile Phone: Use of phones for sending reminders on antenatal/postnatal visits, immunisation, referrals and consultations in Emergencies.                      | √    | √   | √      | √     | 4     |
| 2   | Television: Use of television for live interactive call-in programmes to support e-health projects at the health facility.                                      | √    | X   | √      | √     | 3     |
| 3   | Television/DVD: Use of TV/DVD to disseminate health tips.   | X    | √   | √      | √     | 3     |
| 4   | Radio: Use of radio for interactive live programmes to support e-health projects at the health facility   | √    | X   | √      | √     | 3     |
| 5   | Public Address system: Use of public address system to disseminate MCH information in the community and for maternal health education during antenatal classes. | √    | X   | √      | √     | 3     |
| 6   | Internet: sending personal emails on safe MCH practices to mothers.   | √    | √   | X      | X     | 2     |
| 7   | Projector/Laptop: Use of projector and laptops during health talks.   | X    | √   | √      | √     | 3     |

√ = Used, X= Not Used      N= 9

Source: Field Note of the Interview sessions with health care providers

In Ondo State, a matron in one health facility in charge of the *Abiye* project described how the mobile phone was used:

“We normally use the *Abiye* phone to remind pregnant women about their antenatal appointments and we watch over them till they give birth. We do this to discourage pregnant women from visiting *Iya Agbebi* (Traditional birth attendant)”.

A health care provider interviewed in Gombe State reported that: “We use projectors during antenatal clinics. We also send information to women through text messages. It saves time and reduces pressure. It has reduced the crowd at the clinics daily”.

Similarly, in Kaduna State, a health care provider confirmed the use of mobile phones:

“In this health facility, we have volunteers and community health care providers monitoring pregnant women and mothers. They (volunteers and community health care providers) monitor their health using mobile phones and we can call the women directly to find out about their health. Pregnant women and mothers also call us when they need help or during an emergency. Most of the women who are registered with us usually contact us on the phone, even at odd hours, and we listen to them”.

In Imo State, the use of the mobile phone for MCH care was a little different. Besides its use for sending text messages and calling mothers, the health care provider also indicated that: “Sometimes, I make audio recordings of health talks which I transfer to their (mothers’) phones through Bluetooth or file-sharing application or the Internet, especially those with android phones”.

Besides the reported applications of mobile phones described, the health care provider described the specific application of other ICT tools. In Imo State, the health care provider stated that: “Apart from face to face chat; we have digital video disk (DVD) containing video recordings on the care of mother and child during pregnancy. So we play the DVD for mothers to watch during antenatal clinics. We do this while taking the vital signs of the mothers”.

A health care provider in Kaduna State stated that:

“Like I told you we use Power-point slides and projector for our presentation. My specific role is to prepare the information on slides. We normally use this during antenatal and postnatal visits”.

Some health care providers involved in the *Abiye* project in Ondo State also indicated the use of other ICT tools. In Ondo State, health care providers reported that they use other ICT devices, like iPad and laptops for generating monthly reports, which they normally send to

the State Ministry of Health by email. The monthly report often contained statistics and other information indicating the total number of antenatal visits, postnatal visits, child immunisations and deaths. They no longer travel down to the state capital to submit the report. The use of the Internet by health care providers for MCH information was also reported in Imo State. The health care providers in Imo State reported using it for referrals during emergencies, preparing Microsoft Power-points slide for health talks and sharing of MCH information with mothers.

Regarding the use of radio for communicating MCH information, the health care providers reported its use to support on-going ICT projects for maternal and child health care in the health facilities. A major programme mentioned by one health care provider was the “Mother and Child programme” on Radio Nigeria. This programme was usually anchored by health care providers from the state ministry of health. They are designed to support on-going e-health projects in the states.

### **MCH information communicated via ICT by Nigerian health care providers**

The different types of MCH information disseminated to mothers were revealed during the interview sessions with the health care providers. Health care providers in the four states sent appointment reminders, health tip during emergencies, information on family planning, how to treat cold, catarrh, diarrhoea, and nutrition in pregnancy (See Table 3).

**Table 3: MCH Information health care providers communicate to mothers via ICT**

| S/N | Type of MCH information   | Ondo | Imo | Kaduna | Gombe | Total |
|-----|---|------|-----|--------|-------|-------|
| 1   | Appointment reminders on antenatal/postnatal visits, immunization | √    | √   | √      | √     | 4     |
| 2   | Health tips on what to do during emergencies                      | √    | √   | √      | √     | 4     |
| 3   | How to treat common cold and catarrh                              | √    |     | √      | √     | 4     |
| 4   | How to treat diarrhea in children and during pregnancy.           | √    | √   | √      | √     | 4     |
| 4   | Nutrition in pregnancy  | X    | √   | √      | √     | 3     |
| 5   | Family planning   | √    | √   | √      | √     | 4     |

√ = Used, X = Not Used    N = 9    Source: Field Note of Interview with health care providers

## **ICT use and mixed impacts on clinic attendance, maternal health practices and outcomes**

A major influence of using ICT for health talks during antenatal and postnatal visits was identified by health care providers. The interviewees (health care providers) reported an increase in the use of health facility as a result of the use of mobile phones for appointment reminders and communicating health tips to pregnant women and mothers. In Gombe State, a health care provider highlighted this:

“We had a a great improvement in the turnout of pregnant women. Before, only 10 or at most 20 pregnant women visited the clinic; but now we record 60 women coming for antenatal service in a day. They are becoming more aware of the health information and services we are providing”.

Similarly, in Ondo State, a matron stated that: “Our workload has increased; more women are coming to the clinic because of the *Abiye* programme. So we have more work to do”.

However, the response from a health care provider in Kaduna State indicated a different outcome. An expression from the health care provider showed that adopting ICT for MCH care may also help to control crowd at the health facilities. For example, a health care provider in Kaduna reported that:

“Because most of the time we pass information to pregnant women through text messages, it saves time and pressure. It has reduced the crowd we attend to daily, while we still maintain a good number of registered pregnant women. ICT has also made our follow-up for nursing mothers effective, especially for the immunisation of their infants”. A lot the mothers were able to complete the one-year routine immunization for their babies.

In Ondo State, a health care provider stated that: “The major outcome I can see is that several women can now access health information and services easily, even when they cannot get to the hospital”.

Another effect observed, in Ondo State by a health care provider was the effect on the infant death rate. The use of ICT by health care providers led to a reduction in the occurrence of *Makije* (the deaths of newborns within the first week after birth) which is a major health challenge in Ifedore Local Government Area. This was how the health care provider in Ondo State put it:

“We normally experience *Makije* (the deaths of newborns within the first week after birth) in this area, but we observed that after the *Abiye* programme (Safe Motherhood e-health project) was launched, the death of newborns within the first seven days of life has reduced”.

Apart from the influence of ICT use on the use of health facility, access to MCH information and mortality, the health care providers also reported the impact of the use of ICT for MCH care on their daily schedule and the attitude of health care providers.

The matron in Imo State noted that:

“We have experienced great changes. The use of ICT changed the attitude of our staff and has made the job easier; everyone wants to be involved in the project”.

A health care provider in Ondo State argued that:

“Our workload has increased; more women are coming to the clinic because of the *Abiye* programme. So, we have more work to do”.

These results indicate that using ICT tools for MCH care can boost the morale of health care professionals and at the same time may increase the workload of the overburdened care giver which may constitute a major inhibitor to using ICT for MCH care.

## **Constraints of using ICT for MCH care**

The health care providers identified the cost associated with using ICT for MCH care as a major challenge. Health care providers sometimes bore the cost associated with the use of ICT tools, especially mobile phones and the Internet. Except for Ondo State and Imo State where the cost of using ICT tools (mobile phones) was borne through corporate social responsibility by a telecommunication company (Globacom Limited), and the Federal Medical Centre - Owerri respectively. The ICT-based interventions in the other states were initiated by not-for-profit organisations and state governments.

Apart from the cost associated with using ICT tools and services, health care providers also expressed concern over unreliable power supply in the health facilities, especially when using laptops, projectors or DVD/TV during the antenatal clinic. As a result, they usually missed the opportunity to use the ICT tools when there was a power outage. This issue was highlighted in the four states. For example, a comment on the issue by one of the health care providers affirms this: “We are usually unable to use projector and laptops during antenatal clinics when there is a power cut. So, we are left to do health talk (Face-to-face chat) without any ICT tool”.

A constraint unique to Ondo State indicated by a health care provider is the challenge of double registration. After the initiation of the *Abiye* programme, some mothers in the community saw the introduction of mobile phone for MCH care as an opportunity to own a phone for free, and not just to access MCH information and services. Thus, they end up registering in more than one health facility so that they could have a double portion of the *Abiye* delivery kit. Besides these three issues, the health care providers in the four states were also dissatisfied with the irrelevant or unexpected calls made by mothers to them (health care providers) at odd hours.

## **Discussion**

The adoption of ICT for MCH care by health care providers is still evolving in Nigeria. Health care providers in Nigeria use ICT tools such as mobile phones, projector/laptop, Internet, radio, television/DVD and public address system for MCH care. The use of ICT tools made MCH care more interesting for the respondents (health care providers) involved in the study. This may probably be due to the association of ICT tools for patient care with advanced clinics<sup>23</sup>.

The use of ICT tools for MCH care by health care providers also resulted in more women using the health facility after receiving health tips via ICT tools. These results underscore the belief<sup>24</sup> that using ICT to enlighten people about their well being can attract users to such service. This may be the underlining reason for an increase in the use of available MCH service when appointment reminders were sent to mothers. This result supports the finding obtained from a similar study in and Kenya<sup>25</sup> which reported an increase in the number of facility deliveries. Similarly, in Rwanda<sup>20</sup>, the use of mobile phones for sending text messages on MCH information increased the use of health facilities. More mothers attended antenatal clinics because they received regular alerts on child nutrition sent via mobile phones. Consequently, facility deliveries increased by 27% at the end of the one-year study<sup>26</sup>. The number of home deliveries was also reduced from 104 per month to 65 per month<sup>27</sup>.

Using ICT tools for MCH care has encouraged the adoption of MCH practice like the uptake of immunisation. The findings align with those obtained from the Every Child Count project<sup>25</sup> and MOTECH project in Ghana<sup>28</sup> where mothers were influenced to take immunization and also attend more antenatal and postnatal visits by regularly sending information on vaccination. This result further confirms the behavioural change theory that providing people with information can change their beliefs, attitudes and behaviours<sup>29</sup>.

Health care providers' use of ICT tools can also improve health outcomes as health professionals can promptly refer pregnant women and infants during emergencies. For example, one of the respondents highlighted a reduction in the death of infants (*makije*) within the first week of life. This impact was earlier reported in Tanzania in a study by Nyamawe and Hassan<sup>30</sup> where the maternal and neonatal rates reduced from 529 per 100,000 live births to 454 and 88 per 1000 births to 51 respectively for a ten-year period.

Nonetheless, the adoption of ICT for caring for pregnant women and infants comes with a few challenges. One of the challenges is the issue with the power supply identified by the study participants. Unreliable power supply is a major constraint that affects adversely the sustainability of ICT-based project and the opportunity to maximize the gains of ICT for MCH care and outcomes. Health care providers sometimes missed the opportunity to use projectors/laptops during antenatal clinics and were usually unable to recharge their phones when there was a power outage. Another concern highlighted by the health care providers, especially with using mobile phones for MCH care is the problem of irrelevant calls at odd hours. This could discourage health care providers from using ICT platforms for MCH information services and care.

Despite the temporary loss of power and occasional reduction in the use of ICT, plus the irrelevant calls and increase in workload; using ICT for MCH care was still impactful, especially regarding reduction in infant mortality and the increase in the number of women reached by skilled health professionals. It is therefore very important to address these constraints; otherwise, the Nigerian health sector may fail to take the full advantage of the opportunities ICT offers for MCH care.

## **Conclusion and Recommendation**

This study has shown that adopting ICT for MCH care can lead to a rise in the demand for MCH information services and care in public health facilities in Nigeria. ICT tools used for MCH care in these facilities are, Internet/computer, television/digital video disk and radio, with the mobile phone being the most popular. Using ICT tools for MCH care can improve health outcomes and the adoption of safe health practices. Hence, it is important to replicate harmonized and integrated ICT-based projects that can be implemented nation-wide to harness the potential of ICT for improving maternal and child health.

The low use of ICT such as Internet indicates the need to improve power supply and supportive ICT infrastructure to maximize the gains of ICT tools for MCH care. Health care providers (supported by the Nigerian government) needs to fully adopt ICT for MCH information services and care at all levels of care. Health facilities in Nigeria should be adequately equipped with ICT infrastructure; such as, mobile phones as well as toll-free lines for out-patients and reliable Internet services that would promote maternal and child health services. To overcome the challenge of cost, ICT-based project for MCH should be integrated into the corporate social responsibility activities of GSM companies in Nigeria. This will help to subsidize the cost of ICT gadgets and the charges attached to their use. The challenge with the unreliable electricity supply can be addressed by providing alternative power supply such as power banks, solar energy kiosk, inverters or generators.

In general, this study highlights the important role ICT tools can play in improving MCH care. However, the study is not exhaustive as it did not consider how health care providers use ICT tools in private health facilities in Nigeria. Similar research could be replicated in private health facilities in the country that implement similar projects for MCH in Nigeria. Future research can also focus on the evaluation of e-health information products and services for MCH provided by health care providers. The impact of using ICT for MCH care

on the disposition of health care providers to work and workload can also be examined. This would provide valuable information which could be used to ensure the use of ICT for maternal and child health care in a realistic manner.

Mothers, infants and health workers are vulnerable to the deadly coronavirus. Exploring ICT for remote consultation, information dissemination and education will translate to less frequent visits to antenatal clinics. This would limit exposure to infection. Already governments institutions, businesses and individuals are being compelled by COVID 19 to use virtual platforms to transact business, communicate, counsel, conduct job interviews, hold meetings and deliver lectures. This pandemic provides the impetus for stakeholders (government, private sectors and NGO's) to accelerate and boost their investment in a robust ICT infrastructure and to strengthen the capacity of health workers to remotely serve and save the lives of this vulnerable group.

### **Limitation of the study**

The study was limited because it focused mainly on data from pilot ICT projects focusing on MCH care in Nigeria. However, the study presents a significant part of the ICT interventions as well as, maternal and child health scenario in the country.

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