International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 02 | Feb-2018 www.irjet.net p-ISSN: 2395-0072

AN ENHANCED TECHNOLOGICAL APPROACH TO IMPROVING MATERNAL HEALTH USING GLOBAL SYSTEM FOR MOBILE COMMUNICATION SYSTEM

[1]Elias Ayinbila Apasiya, [2]J. K. Panford, [3]J. B. Hayfron-Acquah

[1,2,3] Dept. of Computer Science, KNUST, Kumasi, Ghana

Abstract - *There is a rising evidence of the positive role that mobile communication devices can play in improving the health of patients. Using the stratified sampling method, data was obtained from pregnant women, nursing mothers and health workers where the services of MoTech were provided. In order to put this research within the larger development context, an extension literature review was carried out on global systems for mobile communications, related issues on maternal health as well as existing mobile aided applications such as CliniPak and MoTech.*

The outcome of the study indicates that mobile phone technology in maternal healthcare is acceptable to patients as MoTech was positively viewed by both the health workers and pregnant women irrespective of their age and educational status. However, the current scope of the system is limited to a small cross-section of the target population. In light of this, it is recommended that the medical providers take up the initiative to send patient medication regimes, appointment notices, health education related information and test results through SMS such that patients who owns non-smart phones could appreciate the mobile aided health service system.

Key Words: **MOTECH, GSM, SIM, PDA, ICT, SMS, GPRS**

1. INTRODUCTION:

How healthy a community is contributing significantly to its development in a sustainable faction. In the advanced world, people have access to highly sophisticated medical care due to the exploration and application of technology. Healthcare technologies contribute to a fifth of the GDP of developed countries [5]. On the contrary, both low and middle income countries lack access to medical information, healthcare and quality treatment. They are also faced with the problem of affordability and behavioral norms. Reduced health level, a widespread of organisms unrestrained, avoidable and non-avoidable illnesses and insufficient healthcare provisions are well-thought-out to be a main warning of people, societal, and commercial growth in emerging nations [2]. On the global front, the United Nation's Millennium Development goals four (4) and five (5) is aimed at reducing child mortality and improving maternal health [18]. The effort towards improving maternal healthcare in Ghana has rather been slow. This clearly calls for homegrown innovations that adopt technology to provide direct solutions to these challenges. The Global System for Mobile Telecommunication (GSM) is one of the technologies used in sending m-medical information to subscribers. It operates on hardware networks that include mobile phones, mobile computers (including netbooks, tablets, and personal digital assistants), pagers, digital cameras, and remote sensors. GSM solution has the potential to enable medical workers and patients to come into contact with each other through SMS, calls, or Internet-based video links instead of having to spend money to travel to the clinic or hospitals that will eventually take them a lot of time to see the healthcare personnel. Internationally, the use of portable materials which include GSM for health might rapidly produce as considerably as $60 billion annually in trade and other economic activities, based on approximations by McKinsey & Business and Price water house Coopers (Price water house Coopers, 2010). In the expiration of 2010 additional 70% of the global populations of 5.3 billion portable users were in the emerging economies, the rapidly-increase part of the mobile trade (International Telecommunication Union, 2010). As such a study on an enhanced technological approach to improving maternal health using Global System for Mobile Communication system (GSM) is both crucial and timely.

1.1 Problem Statement

The progress of developing countries on the lather of development have been seriously hampered by health related challenges such as inadequate resources and scares healthcare information leading to the widening of the gap between them and the developed countries. In 2013, estimates from the United Nations Fund for Population Activities (UNFPA) revealed that 289,000 women died of pregnancy or childbirth related causes. Approximation specified by the World Health Organization [24], shows that in the African continent, there is a minimum of 1000 demises per 100 000 live deliveries for maternal death, which is a big problem. Information provided by WHO [24], shows that, in spite of the determination in increasing quality medical care and access to available data associated to medical care, medical knowledge remains to be a big problem for both persons and the country as a total. In Ghana, the rate of maternal mortality reduced from 760 to 380 maternal deaths per 100,000 live births from 1990 to 2013 owing to the significant investment made in the health sector (United Nation Population Division, 2013). This however, falls short of the 75% reduction in maternal mortality targeted by Ghana under the MDG5. Thus, Ghana was unable to achieve

its target of reducing maternal mortality as it only achieved 332 maternal mortality rate in 2014, a figure which is less than 50% reduction from 1990. If this trend continues, Ghana will only be able to achieve a 75% reduction in maternal mortality rate (using 1990 as the baseline) in 2037. Additionally, once talking about medical delivery materials and work provision, getting quick medical attention is a huge problem because of bad access roads and unsatisfactory ambulance attention and means of transportation. Furthermore, medical service providers' capacity to produce operational and current regular information and maintain sick people medical histories up-to-date for appropriate analyses is a big problem in Ghana. As such, a study on an enhanced technological approach to improving maternal health using global system for mobile communication system (GSM) becomes useful.

1.2 Research Aims

The overarching aim of the review is to document an enhanced technological approach to improving maternal health. In principle, the research tries to accomplish these precise aims;

- To find out variables that affect the adoption of portable applications in medical care at the Kassena Nankana West District in the Upper East Region of Ghana
- To examine the challenges that women face in the use of mobile aided maternal services in the Kassena Nankana West District
- To evaluate the current technological applications available for accessing maternal medical services in the Kassena Nankana West District
- To design an enhanced technological approach of providing maternal medical services

1.3 Study Questions:

In respect to the specific aims stated above, the study poses the following questions;

1 What factors influence the adoption of mobile phone applications in medical care in Kassena Nankana West District?

2 What are the challenges that women face in the use of mobile aided maternal medical services in the Kassena Nankana West District?

3 What are the current applications available for accessing maternal medical attention at the Kassena Nankana West District?

4 What improvement can be made to design and implement mobile aided maternal services in the Kassena Nankana West District?

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter focuses on the review of literature related to technological approach to improving maternal health. The key concept in the research topic such as Global System for Mobile Communications, and maternal medical are defined in this chapter. The chapter also discusses case studies of mobile technology approaches for improving health which include project Masiluleke, the Biometric treatment compliance tracking system, Operation ASHA, Clinical Patient Administration Kit (CliniPAK)-Nigeria, and Mobile Technology for Community Health-Ghana (MOTECH). The chapter further captures functions of Mobile Applications in the Medical system, the barriers to the employment of portable applications in medical attention and develops a conceptual framework for the study.

2.1 Global System for Mobile communications (GSM)

The Global System for Mobile communications is one of the widespread standards used for mobile communication in the world. Currently, the technology is used in over 200 countries by more than 3 billion people around the world. GSM technology was a second generation (2G) but there have been the third generation (3G) and beyond. Mobile phones which use the GSM possess features such as roaming across countries, Short Message Services, and utilization of Internet by means of General Packet Radio Service (GPRS) [19]. In terms of its infrastructure, the GSM has Base Location, Base Distribution and Transmitter point, Transportable Interchanging Hub, Interconnected and Interchanging Sub connections. The above listed infrastructure represents the main cores of GSM but there are also numbers of subsystems which forms part of the technology.

It operates on hardware networks that include mobile phones, mobile computers (including netbooks, tablets, and personal digital assistants), pagers, digital cameras, and remote sensors [20]. In this study, the GSM will be used in designing maternal care system. The GSM will be used to provide a medium of communication between pregnant and nursing mothers and clinicians. A Subscriber Identity Module (SIM) can be inserted into the mobile phones of pregnant women, so that in case of emergency, caution flag will be sent by Short Message Services (SMS) and a few gadgets will have voice support to converse with the patient straightforwardly.

The GSM was introduced in Ghana in the year 1996 under the brand name Spacefon by the Scancom Limited, now MTN

Ghana limited. Currently all the telecommunication companies uses the GSM network [23]. These companies include regional heavyweights such as MTN, Vodafone, Airtel, Expresso and Millicom (Operators of Tigo) and Nigeria's Globacom (Glo) [20]. As at now, GSM network and associated devises can be found in even the remote villages where the people have never even seen a computer. Estimates made in way back 2011 revealed that more than 50% of Africa's population which is about 500 million have subscribe to GSM services [19]. As a technology, GSM continues to evolve, with high-bandwidth services becoming a reality for the current 3rd and 4th Generation technologies.

The main technologies carrying m-medical information are GSM, GPRS, 3G, and 4G-LTE mobile telephone networks; Wifi and WiMAX computer-based technologies; and Bluetooth for short-range communications. These technologies operate on hardware networks that include mobile phones, mobile computers (including netbooks, tablets, and personal digital assistants), pagers, digital cameras, and remote sensors. These software platforms are just as diverse, from open-source operating systems like Linux, Google's Android, and Nokia's Symbian to proprietary ones like Apple's iOS and Microsoft's Windows 7 Mobile.

Overlaid with these operating systems are ways of capturing and processing data such as image recognition, text recognition, and text-to-speech conversion. And on all these foundations sit the millions of applications that have been developed for mobile devices, most of them accessible to the general public through online application stores.

2.2 Maternal Health

Maternal health has been defined as the wellbeing of women from the time they conceive, give birth, to post-delivery period. This comprises of different medical care components such as family planning, preconception, prenatal, and postnatal care with the aim of reducing the rate at which they die during pregnancy. Literature shows that most women die from pregnancy related illness emanating from inability to realize pregnancy danger signs on time; inability to receive the right medical treatment on time; challenges with reaching medical facility promptly; and the inability to receive emergency care at the right time [22]. In the view of [18], all the complications and associated death during pregnancy could be avoided if women are well sensitized for birth and complications.

For instance, family planning can be used in controlling the number, timing, and spacing of human births. The challenge is that it is not all people who deem family planning as appropriate intervention.

As such, motherhood exposes a lot of women especially in sub-Saharan Africa to suffering, ill-health and death. Factors such as Haemorrhage, infection, HBP, unsafe abortion and obstructed labour have been mentioned in literature as the leading cause of maternal morbidity and mortality [22].

Literatures have established that majority of the women who die from pregnancy related causes are those who lack access to sexual and health education [18]. As such 1 out of every 16 woman at Sub-Saharan Africa is at risk of dying during pregnancy or childbirth as against their counterpart in the developing countries whom only 1 in 4,000 is at risk of dying during pregnancy [22].

3. RESEARCH METHODOLOGY

3.1Research Method

This study adopted the mixed method with qualitative bias. Mixed method research approach, involves the use of both qualitative and quantitative research method. These two methods are those most commonly used for research studies of the being conducted now. When both approached are mixed up in the same research, it is commonly termed as the mixed method. According to [21], quantitative research involves the use of quantifiable parameters and observations for the presentation of findings of the study. This approach is the preferred choice in situations where the central idea of the research bothers on relationships [6]. The researcher has adopted to partly use this approach because is very beneficial in providing detailed data gathering and analysis planning for the study. Another reason for the choice of a quantitative approach is because of the inherent ability to measure the expected outcomes of the study and plan the design for the population and samples for the study. Contrary to the quantitative research approach, the qualitative research approach is more liberal and built on unrestricted responses.

[5], stated that qualitative research involves non numerical interpretation of findings and observations of the patterns of the relationship and phenomenon being studied. This approach lays emphasis on processes that is not easily quantifiable and is predominantly drawn from open-ended questions, which allow the respondent(s) to freely express their opinions.

The main object of this study is to demonstrate an enhanced technological approach to improving maternal health using global system for mobile communication system (GSM). To realize the objectives of the study, a semi-structured questionnaire is used in gathering the relevant data needed to evaluate the current MOTECH project in order to propose how an enhanced system can be designed. The semi-structured questionnaire enables the researcher to source for data relevant to meet the need of both qualitative and quantitative requirements for the study.

3.2 Analysis of Data Procedures

This data that was gathered for the research was in arithmetical or numerical, that is, in the way of figures and qualitative ways. Therefore, the results contained both descriptive and numerical investigations. With both situations the main step in respect to the analysis was to examine the validity of the facts. Integrity examinations of the facts were carried out to find out discrepancies in the data in every data gathering tool, un-suitable records and incredible entrances. The examinations were carried by hands. All the anomalies and mistakes were examined and rectified accordingly.

The numerical values and figures were entered, calculated, classified into tables and handled by the use of computer programmes such as Statistical Package for Social Scientist (SPSS) version 16 and Microsoft EXCEL programmes. Qualitative figures were carried out of, from those in quantitative form to deduce the form of results. These qualitative measurements comprised measurement of the central leaning in a sample (example, the mean) and measurement of the range of marks in a sample. Furthermore, the bottom line of numerical results was carried out by the use of charts, diagrams, numerals and rate of recurrence distribution charts.

In respect the descriptive figures, all the data collected from the participants was grouped together accordingly. The objects of data, for example, statements, were then assembled and organised into different collections in a primary manner. When a particular entry appears significant to a number of collections, then it is added through all of them. An interpretation of the groupings put forward by the participators themselves was recorded. The last stage was to make a collection of classes established on the data gotten from the earlier procedures.

3.3 Factors that influence the adoption of mobile applications in medical care in Kassena Nankana West District

3.3. 1 Whether respondents possess mobile phones

One of the most important areas tackled by the researcher was finding out whether the respondents have mobile phones. As presented in Figure 1 pregnant women indicated that they had mobile phones as against 5 who pointed out they did not have mobile phones. However, all of the medical workers and nursing mothers had portable cell phones (47) as of the period of this study case.

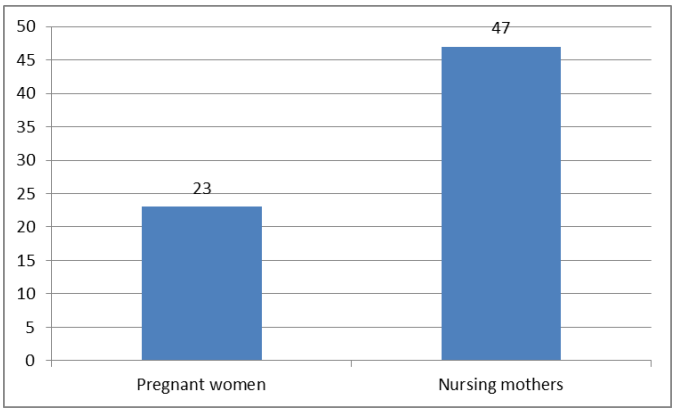

Figure 1: Possession of Mobile phones by Respondents

3.4 Assessment of the current technological applications available for accessing maternal medical services in the Kassena Nankana West District

As revealed by the Figure 2, majority of the respondents asserted that they have at one point contacted medical personnel or received medical information through mobile phone. This was supported by 78.6% of the respondents who responded affirmative to the question of whether they have ever contacted medical personnel of a hospital or received information relating to their medical through the mobile phone.

However, 21.4% of the respondents indicated that they had not contacted the medical providers to request for medical needs or received any information through the mobile phone.

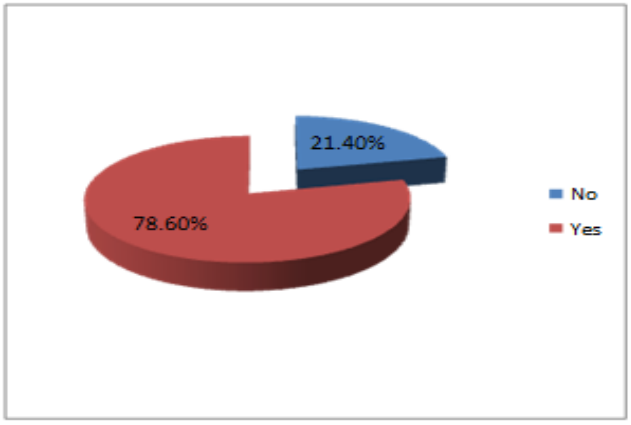

Figure 2: Current technological Applications Response by Respondents

4. Conclusion:

Mobile application aiding medical services and related technologies hold great promise for patients, particularly pregnant women in the communities. These services help

them to manage their health and other conditions, control cost associated to medical care, remain focus to medication regimes and have access to educational messages which provide them with health information. The usage of portable phone technology in maternal medical attention is acceptable to patients as MoTech was positively viewed by both the health workers and pregnant women irrespective of their age and educational status.

Bibliography:

1. Blumberg, B., Cooper, D. R., and Schindler, P. S. (2008). Business research methods (2nd European ed.). New York, NY: McGraw-Hill.
2. Casebeer, A. L., and M. J. Verhoef. (1997). "Merging qualitative and computable investigative procedures: Taking into Consideration, the opportunities for promoting the study of protracted illnesses." Prolonged Ailments in Canada 18:130-5.
3. Hackley, E. C. (2003) 'Conducting research works in advertising, administration and user investigations' London, Routledge.
4. Joppe M. (2000). The research process. [Online] Available: http://www.htm.uoguelph.ca/pagefiles/MJResearch/ResearchProcess/home.html
5. McDaniel, C. & Gates, R. (1996). Contemporary Marketing Research. West Publishing.
6. Neuman, W.L.(2003). Social Research Methods: Qualitative and Quantitative Approaches. Boston. Pearson Education Inc.
7. Saunders, M., Lewis, P., Thornhill, A., (2000) Research Methods for Business Students Second Edition, UK, Financial Times, Prentice Hall
8. Awoonor-Williams J. K, Vaughan-Smith MN, and Phillips JF. 2010. "Scaling-up medical system innovations at the community level: A case study of the Ghana experience" in Malarcher, Shawn (ed) Social Determinants of Sexual and Reproductive Health: Informing Future Research and Programme Implementation. Geneva: World Medical Organization.
9. Baldwin P., and Thomas L., (2005): "Promoting private sector investment and innovation to address the information and communication needs of the poor in sub-Saharan Africa". Washington, DC: info Dev, Alcatel. Accessed on December 12, 2012 at: http://www.infodev.org/en/Publication.11.html
10. Binka, F. N., A. Bawah, J. Phillips, A.Hodgson, M. Adjuik, and B. MacLeod. (2007). Speedy Accomplishment of the Infant Existence Millennium Development Goal: Facts from the Navrongo Experimentation in Northern Ghana. Tropical Medication and Global Health 12:578-583.
11. Blaschke S, Bokenkamp K and Cosmaciuc R. (2009): Using Mobile Phones to Improve Child Nutrition Surveillance in Malawi. UNICEF Malawi and UNICEF Innovations; May 2009.
12. Chiba A, Lwina M. O. and Anga J. (2008): Mid-wives and cellular phone: employing ICTs to increase medical attention in Aceh Besar, Indonesia. Asian J Commun 2008; 4: 348–364.
13. Clifford, G.M., Gallus, S., Herrero, R., Munoz, N., Sniders, P.J. and Vaccarella, S. (2008): Global spread of human papillomavirus kinds in cytological ordinary ladies in the Worldwide Agency for Investigation on Malignant cells HPV occurrence reviews: a pooled scrutiny. Lancet. 366(9490): 991-998.
14. Diero L, Rotich J. K. and Bii J. (2006): A computer-based medical record system and personal digital assistants to assess and follow patients with respiratory tract infections visiting a rural Kenyan medical centre. BMC Med Inform Decis Mak 2006; 6: 21.
15. Frimpong J. A., Helleringer S., Awoonor-Williams J. K., Yeji F., and Phillips J. F. (20012): Do management increase medical personnel output? Facts from the Upper East Region of Ghana. Tropical Medication and Global Health;16:1225-33.
16. Ghebrehiwet, M. & Morrow, R.H. (2002). Delay in in quest of and getting emergency obstetric attention in Eritrea.
17. Gormley R. H., Quinley K. E. and Shih T (2009): Use of portable handsets for cervical malignant cells examination in Gaborone, Botswana. http://clickdiagnostics.com/wp/ press/documents. Published November 2009. Accessed March 7,
18. O'Hara, L. A. (2006). Relation of employee and manager emotional intelligence to job satisfaction and performance. Journal of vocational behavior,68, 461-473.
19. Kaplan, J.J. (2006). Elements in Data Studies: Developing a dispositional attribution model to explain dissimilarities in the expansion of statistical know-how. Unpublished Doctoral Dissertation. [Online], http://www.stat.auckland.ac.nz/~iase/publications/dissertations/06.Kaplan.Dissertation.pdf
20. Sam, A.K. and Buabeng, E.Y. (2011): The Effects of Price Promotions on building a customer base

within the Ghanaian mobile Telecommunication Industry; The Case of Vodafone Ghana. Blekinge Institute of Technology (BTH), Sweden.

21. Casebeer, A. L., and M. J. Verhoef. (1997). "Merging qualitative and computable investigative procedures: Taking into Consideration, the opportunities for promoting the study of protracted illnesses." Prolonged Ailments in Canada 18:130-5.

22. Ghebrehiwet, M. & Morrow, R.H. (2002). Delay in in quest of and getting emergency obstetric attention in Eritrea.

23. Oluniyi D. A. (2005). Competition among the networks, accessed from http://techbaron.com/

24. WHO, (2004), www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full