The Use of ICT Tools (Mobile Phones) to Improve Awareness of Pregnancy Danger Signs among Pregnant Women in Rural Communities of South Africa

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ABSTRACT The present study investigated awareness of pregnancy danger signs, symptoms and associated factors among a group of South African pregnant women attending prenatal care clinics in rural setting. A case study approach was used. Fifteen participants were purposively selected out of a population of pregnant women in five rural community clinics. Data was collected using semi-structured open-ended interview questions. The interviewees (pregnant women aged 15 years and older, who attended 1 of 5 prenatal care clinics) were asked to tell in their own words their knowledge and awareness about pregnancy danger signs among pregnant women. The findings revealed that the participants' actual knowledge about the danger signs and symptoms of pregnancy complications was very low. Again, self-perceived awareness about pregnancy danger signs was very limited. However, it was further revealed that 93% of these pregnant women own mobile phones. The results led to a proposed Pregnancy Danger Signs Mobile Architecture Framework (PDSMAF) to provide systematic awareness education to pregnant women regarding pregnancy danger signs. The mobile architectural framework will not only improve awareness but increased quality of primary healthcare (PHC) services through better pregnancy case awareness, registration and management.

INTRODUCTION

World Health Organization (WHO) indicated that about 529,000 mothers die each year from maternal causes all over the world and greater percentage (99%) of these deaths come from developing countries (WHO 2004). Other researchers indicated that in the year 2005 alone about 535,900 women died of causes related to pregnancy and childbirth and half of these deaths again occurred in sub-Saharan Africa (Hill et al. 2005). According to Gebrehiwot et al. (2014), pregnancy is a very important event from both social and medical points of view and therefore, pregnant women should be given special care and attention by the family, community and from the health care system in every country. Pregnant women must be assisted through antenatal care to maintain normal pregnancies. This can be achieved through health promotions and disease prevention programs; early detection and treatment of complications associated with existing diseases; and birth preparedness and complication readiness planning.

During pregnancy, the danger signs are not the actual obstetric complications, but symptoms that are easily identified by non-clinical personnel (Gebrehiwot et al. 2014). Knowledge of the danger signs of obstetric complications is the first essential step for appropriate and timely referral to obstetric care. The commonest danger signs during pregnancy include severe vaginal bleeding, swollen hands/face and blurred vision. Excessive vomiting and severe abdominal pain have also been reported. Key danger signs during labor and childbirth include severe vaginal bleeding, prolonged labour, convulsions, retained placenta, premature rupture of membrane and sometimes malposition of the foetus. Danger signs during the postpartum period include severe bleeding following childbirth, loss of consciousness after childbirth, and fever. Raising awareness of pregnant women on these danger signs would improve early detection of pregnancy problems and reduces the delay in deciding to seek obstetric care (Goodburn and Campbell 2001). Fortunately, many women in rural communities in South Africa have primary health care facilities (clinics) available to assist them during pregnancy. However, the National Primary Health Care Facilities survey conducted in the year 2000 showed that only 87.4% of the clinics are able to provide antenatal care, but unfortunately services are not always provided when needed due to socio- technical problems (Viljoen et al. 2000). The inability of some of the clinics to provide antenatal care hamper pregnant women from becoming aware of early dan-

ger signs associated with pregnancy. However, the use of Information and Communication Technology (ICT) tool has the potential to improve awareness of early detection of danger signs associated with pregnancy. There has been considerable international discussion about the potential of ICTs to make major impacts on improving the health and well-being of poor and marginalized populations (Dubow 2006). The use of ICTs is growing in many areas of health communication including, patient education, decision and social support, health promotion, knowledge transfer and delivery of services (Suggs 2006).

Objectives

Thus, the objective of this research is to assess awareness of pregnancy danger signs, symptoms and associated factors among a group of South African women attending maternity clinics in rural communities. Based on the findings the researcher proposes a mobile phone architectural framework to improve awareness of pregnancy complication among pregnant women.

The proceeding sections of this study are presented as follows: related work, methods, results and discussion, proposed Pregnancy Danger Signs Mobile Architecture Framework (PDS-MAF) and finally the conclusion.

Related Work

The Reconstruction and Development Program (RDP) of 1994 provided the framework for health priorities in South Africa and formulated goals and objectives for maternal health among other health issues (The Reconstruction and Development Program 1994). In 2000, the National Health System Committee of South Africa (NHIS/SA) compiled initial Health Goals and Objectives for the country. These were then reviewed and published in the White Paper in 2000 as Health Goals, Objective and Indicators (HGOI) for 2001-2005 (Department of Health 2001). The national Department of Health, further, developeda long term strategy for 2006-2010.The objectives of the strategy included improving access to antiretroviral (ARVs) drugs for pregnant women to improve women's health and reduce maternal and neonatal mortality and morbidity (Dubow 2006). The targets included the provision of 50% maternal service facilities and trained

health professionals to assist in the prevention of mother-to-child transmission of HIV and ARV programs. Ten recommendations were made in a Saving Mothers document 1999-2001 and these targets were set to be achieved by December 2004 (Pattinson 2002). Among the ten recommendations is an annual activity, aimed at raising community awareness on the importance of safe pregnancy through quality information and education programs.

In promoting community awareness on the importance of danger signs and safe pregnancy which are of paramount importance to rural communities in South Africa, the use of ICTtool (Mobile phone) has the potential to promote and improve this awareness as set by Department of Health. ICT is defined as a tool that facilitates communication and the processing and transmission of information by electronic means (Castells 2001). This definition encompasses the full range of ICTs, from radio and television to telephones (fixed and mobile), computers and the Internet.In the present study, the ICT tool which will be considered is the mobile phone because greater percentage (93%) of people in South Africa own mobile phones. South Africa is amongst countries with the highest proportion of mobile phone users per population, with 93 out of 100 people being subscribed to a mobile phone network (Mars and Seebregts 2008). Mobile phones have become a part of everyday life and as a result it has become an important item for every individual. It has also become a very important tool for communication and it has helped in the improvement of developing countries where there is no access to telephone line networks (James and Veerstag 2007).

Some of the functionalities of mobile phones include e mailing facilities, traditional messaging and other chatting system.

Laptops which were important ICT tools ten years back are increasingly being substituted with mobile phones, since mobile phones have the facilities provided by a laptop such as internet and messaging with the mobility feature (Alexander 2008). Using mobile phones as a means of communication is the most preferred means of communication in the twenty- first century. The mobile phone has become essential devices not only among elderly people but among young people (Lenhart et al. 2010). Mobile phone usage in rural communities has increased over the years and greater number of pregnant wom-

en own mobile phones. The use of mobile phones to improve healthcare has been classified as mobile health (m-health).

Cameron (2009) defined m-health as the "delivery of healthcare services via mobile communication devices such as cell phones. The applications of m-health range from the use of text messages to improved health of the citizens to wide-scale alerts about disease outbreaks in geographical areas." HIMSS (2012) defined m-health as "the use of mobile networks and devices to support e-care. This means leveraging health care on general-purpose tools such as smart phones and Short Message Service (SMS) to drive active health activities by patients and clinicians." HIMSS (2012) further defined m-health as "the ubiquity of mobile devices in a developed or developing world is to present an opportunity to improve health outcomes through the delivery of innovative medical and health services with the use ICT."

The motivation behind the development of the m-Health field arises from two factors. The first factor concerns the myriad constraints felt by healthcare systems of developing nations. These constraints include high population growth, a high burden of disease prevalence, low health care workforce, large numbers of rural inhabitants, and limited financial resources to support healthcare infrastructure and health information systems (Kinfu et al. 2009). The second factor is the recent rapid rise in mobile phone penetration in developing countries to large segments of the healthcare workforce, as well as the population of a country as a whole (Kinfu et al. 2009). With greater access to mobile phones to all segments of a country, including rural areas, the potential of lowering information and transaction costs to deliver healthcare improves.

METHODS

The study was carried out in the North West Province of South Africa. Five public clinics in the North West Province of South Africa were purposefully selected. These clinics were selected based on their geographical locations which span across the entire province. The participants for the study were drawn from the population of pregnant women in the five clinics. In describing population, Polit and Beck (2008) indicated that it is the aggregate of cases having a common and designated criterion that is accessible as subjects for a study. A purposive sampling technique was used in selecting the participants. The study population included all pregnant women, aged 15 years and older, who attended 1 of 5 prenatal care clinics at any time during March 2013, regardless of gestational age. Three participants were selected from each clinic. The participants were selected by their pregnancy status and socio-demographic characteristics which were relevant to the study. A total of 15 pregnant women were selected and they all volunteered to participate in the study.

Data was collected through face-to-face semi-structured open- ended interviews by 6 trained female healthcare workers. The interview question covered socio-demographic characteristics which included age; education; employment; husband's education; monthly income; family size; marriage duration; consanguinity; and possession of mobile phones. The core questions were about awareness of Pregnancy Danger Signs among Pregnant Women in rural communities, which was measured at 2 levels. First, self-perceived awareness about pregnancy danger signs and symptoms were evaluated. Second, the woman's actual knowledge of pregnancy danger signs and symptoms were recorded. The interview lasted for one hour with each interviewee and was audio recorded and transcribed by the researcher. Integrity of data entry from the study was checked by another researcher. Transcripts were manually coded using Wolcott (1994) method of case study analysis techniques. After the initial coding, broad categories were identified by searching for patterns in the participants' responses.

RESULTS AND DISCUSSION

The summary of the socio-demographic characteristics of the 15 pregnant women who participated in the present study is as follows. The average age of the study group was 27 years. Most of the women were less than 30 years of age; were educated to high school level or less; and many were unemployed. The results showed that 42.2% of women had a family income of less than 2000 rand per month. Regardless of low income of many of the pregnant women interviewed, each one of the pregnant women possessed a mobile phone. Again about 28% had 3 or more children; and 37.1% were married. In all, 79.7% women experienced at least 1 of the preg-

nancy danger signs and symptoms. Many of these women (91.3%) visited a clinic as a consequence pregnancy danger signs. On the contrary, only few were informed by a doctor about the signs and symptoms of life-threatening obstetric complications.

The Woman's Actual Knowledge of Pregnancy Danger Signs and Symptoms

The participants' perceived knowledge about the danger signs and symptoms of pregnancy complications was very low. A total of 15 women (16%) recognized with, at least 4 of the 12 danger signs and symptoms included in the study, while (64%) women recognized at least 1 of these signs and symptoms. In total, 39% of the women could not recognize any of the danger signs. Overall,72.6% of women said they had general knowledge about pregnancy danger signs and symptoms, while a smaller proportion of women knew specific danger signs and symptoms by name. The danger signs and symptoms that were most often recognized were vaginal bleeding, dizzinessand vomiting. Other danger signs like swelling of face or feet, abdominal pain absence of fatal movement, intermittent headache, rupture of membranes, contraction of the uterus, fever and blurred vision were less known to many of the pregnant women. Regarding the source of information about, pregnancy danger signs and symptoms, 73.1% of women obtained information from sources other than a doctor or healthcare provider.

Awareness of the danger signs and symptoms of pregnancy complication should help women make timely decisions about medical care (Purdin et al. 2009). However a considerable proportion of women enrolled in the present study recognized fewer than 4 danger signs of serious pregnancy complications, and nearly 50% could not name any of these signs and symptoms. In addition, only approximately one- quarter of the study group reported being informed of the danger of pregnancy disorders. Further, the majority of women in the current study perceived themselves as knowledgeable about obstetric danger signs and symptoms, yet their actual level of awareness was low. Similar findings were reported by other studies of women interviewed after receiving pregnancy care, indicating a lack of awareness about pregnancy danger signs and symptoms (Nikiéma et al. 2009). This lack of

awareness is of great concern to the United Nations.

Given the critical importance of the Millennium Development Goals to reduce child mortality and improve maternal health (MDGs 4 and 5), the United Nations established in January 2011 a high-level commission to improve global reporting, oversight and accountability for women's and children's health—the Commission on Information and Accountability for Women's and Children's Health (CoIA). CoIA sought to increase the likelihood that pledges for women's and children's health are honoured and that resources are spent in the most effective way to save lives. Information and communication technology (ICT) and mobile health applications play an essential role in meeting the ten recommendations set by the CoIA which included the provision of pregnancy complication awareness.

From the discussion, it is apparent that a gap exists between claiming knowledge as reported by women and actual awareness of the signs and symptoms of pregnancy complication (Pemba el at. 2010). Therefore, it is important that health education emphasising awareness of Pregnancy Danger Signs using mobile phone technology be implemented to meet these needs.

The Need for Mobile Phone Architectural Frame Work to Improve Awareness of Pregnancy Danger Signs among Pregnant Women

The preliminary results of above research have demonstrated the feasibility of improving the quality of care through simple mobile phone,and have also suggested that remote awareness and distance training can greatly improve the knowledge of pregnancy danger signs among pregnant women. The major problem facing all pregnant women are

1. Poor knowledge and skills in early identification of high risk pregnancy
2. Poor antenatal case management
3. Poor communications between group members of pregnant women and health care providers

Introducing an ICT-supported mobile phone antenatal care architecture will seek to achieve:

1. Increased quality of primary healthcare (PHC) services through better pregnancy case awareness, registration and management

2. Better awareness and training opportunities for pregnant women.

The Pregnancy Danger Signs mobile phone architectural framework is demonstrated in Figure 1.

The Pregnancy Danger Signs Mobile Architecture Framework(PDSMAF) represents the multimodal interface of the whole system. The architecture allows a high grade of scalability in terms of both services and functionalities. The PDAMAF is a health institution architecture design to send short messages (SMS) or pre-recorded voice messages to mobile phones of pregnant women who have registered to receive antenatal care in a community. The PDAMAF provides group interaction between pregnant women via a Knowledge management service component of the PDAMAF.The framework has the following components which are described below.

Data Acquisition

Data collected by the system will be used for patient's management and monitoring. To preserve the accuracy and the continuous updating of data, different data entry modalities have been defined:

⬩ Automatic acquisition using medical devices;
⬩ Manual acquisition of parameters monitored daily by the patient/doctor/paramedic.

Patient Monitoring

The distance patient monitoring allow doctors and caregivers to be continuously informed about the health conditions of the patient. In particular, the plug-in offers:

⬩ Patient history to summarise the characteristics of the disease and therapy to follow its evolution;
⬩ Automatic alert services to remind regularly controls and to point out critical events;
⬩ Manual alert to signalize critical events for the patient health.

Decision Support Service

The DSS supports the different users to manage ordinary and extraordinary events. Using data mining algorithms and ontology the DSS is able to suggest alternative therapies; to send automatic alerts based on patient monitoring; to select interesting case studies, on the basis of real cases, to be used in learning and training process.

Data Service Gateway

The Data Service Gateway (DSG) is a service infrastructure that allows the integration and interoperability of data in the whole system. The component ensures the extensibility of the system, the decoupling between distributed com-
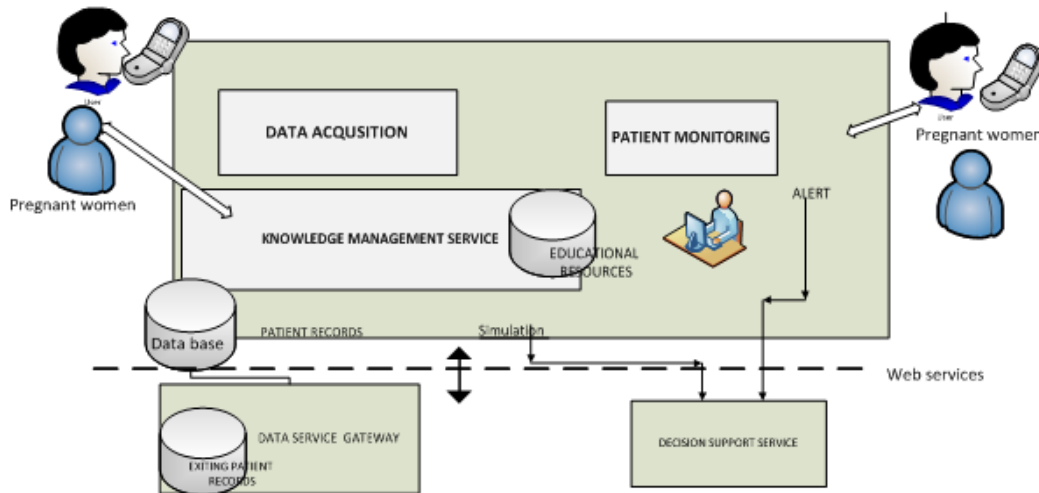

Fig. 1. The Pregnancy Danger Signs Mobile Architecture Framework (PDSMAF)

ponents, and the transparency of the communication model and the integration of the system.

Knowledge Management Service (KMS) System

This is a complex administrative system which is used to deliver electronic content in the form of SMS and voice messages to organize pregnant women who participate in antenatal services in local clinics.

The web interface is created and downloaded on the mobile phones of pregnant women who register. This is linked to a knowledge management system hosted in a clinic or hospital. The knowledge management system is monitored by a system administrator.

The system administrator group these registered pregnant women into discussion groups of 5-10.

The system administrator sends an SMS about a topic to the registered members. It generated the discussion thread where each member gives a response via knowledge management service system. The system administrator monitors the responses and finally provides a correct response from the educational resource data base and SMS it to all of them. The system will adapt a communication platform where messages can be sent in a preferred language to the recipients. Again, voice SMS messages which have been pre-recorded and stored in the educational resource data base can be sent to the pregnant women. Pregnancy quiz, games programs to educate the pregnant women can be downloaded onto the mobile phones a series of text messages that tell a story with embedded pregnancy message to the pregnant women.

CONCLUSION

Having reviewed the problems associated with awareness of pregnancy danger signs among women who attend maternity clinics in the North West Province, unpacked the importance of safe pregnancy through quality information and education programs, investigated the socio-demographic characteristics of pregnant women in rural areas, as certained the level of actual knowledge of pregnant women pertaining to pregnancy danger signs, symptoms and awareness. It was revealed that few women knew about danger signs pregnancy. Further, many pregnant women lacked awareness about preg-

nancy danger signs and symptoms which could affect them. These challenges led to a Pregnancy Danger Signs Mobile Architecture Framework (PDSMAF) to improve the awareness of pregnant women regarding pregnancy danger signs. The mobile architectural framework will not only improve awareness but promote the quality of Primary Healthcare (PHC) services through better pregnancy case awareness, registration and management.

RECOMMENDATIONS

The researcher recommended that pregnant women be given basic training on usage of mobile phone applications once a week after registering with a nearby antenatal clinic. It is further recommended that strong mobile phone signals be provided by the service providers.

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