Mobile Technology for Health Information Dissemination

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Abstract: Currently Namibia disseminates health information to the communities manually through health extension workers from the Centre for Disease Control (CDC) travelling to the communities for health campaigns, distribution of pamphlets and roadshows. Dissemination is also through community radio stations and the television. Taking into consideration that Namibia is a vast and sparsely populated country, this manual system of dissemination is not efficient and effective. The use of mobile devices has become a significant part of our everyday lives. This study is centred on the development of a prototype mobile application for health information sharing and dissemination, by taking advantage of the fact that Namibia currently has a cell phone ownership rate of 110%. The study employed a qualitative approach as the first phase of the research, applying an interpretive and a qualitative multi-case study research design. Semi-structured interviews, focus group interviews, questionnaires and document sampling were used as data collection methods to identify the system requirements for the prototype mobile application. Health personnel, IT experts, and health policy makers from two Windhoek hospitals, the Ministry of Health and Social Services, the CDC and members of the community were participants in this research study. SPSS was used to analyse the quantitative aspects of the data, while the qualitative data was reduced, rearranged and integrated to come up with a theory. The information collected focused on the distribution of cell phone ownership, current channels of health information access, prevalence of diseases, literacy levels and frequency of visits to health facilities in the sample as a reflection of the general populace. Through laboratory experimentation, the second phase of the study led to the development of a prototype mobile application. The mobile application content covers the common diseases in Namibia, their definition, the causes of the diseases, the symptoms of the diseases, how to prevent the diseases and whom to contact for information on the diseases. An expert review of the developed prototype was undertaken. The evaluations were in the areas of usability, efficiency, user satisfaction, accessibility, speed and adaptability and set the direction for future work.

Keywords: mobile technology, healthcare, health information systems, health information dissemination.

1. Introduction

Namibia faces challenges in providing health care information/services to the rural, remote and under-resourced communities. The country has a dual system of public and private health care providers with public health care providers constituting 85% of the population of healthcare providers (Smith, 2011). Namibia has 343 hospitals and clinics spread across the country, thereby making it difficult for the health care service providers to enable access to healthcare information to remote communities since the country is sparsely populated (Health in Namibia). The healthcare centers in Namibia, i.e. both public and private institutions, have challenges in distributing healthcare information to the whole population

of the country. The mobile application developed in this research for health information sharing allows members of the communities to access their health related information from anywhere and at any time without physically visiting the hospitals or clinics. The use of the mobile healthcare system will improve the process undertaken in providing healthcare services to the rural communities in Namibia (Qiang, Yamamichi, Hausman, & Altma, Mobile applications for the health sector, 2011). The Ministry of Health and Social Services (MoHSS) lacks a suitable platform where the communities and health service providers can interact with each other through a mobile application platform where awareness of diseases and health information is shared between the community and health service providers. The exchange and distribution of information within the environment can significantly address the challenge of access to health information services highlighted in the National Development Plan 4 (NDP4) (Commission, 2012). This study therefore investigated this further and recommended a mobile healthcare application as a solution to address the challenge. The study is expected to improve the way the MoHSS disseminates health information to the communities in Namibia through the development of a mobile application. This study was undertaken because this would allow members of the communities to access health related information from anywhere, anytime, without physically visiting the hospitals or health centres.

2. Related Literature

The wide spread use of information and communication technologies (ICTs) has permeated almost all aspects of life including the healthcare sector. The intersection between healthcare business processes and information systems to deliver better services is popularly known as health information systems (HIS) (Anshari, 2011) and (Tossy, 2014). According to (White, 2015), HIS is the organisation of people, institutions, and resources to deliver healthcare services to meet the health needs of target populations (White, 2015). Healthcare systems encompass all organisations, people and factions whose primary intent is to promote, restore or maintain health to ensure that health information is made available to the general public. The use of HIS is important because they help societies to access healthcare information. The World Health Organisation (WHO, 2008) report articulates that health systems are defined as comprising of all the organisations, institutions and resources that are devoted to producing health-related activities. A health activity is defined as any effort, whether in personal healthcare, public health services or through intersectional initiatives, whose primary purpose is to improve health. Furthermore, the use of HIS can allow health service providers to promote, restore or maintain health through healthcare systems technologies.

Healthcare information systems are also referred to as relationships between people, processes and technology to support operations and management in delivering quality healthcare services (Tossy, 2014). Tossy (Tossy, 2014) adds that a healthcare information system is a set of components and procedures organized with the objective of generating information which will improve health care management decisions at all levels of a health system. They are used in healthcare to devise, execute, and measure health interventions which have reliable data and performance of different parts of the health system.

Mobile health involves the use of mobile computing medical sensors, and communication technologies for health care. However, successful implementation of mobile health makes the right information available at the right place, at the right time, and in the correct form. Mobile devices are attractive platforms for delivering remote patient health monitoring services. In recent years many researches have employed mobile phones as tools for symptom monitoring in heart disease, diabetes, and other chronic diseases, and for a range of different health problems.

Mobile devices are already being used in the health domain. Mobile devices are used by health care students in a variety of ways: to log their experiences, to access information about medical conditions and drug treatment, to perform calculations, and to make basic notes (Ventola, 2014). Mobile devices have become ubiquitous in health educational settings, particularly because they are a "learn anywhere" resource for accessing information or double-checking knowledge. Health care students are increasingly relying on mobile devices as a "pocket brain" for quick, easy access to the information they need in order to succeed in their programs and careers. Resources frequently used by health care students include: online textbooks and lectures, medical podcasts, medical calculators, and search engines to look up unfamiliar terms. In addition, many mobile applications for health care students can be used for knowledge assessment, such as case study quizzes or tests to help prepare for board examinations. The ability to access all of these resources has been shown to enhance student learning in the clinical environments and to increase student knowledge scores.

Health care professionals now use smartphones or tablet computers for functions they used to need a pager, cell phone, or PDA to accomplish. Smartphones and tablets combine both computing and communication features in a single device that can be held in a hand or stored in a pocket, allowing easy access and use at the point of care. In addition to voice and text, new mobile device models offer more advanced features, such as web searching, global positioning systems (GPS), high-quality cameras, and sound recorders. With these features, as well as powerful processers and operating systems, large memories, and high-resolution screens, mobile devices have essentially become handheld computers. The widespread adoption of mobile phone technology has changed how people communicate. Mobile phone technology has also had implications for the treatment of health conditions and is playing a role in emerging treatment techniques for various conditions, including substance use disorder treatment, by providing tracking, education and support.

There are a number of real-life examples of mHealth applications, which include (Nkosi, 2011)

- A mobile application for a diabetic monitoring and assessment, namely, SapoFit. This application was customized per user to keep a daily personal health record (PHR) of his or her food intake and daily exercise. It can be used to control obesity and also to control malnutrition problems.
- The goal function of the Lactation application is to inform the risk of consuming a product during breast-feeding. It is an application for clinical professionals and families about breast-feeding compatibility with medical prescriptions, environmental contaminants, diseases, and herbal substances.
- A mobile compatible web-based tool to estimate the risk of suffering from type 2 diabetes is named Diab-Alert. This tool can help users become more aware of their risk of diabetes and initiate lifestyle changes to prevent this disease.

3. Aims and objectives

The aim of the study was to develop a prototype mobile application for community information sharing. The system allows members of the communities to access health-related information from anywhere, at any time, without physically visiting the hospitals, clinics and health centres. The objectives of the research therefore are:

- To understand how healthcare information are currently shared between the service providers and the communities in Namibia.
- To examine how information relating to healthcare can be distributed and accessed through mobile technologies.

- To develop a customised mobile healthcare system for community information sharing in Namibia.

The main research question of the study was: "What should be the features of a mobile application prototype, which will allow Namibian communities and service providers to access and disseminate information?"

The sub-questions are:

- How is healthcare information currently shared between the service providers and the communities in Namibia?
- How can health information access and dissemination be enhanced through a mobile ICT-enabled communication and dissemination mechanism?

4. Methodology

The first phase of the study was qualitative and applied a multi-case study research design. Information was sought from the different stakeholders such as the CDC, MoHSS, two hospitals in the Khomas region and the communities that then fed into the features of the application. Face-to-face semi-structured and focus group interviews were conducted with health personnel, health administrators, IT technicians from the health sector and doctors and nurses. 93 questionnaires were distributed to members of the community. Document sampling was also conducted as a data collection method. All this was done to identify the requirements for the mobile application to be developed. The questions for both the semi-structured interviews and questionnaires were developed from a critical analysis of literature, which identified gaps in research work on current health information dissemination systems and the usage of mobile applications in health information dissemination. SPSS was used to analyse the quantitative aspects of the data, while the qualitative data was reduced, rearranged and integrated to come up with a theory. The information collected was on the distribution of cell phone ownership, current channels of health information access, prevalence of diseases, literacy levels and frequency of visits to health facilities. Through laboratory experimentation, the second phase of the study led to the development of a prototype mobile application that would enable anyone to install the application on their phones in order to access general diseases information. Expert reviews were sought on the prototype and the result sets the ground for future research work.

5. Technology description

The questionnaires and interviews from the participants resulted in various findings, which led to the development of the mobile application prototype for health information sharing. According to the data collected, the most prevalent diseases were malaria, obesity, cholera, diabetes, tuberculosis, leprosy, coronary heart disease, cancer, HIV and Ebola; hence the initial application concentrates on information dissemination for such. Based on the research findings, a large number of the sample population is literate; therefore the application developed supports text-based information in addition to graphics. In addition, the study found that a large number of people visit clinics and hospitals; therefore the application will benefit even those who are not owners of smartphones but visit clinics and hospitals as well provided the clinics have access to mobile technologies. Also, the majority of the population own cell phones.

The mobile healthcare application consists of 11 modules or contents: the first content is the home. The home page has a number of buttons each representing a particular disease. For example, when you click on the malaria button you can find general information on what malaria is all about, what causes malaria to spread, what are the common symptoms of malaria, how malaria can be prevented and whom to contact should you be infected with malaria, etc. The other buttons are for diseases such as cholera, diabetes, tuberculosis,

leprosy, coronary heart disease, cancer, HIV/AIDS and Ebola respectively. Figure 1 shows the architecture of the mobile application system.

The user either uses a cell phone or via Unstructured Supplementary Service Data (USSD)/ internet, accesses health-related information from the file server that sits in the CDC/MoHSS. Alternatively, the user can request information via USSD through a network antenna. The network antenna converts radio frequency into alternating current (AC) or vice versa. From Figure 1, the database at the CDC stores information on the various diseases. A copy of the application that disseminates information is also stored on the same database. Users can register with the database for access to the application. They can download a copy of the application onto their cell phones by making a request to the CDC server. Alternatively, where the users have smartphones, the server sends the copy of the application to their Gmail and Yahoo accounts. Once the application resides on a user's cell phone, any CDC server updates on disease information can easily be broadcast to the communities.
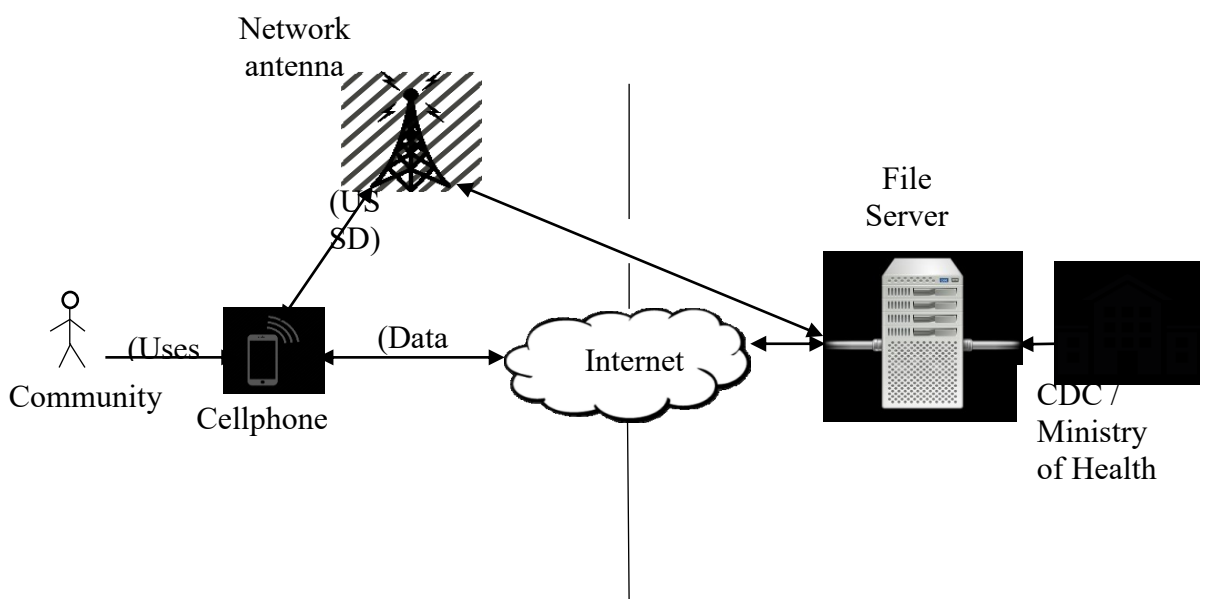

Figure 1: Architecture of mobile application system

Android Studio was used as a development tool for the application because it is regarded as an integrated development environment that provides the fastest tools for building applications on every type of Android device.
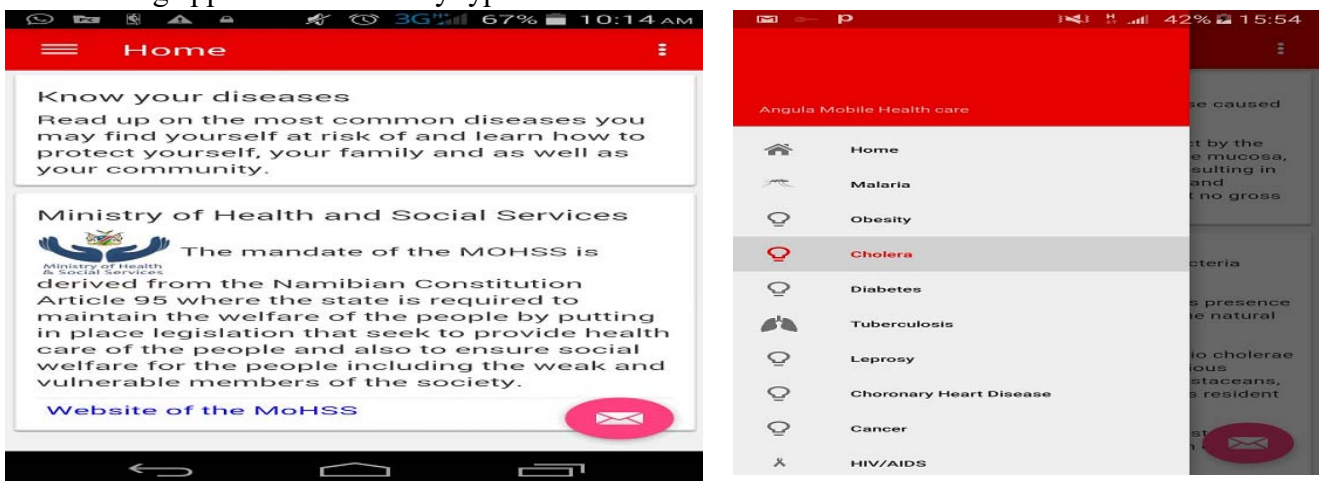

Figure 2: User interfaces

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The mobile health application consists of a home page (Figure 2a), which is the introduction to the application and the MoHSS. The next page is a listing of the diseases such as malaria, obesity, cholera, diabetes, tuberculosis, leprosy, etc. Associated with each disease is a button. When each button is clicked general information about a particular disease appears, such as its causes, symptoms, preventative measures and contact details (Figure 2b).

6. Expert reviews of the application

Three experts were consulted for the review of the application. One was from the Prime Minister's Office, as it is the office that is the custodian of the framework that approves all health information systems in Namibia, in line with laid down guidelines. The second expert was from the MoHSS as the users of the system. The third was from the UN WHO as the overseeing body on health worldwide. In the opinions of the experts, the developer should include additional features in the application such as the contact details of ambulances, hospitals, pharmacies and all related institutions. The experts also felt that the system should put into consideration the fact that there are literate and illiterate users. The experts concurred that the application was user friendly. As compared to the current way of information dissemination by the CDC, the application greatly improves the way information is disseminated. It is a cost-effective way of dissemination as it cuts down on the costs involved in travelling, production and storage of fliers and pamphlets. The cost is switched to the users as the users shoulder the communication costs in accessing the information. The advantage of the application sitting on a cell phone is that users access these devices on a regular basis. As a result, if ever any urgent information is disseminated, it reaches the communities in real time. The information therefore is accessible anywhere and at any time as long as there is network coverage. In terms of speed, the application is much faster than the manual system. The application works both offline and online.

7. Business Benefits of the application

This research study developed a mobile application prototype as an interaction channel through which information is exchanged between communities and health service providers. The outputs from the research address the challenge facing the Namibian government and the communities on access to health services. The mobile application prototype can operate effectively in rural, under-resourced and remote areas to provide health-related information to an otherwise hard-to reach population. There are a number of benefits that the developed application brings.

The application enables anyone and everyone to have easy access to general disease information through mobile phones, which are a common gadget in the Namibian population. Community members can access general disease information at anytime, anywhere, and without physically visiting any healthcare centres, clinics and hospitals. That means caregivers and communities with access to the prototype platform can access information wherever they happen to be (Boland, 2007). The MoHSS, CDC and health service providers no longer necessarily need to send health officials to the 14 regions of Namibia to disseminate health information that frequently as some of the burden will be taken over by the application. This means therefore that the mobile application prototype will support and enable the MoHSS, CDC or healthcare service providers' mandate to disseminate healthcare information to the communities and the society at large (Ackerknecht, 1982). The use of the mobile application prototype will enable healthcare service providers to achieve effective and efficient health service delivery to the communities in general (Rafael, 2007). The technology takes advantage of the fact that most of the Namibians have access to mobile technologies in the place of the traditional

media such as the radio and television (Bates, 2003). The mobile application simplifies and automates the current manual way of distributing healthcare information to the communities. This study therefore addresses the challenges faced by MoHSS, CDC and health service providers in Namibia on how community members access health-related information and how healthcare information are currently shared between the service providers and the communities and also how information relating to healthcare can be distributed and accessed by the sparsely distributed population of the country.

8. Conclusions

The challenge of access to health information by the under-resourced communities is not only a Namibian problem but cuts across the whole of sub-Saharan Africa and most developing countries of the world as well. A health information divide exists also between the public and private health institutions in Namibia. Most under-resourced areas of Namibia are supported by public institutions, taking into consideration that private healthcare is pretty expensive. With 343 hospitals and health centres spread across Namibia the current centralisation of health information dissemination through the CDC is overwhelming for this institution. No wonder access to health information by the remote, sparsely populated communities is a huge challenge for Namibia.

The mobile application developed in this research will allow these sparsely populated remote communities access to health-related information from anywhere at any time without physically visiting the hospitals, clinics and health centres which are in themselves far apart from one another. Communities have to travel long distances to get to these health institutions. With disease outbreaks occurring any time and in any part of the country, it is of profound importance that the population is made aware in real-time so as to take preventative measures. The current manual system of health information dissemination is unable to cover that gap, which the cell phone can. The mobile application developed targets the most prevalent diseases in Namibia currently. The advantage of this technology is that it is low-cost, locally-developed and customised to the Namibian environment.

The experts who reviewed the prototype concur that it would be of significant benefit to Namibia once commercialised as long as it integrates with all forms of health-related institutions including pharmacies, ambulances, fire brigade, etc. Integration in the health sector is one area that requires special attention and research. It includes integration of the hardware, software and business processes. Further research should also put into consideration the varied range of user profiles of the prototype including language differences and literacy levels to name but a few.

References

Ackerknecht, E. (1982). *A short history of medicine.* JHU Press.

Anshari, M. N. (2011). Health Information Systems (HIS): Concept and Technology.

Bates. (2003). Improving safety with information technology. *New England Journal of Medicine, 348*(25), 2526-2534.

Boland, P. (2007). The emerging role of cell phone technology in ambulatory care. *Journal of Ambulatory Care Management, 30*(2), 126-133.

Commission, N. P. (2012). *Namibia's National Development Plan NDP4.* Windhoek: Republic of Namibia: National Planning Commission.

Health in Namibia. (n.d.). Retrieved February 23, 2017, from https://www.revolvy.com/topic/Health%20in%20Namibia&item_type=topic

Nkosi, M. (2011). Improving the capacity, reliability & life of mobile devices with Cloud Computing. CSIR, Meiring Naude Road, Pretoria, 0001, South Africa.

Qiang, C., Yamamichi, M., Hausman, V., & Altma, D. (2011). *Mobile applications for the health sector.* New York: ICT Sector Unit, World Bank.

Qiang, C., Yamamichi, M., Hausman, V., & Altma, D. (2011). *Mobile applications for the health sector.* New York: ICT Sector Unit, World Bank.

Rafael, P. (2007). *Cisco secure wireless network to the point of care.* Mancha, Spain.

Smith, J. (2011). *RC hospital makes history.* Retrieved February 23, 2017, from http://www.namibian.com.na/index.php?id=78198&page=archive-read

Tossy, T. (2014). Major Challenges and Constraint of Integrating Health Information Systems.

Ventola, L. (2014). Mobile Devices and Apps for Health Care Professionals: Uses and Benefits. *Pharmacy and Therapeutics*, 356-364.

White, F. (2015). Primary health care and public health: foundations of universal health systems. *Medical principles nad practices, 24*(2).

WHO. (2008). *Support tool to assess health information systems and develop and strengthen health information strategies*. New York, USA: WHO.