

MOBILE HEALTH COMMUNICATION IN IMPROVING MATERNAL CARE IN NIGERIA

PROF. GREG EZEAH

Department of Mass Communication
Faculty of Arts, University of Nigeria, Nsukka
gregory.ezeah@unn.edu.ng, 08037728393

&

AMUSHIE SUCCESS IJEOMA

Department of Mass Communication
Faculty of Arts, University of Nigeria, Nsukka
Amushie2010@gmail.com, 08166372057

ABSTRACT

The emergence of Mobile Health (mHealth) communication has created new opportunities to enhance maternal healthcare, particularly in developing countries with high maternal mortality rates. Maternal health, which encompasses a woman's well-being during pregnancy, childbirth, and the postpartum period, is a crucial public health concern. In Nigeria, complications arising during pregnancy and childbirth contribute significantly to the high morbidity and mortality rates among women of reproductive age. Many of these complications are linked to harmful practices resulting from misinformation or a lack of proper health education. This study explores key concepts related to mHealth communication, maternal health, and mortality in Nigeria. It also examines mobile applications designed to support maternal healthcare and highlights the benefits of mobile communication in improving maternal health outcomes. The research is framed within the Technology Acceptance Model (TAM), which emphasizes that an individual's intention to adopt and use a technology is influenced by its perceived usefulness (PU) and perceived ease of use (PEOU). The integration of mHealth communication in Nigeria holds great potential for significantly enhancing maternal care services and outcomes.

Keywords: Mobile Health Communication, Maternal care, Mobile Devices, Technology Acceptance Model.

Introduction

Maternal health, which refers to the well-being of women during pregnancy, childbirth, and the postpartum period, represents a critical issue tied to a pivotal phase in a woman's life (WHO, 2012; WHO, 2016; Adamu, 2012). This includes preconception, prenatal and postnatal care that includes healthcare aspects of reducing maternal morbidity and mortality. Maternal mortality is one of the leading causes of deaths among women aged 15 to 49 across the world. Pregnancy-related death is defined as death of a woman attributable to causes related to or aggravated by the pregnancy or any resultant condition, which occurs either during the pregnancy, within 42 days of termination of pregnancy, or as a result of an otherwise unnatural termination of pregnancy (Akaba et al., 2021; Orgingene and Morgan, 2020; Fasina et al., 2020; Meh et al., 2019). In many developing nations, pregnancy-related problems claim the lives of several women every day, yet many of these deaths are preventable, according to

current research and international publications (UNICEF, 2023; UNICEF, 2022; Adesina and Adegboye, 2020; NDHS, 2018).

In Nigeria, the prenatal phase is a particularly dangerous time for many women and girls who become pregnant annually. Nigerian pregnant women are at a high risk of maternal mortality; nearly 1 in 10 die from pregnancy and childbirth related causes. Notably, this is higher than the Sub Saharan African average where 1 in 31 women face similar risks (Oreh, 2022; Adesina and Adegboye, 2020; Ogu and Ephraim-Emmanuel, 2018; WHO Factsheet, 2017). Nigeria's maternal mortality rate in 2017 was 917 per 100,000 live births, but that increased by more than 14 per cent between 2017 and 2020, up to approximately 1,047 per 100,000 live births (WHO, 2022; World Development Indicators, 2021). It has been revealed that the nation is one of the leading contributors to deaths during pregnancy and childbirth globally.

Major contributory factors to the high morbidity and mortality associated with women of reproductive age in Nigeria are major pregnancy and delivery problems (Adamu, 2011; Cooke and Tahir, 2013).

Due to a lack of knowledge about available health services and the symptoms of pregnancy complications, many pregnant women use unhealthy practices, which have been linked to these complications (Federal Ministry of Health Nigeria, 2011; Doctor, Bairagi, Findley, Helleringer and Dahiru, 2011). High maternal mortality has underlying effects for children under five's survival as well as the social and financial well-being of families at the micro level. At the macro level, poor productivity levels in many nations have been related to high rates of maternal and infant mortality, which has cost the world some \$15 billion (USAID, 2001; Joshi, 2012).

Communication is fundamental to human interaction and plays a central role in all aspects of life, from personal relationships, social interactions, business transactions, education, and healthcare (Beebe, 2020). Communication is no longer considered an optional component but is now recognized as a central element in healthcare delivery and public health. Health communication involves the strategic sharing of information, education, and messages designed to promote health, prevent diseases, and shape health-related behaviors within a population (WHO, 2021). It encompasses various channels, including mass media, interpersonal communication, community engagement, and digital platforms. Effective health communication seeks to raise awareness, increase knowledge, change attitudes, and motivate individuals and communities to adopt healthy behaviors and lifestyles.

The advancement of mobile phone technology has paved the way for mobile healthcare services. Mobile internet connectivity when combined with such technologies enables uninterrupted access to healthcare resources throughout all spaces and times. Such complete connectivity works as an essential requirement for successful mobile health communication systems. The swift proliferation of mobile technologies in healthcare's systems has catalyzed the emergence of mobile health (mHealth), a dedicated discipline focused on delivering health related resources and services via portable digital platform. mHealth communication represents an innovative domain within healthcare, where medical information, guidance and interventions are disseminated through handheld devices to enhance accessibility and patient engagement. These include, but are not limited to, mobile applications, social media platforms

or even SMS/health text messaging. According to the Nigerian Communications Commission (NCC), smartphone penetration in Nigeria has been on the rise, with over 196 million active telephone subscribers and 143 million internet users recorded in June 2020, reflecting increases of 12.6% and 17.2%, respectively. It is projected that smartphone penetration will reach 60% by 2025. This upward trend presents a significant opportunity to enhance maternal care by providing timely health information, improving communication between healthcare providers and patients, and supporting data collection and monitoring efforts.

A number of measures are still being implemented by Nigeria for offering maternity healthcare to all citizens. At the 2014 Presidential Summit, Nigeria reaffirmed its commitment to ensuring universal healthcare coverage whilst by 2030 projections, identify that this initiative could avert the death of up to 309,000 maternal fatalities (Abubakar et al., 2022). Therefore, the attainment of this goal makes an urgent need for developing, implementation and evaluation of innovative, context specific and sustainable health interventions. These interventions should thus aim to decrease harmful practices, enhance health care accessibility, and stimulate women to attend to healthcare from trained medical professionals. For example, mobile health communication to improve maternal health outcomes is one such example for intervention.

Mobile Health Communication

Mobile health communication (mHealth) gives the service and information of healthcare through mobile technologies. In accordance with the World Health Organization (WHO, 2011), mobile health (mHealth) encompasses the application of portable technologies such as smartphones, remote patient monitoring tools, digital assistants, and similar devices to address clinical and population health challenges. These tools facilitate healthcare delivery by bridging gaps in medical services and advancing public health objectives. However, HIV self-tests have been recognized as an effective tool for improving healthcare delivery, especially when in person medical consultations are hard to obtain (Kahn et al., 2010; Chib et al., 2015; Colaci et al., 2016).

Maternal health initiatives across Africa are increasingly leveraging digital innovations such as mobile health (mHealth) platforms, to expand access to and utilization of essential prenatal and delivery care services. Studies have demonstrated that these programs successfully improve pregnant women's self-efficacy by presenting pertinent health information to pregnant women, improving two-way communication between healthcare providers and pregnant women, increasing utilization of health facilities (Oyeyemi, et al 2014; Okonofua, et al 2022).

Mobile health (mHealth) platforms empower individuals to autonomously track and manage their healthcare needs remotely, functioning as a digital tool that promotes self-directed health monitoring and intervention. The research is that information systems are in place for maternal healthcare in developing countries and information and communication technologies (ICT) can help apply many of the services offered (Yvonne et al., 2018). Dalton et al. (2018), through a comprehensive review of existing research, highlighted that many smartphone applications for maternal education have been clarified to help socially disadvantage pregnant women.

A mobile health tool called Text4Life was created to improve women's utilization of medical facilities and give pregnant women and 12 healthcare professionals two-way contact. It also helps pregnant women feel more confident by giving them pertinent health information.

Maternal Mortality in Nigeria

Despite sustained international efforts to curb maternal mortality, it persists as a critical global health challenge. As of 2020, the worldwide maternal mortality ratio (MMR) stood at 223 fatalities per 100,000 live births, reflecting ongoing disparities in healthcare access and outcomes (WHO et al., 2023). As Africa's most populous nation, Nigeria, accounted for 28% of global maternal fatalities and reported the highest maternal mortality ratio (MMR) worldwide with 1047 fatalities per 100,000 live births in 2020 (WHO et al., 2023). Statistically, a Nigerian woman faces a 1 in 19 probability of experiencing life-threatening pregnancy- or childbirth-related complication. Despite these persistent challenges, global initiatives strive to reduce the worldwide MMR to under 70 deaths per 100,000 live births by 2030, aligning with targets set by international health organizations (Kassebaum et al., 2014; WHO, UNICEF, UNFPA, 2015). However, East Asian and Latin American nations are expected to make progress, Sub-Saharan African (SSA) nations are probably going to fall short of global goals (Nicolai et al., 2015).

Enhancing maternal health outcomes begins with a thorough understanding of the root causes behind maternal fatalities. According to the World Health Organization (WHO, 2011), maternal mortality is defined as the death of a pregnant individual resulting from complications directly or indirectly linked to gestation, prenatal care, or childbirth, excluding fatalities stemming from unrelated accidental causes. These deaths may occur at any stage between conception and 42 days following the conclusion of pregnancy. This notion separates maternal deaths into two categories which include diseases of obstetrics as direct obstetric deaths alongside indirect diseases of obstetrics. Direct mortality is caused by obstetric issues during pregnancy, childbirth, and the postpartum phase. Pregnancy-exacerbated cardiovascular conditions or pre-existing illnesses like HIV are the causes of indirect obstetric fatalities. Hemorrhage emerged as the leading contributor to maternal mortality, accounting for 27.1% of cases, followed by hypertensive disorders (14%), sepsis (10.7%), and unsafe abortion (7.9%), of maternal deaths according to a study Say et al. (2014). It has been established that multiple maternal deaths could be prevented so maternal health literacy must become a priority. Women can achieve these results by developing obstetric warning sign recognition alongside skilled professional healthcare during pregnancy plus childbirth and postpartum care.

The use of mHealth in Maternal Healthcare

mHealth, a type of digital health, is the term used to describe the use of electronic or mobile technology in maternal health initiatives. The sharing of health-related data via mobile devices is the primary element of mHealth. Coded data, text, photos, audio, and video are all examples of information (Amoakoh-Coleman et al., 2016). Applications for mHealth are praised for being affordable and available, especially to poor and excluded groups. They have been suggested as practical ways to enhance the health of expectant mothers and babies. According to a systematic analysis, mHealth treatments more than doubled women's attendance at prenatal care in low- and middle-income countries (Amoakoh-Coleman et al., 2016).

In Nigeria, the Abiye project, a mHealth initiative, reduced maternal mortality in Ondo State, increased facility utilization, and gave women free cell phones. During obstetric problems, this strategy allowed pregnant women and their healthcare practitioners to communicate in both directions (Oyeyemi & Wynn, 2014a). According to other research, mobile phone applications that give pregnant and postpartum women health information boost their self-efficacy (LeFevre et al., 2018). In Sierra Leone a mHealth intervention, enabling two-way communication between traditional birth attendants (TBA) and healthcare professionals, allowed for referral of women to health facilities (Sondaal et al., 2016). A low-cost technique for determining the spatial and temporal pattern of malaria in Uganda was made possible by the combination of mHealth and geographic information systems. This enhanced the capacity to address the condition effectively, particularly among expectant mothers (Larocca et al., 2016). Mobile health (mHealth) can be used for maternal care in the following ways:

Health education and awareness: the ability to disseminate health education and awareness, mobile platforms can deliver crucial information to pregnant women and new mothers through SMS, voice messages and mobile applications. These messages can cover a wide range of topics, including prenatal and postnatal care by providing guidelines on nutrition and exercises; educating women about symptoms of potential complications like preeclampsia; tips on breastfeeding etc.

Appointment Reminders and Follow-ups: mHealth solutions can automate reminders for antenatal care (ANC) visits, vaccinations and postpartum check-ups. These reminders help to make sure that women stick to their healthcare schedule and decrease the odds of complications facing mother and infants alike.

Remote Consultations and Support: telemedicine services facilitated by mobile technology allow pregnant women, especially those in remote or underserved areas to consult healthcare professionals without the need to travel. This access is vital for managing pregnancy-related issues and emergencies.

mHealth For Maternal Care in Nigeria

There are a lot of creative mHealth applications. Applications that address monitoring, emergency interventions, and maternity care and wellness. In 2011, the World Health Organization (WHO) evaluated and endorsed multiple innovative health technologies deemed capable of addressing critical health gaps and tackling persistent global health challenges.

Maternal health has made extensive use of mHealth. These consist of smartphone applications such Health e-Babies (Dalton et al., 2018) and Winsenga (Indaba, 2014). Winsenga is a mobile application that uses a phone to track a fetus's heart rate (Indaba, 2014). A mobile application, Winsenga uses a phone as a method to track a fetus's heart rate (Indaba, 2014). In this sense, this app is newly technical advancement of Pinard Horn app that many rural midwives use to record the heart rate of the fetus during pregnancy. Not only is the app a painless form of testing that delivers results in two minutes, the system is designed to be low -cost and prioritizes healthcare equity, aimed to deliver prompt prenatal and maternal care access to expectant mothers in underserved or geographically isolated rural areas.

The health eBabies application (Android based maternal health software) , aims to empower pregnant individuals by delivering tailored guidance on early pregnancy indicators. By offering evidence-based insights, the tool seeks to enhance users self-assurance and alleviate concerns related to prenatal health challenges. This app explains to users that if their pregnancy has any issues, which app should you go to (the nearest medical facility), (Dalton et al., 2018). McNabb et al. (2015) reported that the Commcare app was developed for assisting especially Nigerian community healthcare extension workers (CHEWs) in providing maternal healthcare services to pregnant women residing in urban areas.

Patient data is recorded in real time with this app, guiding CHEWs through prenatal care procedures (McNabb et al., 2015). Thirteen audio segments for health education are included in this app to enhance client counseling (McNabb et al., 2015). Ezeanolue et al. (2015) emphasized Nigeria's dominant telecommunications sector in Africa, with mobile networks catering to over 114 million subscribers and delivering extensive mobile internet coverage via multiple operators. This makes mHealth a promising tool for reducing pregnancy-related mortality and improving maternal healthcare services. West (2015) further noted that Nigerian doctors developed the CliniPAK mobile program, which utilizes touchscreen tablets to assist in managing patient data. However, this application is not designed for self-management and does not provide maternal healthcare support for women in remote communities.

Text4Life another mHealth initiative was built around a Python and Django programming language open-source framework. To enable the swift reporting of pregnancy-related incidents and efficient communication with medical facilities, the system utilizes a custom web user interface developed specifically for the project by Textit®.

Pregnant women and healthcare professionals can communicate in two ways thanks to technologies based on SMS systems. In addition to supporting community pregnancy documentation, it serves as an alarm system. Through an mHealth initiative, expectant mothers are provided with targeted educational content covering pre-pregnancy planning, antenatal care, childbirth preparation, and postpartum recovery. Enrollment in the program requires participants to have mobile devices access (Personal or shared), register their location, phone number, and emergency contacts (primary and secondary relatives). A nominal enrollment fee 2,000 Naira grant membership to a localized health support network, which funds community-based maternal care services (Dansharif et al., 2021)

Text4Life, a technology emergency response system, empowers expectant mothers to rapidly arrange transport to nearby health centers during emergency obstetric situations, ensuring timely access to critical maternal care. By sending a specific keyword via SMS to a designated number, a pregnant woman can signal the need for urgent assistance. This alert is transmitted as a dual SMS, notifying both the healthcare facility and the person in charge of arranging a community driver to transport the woman, ensuring that medical staff are prepared to receive her upon arrival. Prenatal care, labor, postpartum care, and referral services at their main healthcare facilities are provided free of charge to women enrolled in this program. Since June 2019, when Text4Life was launched, there are 1,620 expectant mothers who have registered.

Theoretical Framework

Technology Acceptance Model

Davis' (1989) Technology Acceptance Model (TAM), is one of the most popular framework used to understand the acceptance and adoption of the technology among his users. The contribution is that two important factors influencing people's intention to use (ITU) and actual usage behavior of a technology are perceived utility (PU), and perceived ease of use (PEOU). **Perceived usefulness** quantifies how people believe a new innovation will help them complete activities and reach goals or outcomes. As a result, they are more likely to fully embrace the new technology, given their increased willingness to utilize it. The term **perceived ease of use** refers to how people perceive an innovation to be simple to understand and apply, as well as intriguing and enticing. This could involve elements like how easy it is for beginners to understand and how it would enable them to "do the job" quickly and effectively. People's mindset and their desire for innovation, as well as for using and benefiting from it will be strengthened, if they thought that innovation was easy to use.

This stems from mHealth initiatives having a connection to the topic as perceived use and ease of use are an important factor for pregnant women where they accept mHealth initiatives. mHealth by leveraging mobile health platforms to disseminate real time health updates, send automated reminders for prenatal visits, and facilitate virtual consultations with healthcare providers, maternal health outcome can be substantially improved. These technologies streamline access to critical care resources, ensuring consistent and equitable support for pregnant mothers.

Conclusion

Maternal mortality in Nigeria is a very dangerous issue that must be dealt with as a matter of urgency. Globally, Nigeria holds the third-highest rate of maternal death, with approximately 1,047 fatalities occurring per 100,000 live births. The alarming statistics places the nation above neighboring countries such as South Sudan and Chad in material mortality rankings. surpassing figures for South Sudan and Chad. The opportunity to improve maternal healthcare in the country using Mobile health (mHealth) communication is promising. MHealth offers a timely health information, assists with remote consultations, and facilitates timely reminders of appointments about prenatal as well as postnatal. The use of mHealth can considerably decrease maternal mortality rates and improve general maternal health in Nigeria.

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