UTILISATION OF MOBILE HEALTH IN ZIMBABWE

by

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at the

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SUPERVISOR: MRS KA MABOE

JUNE 2014
DECLARATION

I declare that UTILISATION OF MOBILE HEALTH IN ZIMBABWE is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

17 May 2014

Signature
(Chester Marufu)
ABSTRACT

MHealth is an upcoming area promising to contribute benefits to health service delivery. The purpose of this study was to identify and describe the rate of mHealth utilisation as well as opportunities for mHealth and the barriers to use at one central hospital in Zimbabwe. A quantitative, descriptive, cross-sectional study was undertaken at the central hospital. Data collection was done using structured questionnaires. The entire population of medical doctors at the hospital (N=42) were the respondents of the research. The 18 mHealth activities were chosen from a possible of 101 available. The most used as well as the least used mHealth activities were identified and the reasons for use or lack of use were identified.

The study revealed that 75% of the activities were currently being used and 95% had the potential of future use by medical doctors. This study highlights the potential of mHealth from medical doctors’ perspective.

KEY CONCEPTS

MHealth; mHealth potential; mHealth utilisation; mHealth types; barriers; health service delivery; mHealth benefits; mHealth challenges.
I want to thank the following persons for their respective contributions to this dissertation:

- My wife, Sphelan, for her invaluable support, unconditional love and encouragement.
- A special thank you to my supervisor, Mrs KA Maboe, for her guidance, support and encouragement.
- The Ethical Committee of Harare Central hospital for allowing me to conduct this research in their hospital.
- The Medical Research Council of Zimbabwe, for giving me permission to conduct the study.
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- Medical doctors who pre-tested the survey form, special mention to Dr Machipisa for spearheading this.
- Mr Albert Machisvo, for his assistance with data analysis and the interpretation of the statistics.
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- Mrs R Coetzer, for formatting my work.
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<td>ARV</td>
<td>Anti-retroviral medicine</td>
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<td>EDLIZ</td>
<td>Essential Drugs List and Standard Treatment Guidelines Zimbabwe</td>
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<tr>
<td>EMD</td>
<td>Electronic mobile device</td>
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<td>HCH</td>
<td>Harare Central Hospital</td>
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<tr>
<td>HIV/AIDS</td>
<td>Human immunodeficiency virus/Acquired immune deficiency syndrome</td>
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<tr>
<td>HOD</td>
<td>Head of department</td>
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<td>GMA</td>
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<td>ICT</td>
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<td>ITU</td>
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<td>MDNet</td>
<td>Mobile Doctors Network</td>
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<td>MHealth</td>
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<td>MRCZ</td>
<td>Medical Research Council of Zimbabwe</td>
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<tr>
<td>NGO</td>
<td>Non-governmental Organisation</td>
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<tr>
<td>PDF</td>
<td>Portable document file</td>
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<td>PORTRAZ</td>
<td>Postal and Telecommunications Regulatory Authority of Zimbabwe</td>
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<td>SIM</td>
<td>Subscriber identity module</td>
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<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<td>SPSS</td>
<td>Statistical Package for the Social Sciences software</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<td>UNISA</td>
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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

According to the United Nations Foundation and Vodafone Foundation Technology Partnership’s mHealth for Development report, there is no widely agreed definition of mHealth but the following can be adopted as a workable definition: MHealth is the use of mobile communications – such as personal digital assistants and mobile phones for the provision of health services and information (Vital Wave Consulting 2009:7).

According to the Postal and telecommunications regulatory authority of Zimbabwe POTRAZ (2012:2), cellphone use penetration rate in Zimbabwe had grown to 86.6% by the first quarter of 2012. In the same quarter a 7.3% decline in the number of fixed subscribers was recorded reflecting the increasing popularity of cellphones as tools for communicating and doing business.

Unlike other Southern African countries, Zimbabwe has been slowly embracing mHealth. A search on the internet on the key phrases: “mHealth use in Zimbabwe”, “cellphone use in public health in Zimbabwe”, revealed that most mHealth studies in Africa focus on disease surveillance and health data collection.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

The emergence of the mobile phone as a ubiquitous device for communication has brought thought innovations for many sectors of society, including medical doctors. A comprehensive report on the global wireless industry lists 101 specific health-related activities that can be conducted using mobile phones (Wireless Healthcare 2005:11). Despite this list being nine years old, some of the items on the list remain speculative and/or in the early phases of research.
Despite the availability of evidence of an increased mobile communication penetration rate in Zimbabwe, there is no evidence of mHealth utilisation or the progress thereof. This research looked at “patient identification and treatment activities” of the 101 suggested uses of the mobile phone in health and investigated to find out which ones had been adopted by medical doctors at one major hospital in Zimbabwe and what the adoption rates were. There is a total of 18 “patient identification and treatment” mHealth activities/uses that can be identified from that list. (Please refer to annexure 1 for the list). In most developing countries, mHealth has been initiated and supported by international donors. In Zimbabwe, three pilot projects supported by international non-governmental organisations (NGOs), are known. These pertain to the following:

- Sending of images of completed anti-retroviral (ARV) drugs consumption data forms once every reporting period from the health facility level to the central level.
- Gathering quarterly data on the use of malaria drugs using the magpi (episurveyor) application.
- Reporting weekly on incidences of disease outbreaks such as diarrhoea.

A literature review conducted by the World Health Organization (WHO) and the Millennium Villages Project suggested that most documented information about mHealth was for projects conducted in developed nations rather than developing nations (Mechael & Sloninsky 2008:3). The WHO in summarising global mHealth activities mentioned that results based evaluation of mHealth implementations was not being conducted (WHO Global Observatory for eHealth series 2011b:2).

Most mHealth pilot projects the researcher came across during a literature review were for data/information management. Few of them were concerned with actual patient treatment or care. According to an Indian electronic news site (Gomonews 2011:2), a doctor from India’s Apollo Telemedicine Networking Foundation said: “… there is a need for mobile healthcare to be driven by the needs of patients and doctors, and not by whatever the technologists are currently working on”. According to Dhanraj (2011:323), mHealth projects are now operating in a number of developing countries and some are demonstrating impact to public health. The mHealth field promises to offer opportunities to health providers across multiple sectors that include governments, businesses and non-governmental organisations (NGOs).
1.3 STATEMENT OF THE RESEARCH PROBLEM

According to the United Nations Vodafone Foundation (Vital Wave Consulting 2009:4): “There is a growing body of evidence that demonstrates the potential of mobile communications to radically improve healthcare services - even in some of the most remote and resource-poor environments”. The use of mobile phones by health practitioners in Zimbabwe for health care is relatively unknown. In conducting a literature review, the researcher could not locate information on the uptake of mHealth in Zimbabwe by medical doctors.

This study was a result of this identified information gap. Although almost similar studies have been conducted, they do not specifically address the actual service delivery by medical doctors in Zimbabwe. One such study was done in Kenya at Nakuru Provincial Hospital. The aim of the study was “to evaluate, from a stakeholders” view point, the feasibility of utilising mobile phone technology in Kenya’s reproductive health sector at Nakuru Provincial Hospital” (Ibembe 2011:2). In another study to determine how mobile communication studies can add value to the field of mHealth research in developing countries Chib (2013:70) mentioned that the available mHealth literature did not include gender focused studies. This present study looked into relationships between gender and mHealth use.

1.4 AIM OF THE STUDY

1.4.1 Research purpose

The aim of this research was to identify the status and potential use of selected mHealth activities by medical doctors at Harare Central Hospital (HCH). The research scope covered “patient identification” and “treatment” mHealth activities only.

The researcher looked at the current utilisation and barriers to adoption of the simple basic mHealth applications by medical doctors at HCH in Zimbabwe. The researcher then investigated the opportunities and potential implementation of all the 18 mHealth applications, and made recommendations that will enhance the utilisation of mHealth applications at HCH.
1.4.2 Research objectives

The objectives of this study were to:

- Identify and describe the rate of utilisation of selected mHealth patient identification and treatment activities by medical doctors, at HCH in Zimbabwe.
- Identify and recommend opportunities for future mHealth activities in Zimbabwe’s healthcare services and the barriers to adoption.

1.4.3 Research questions

The following research questions were used to guide the research:

- What are the most common rate of mHealth utilisation areas by medical doctors at HCH?
- What is the correlation between mHealth utilisation and gender/age/employment categories of doctors?
- What are the existing mHealth opportunities in Zimbabwe’s healthcare services?
- What are the barriers to mHealth utilisation encountered by medical doctors?

1.5 SIGNIFICANCE OF THE STUDY

This research contributes to the evidence-base for future decision making on mHealth at Zimbabwe’s central hospitals, by providing:

- Knowledge on adoption of “patient identification and treatment” mHealth activities at HCH.
- Information on how gender, age and employees’ employment category factors are related to embracing mHealth.
- Information on the barriers to adopting mHealth activities from the users’ perspectives. This information will be valuable for future mHealth implementers in Zimbabwe.
- Information on the available opportunities and potential of mHealth in the “patient identification and treatment areas” from the medical doctors’ perspectives.
1.6 DEFINITIONS OF KEY CONCEPTS

1.6.1 Central Hospital

In Zimbabwe this term is used to refer to the two major referral hospitals that are available in the country’s two major cities, Bulawayo and Harare.

1.6.2 MHealth

According to United Nations Foundation and Vodafone Foundation (UNVF), there is no widely agreed-upon definition of mHealth but the following can be adopted as an acceptable definition: MHealth is the use of mobile communications - such as personal digital assistants and mobile phones for the provision of health services and for collecting and coordinating health-related information (Vital Wave Consulting 2009:7).

The following are operational definitions in the study:

1.6.3 Categories of medical doctors

In the context of this study the term will be used to indicate the various levels of medical doctors as found at the central hospitals. The four categories are explained below:

1.6.3.1 Level 1 medical doctor

A recently qualified medical doctor with less than one year’s experience or no experience at all.

1.6.3.2 Level 2 medical doctor

One with more than or equal to one year but less than three years post qualifying experience.
1.6.3.3 Senior medical doctor

Also referred to as Level 3 medical doctor is one with at least three years or more post qualification experience and possibly working on further studies to specialise in a particular area.

1.6.3.4 Consultant medical doctor

Also referred to as Level 4 medical doctor is a specialist medical doctor, who has qualified to practice in a special area like a gynecologist.

1.6.4 Health facility

In the context of this study 'health facility' implies any facility that provides healthcare services whether private or public.

1.6.5 Patient identification and treatment mHealth activities

In the context of this study patient identification activities are those that are related to issues of patient registration/demographics and patient treatments are those activities related to actual treatment of patients (Please refer to annexure 1 for the list). In total 18 activities have been identified for this research. These have been categorised into two:

- MHealth activities considered simple and that do not need significant funding or corporate effort or policy to adopt.
- Those that would not be easy for medical doctors to adopt without corporate intervention, policy or funding.

1.7 RESEARCH DESIGN

The study aimed to quantify answers to questions and derive statistical conclusions and therefore a quantitative non-intervention research method was used. Data were collected about medical doctors’ utilisation of mHealth and analysed against variables of gender, age and medical doctors’ categories. MHealth prevalence among medical doctors was estimated and the study employed a cross-sectional analytical and descriptive design.
1.8 RESEARCH METHODS

1.8.1 Research setting

Only one site, HCH, was selected for the study.

1.8.2 Population

The study population was all the 150 medical doctors employed at HCH.

1.8.3 Sample and sampling

There was no population sampling as the study covered the entire population. The accessible population were the medical doctors that were available during the period the questionnaires were distributed.

1.8.4 Data collection

Self-administered questionnaires were used to collect data and these were distributed to the entire population of medical doctors at HCH. One data collector was used to distribute and collect the research questionnaires over a period of one month. Consent forms were also distributed and collected at the same time by the data collector. Chapter 3 covers in detail the data collection process employed. A sample questionnaire is attached as annexure 2.

1.8.5 Data analysis

The research employed the services of a statistician to help with the analysis of the data. Statistical Package for the Social Sciences (SPSS) software version 20.0 software application was used to capture and analyse the data from the questionnaires. Descriptive statistics were used to synthesise and describe the data. The data was presented in tabular and graphical form. SPSS software was used to investigate relationships between variables.
1.9 RELIABILITY AND VALIDITY OF THE RESEARCH INSTRUMENT

1.9.1 Validity

To ensure validity of the instrument, the following measures were taken:

- The questionnaire was pre-tested with four medical doctors. Corrections were made to the questionnaire before being distributed to the rest of the population.
- A professional statistician was consulted in designing the questionnaire.
- The questionnaire was structured in a logical format.
- By using the entire population, selection bias was eliminated.
- The size of the questionnaire was deliberately shortened so that the respondents would not find completion of the instrument burdensome, resulting in a poor response rate.
- Non discriminating items were observed and avoided in the questionnaire. Monette, Sullivan and DeJong (2002:361) states: “Non discriminating items are those that are responded to in a similar fashion by both people who score high and people who score low on the overall scale”.
- All the completed questionnaires were verified one by one by the researcher and since these were completed anonymously, no follow up questions were possible and therefore non - conforming forms were discarded.

1.9.2 Reliability

To ensure reliability of the instrument, the following measures were taken:

- The self-administered questionnaire partly used a Likert scale. Monette et al (2002:356-357) states that “improved validity and reliability, increased level of measurement and greater efficiency in handling data are the positive aspects of scaling, in general”.
- Use of ambiguous questions as well as areas of overlap was avoided.
- Explanations for the activities in question were included where necessary to clarify the meaning of that activity.
1.10 ETHICAL CONSIDERATIONS

According to Burns and Grove (2003:85), ethics in research are concerned with protecting the rights of the subjects of the research as well as others in the research setting.

The following ethical considerations were adhered to in the study:

- The permission to conduct the research was obtained firstly from the Higher Degrees Committee of the Department of Health Studies, University of South Africa (Unisa) (Annexure 4), HCH Ethics Committee (Annexure 8) and finally from the Medical Research Council of Zimbabwe (MRCZ) (Annexure 6). All approvals are attached in the annexures section of this document.
- The permission to conduct the study was also obtained from the respondents, using consent forms, before the study was carried out.
- The consent forms were distributed to and collected from the respondents at the same time with the questionnaires. Codes were used instead of respondents’ names in identifying both the questionnaires and consent forms, to ensure the confidentiality of the respondents. (Refer to annexure 3 for a sample consent form.)
- The ethical principles of beneficence and non-maleficence were considered in this study. The study did not aim to cause harm to the medical doctors through their participation.

1.11 SCOPE AND LIMITATIONS OF THE STUDY

This study did not exhaust all the possible mHealth application areas but only those falling under the selected “patient identification and treatment” category. The study only looked into mHealth applications by medical doctors and did not cover its use by patients and by other categories of healthcare personnel.

MHealth is a new field and the amount of literature available on this topic was limited. This is evidenced by the results obtained upon a literature search of the topic.
Only self-administered questionnaires were used in one hospital and there were no observations. In-depth interviews with the doctors might have yielded richer information but with the shortage of medical doctors in Zimbabwe, the researcher anticipated that securing time slots for interviews with medical doctors would be a big challenge and prolong the length of the study.

1.12 STRUCTURE OF THE DISSERTATION

This dissertation is organised into five chapters as follows:

Chapter 1 is the introduction to the dissertation and covered the background to the study, the research problem, and purpose of the study, research objectives and significance of the study, research ethics, scope and the limitations of the study.

Chapter 2 covered the literature review. It looked into existing literature on types of mHealth, its benefits and challenges. It also looked into other existing mHealth initiatives and current mHealth knowledge.

Chapter 3 outlined the study’s research design and methodology. The population, data collection, data analysis and the instrument used to collect the data were discussed. Research ethical considerations were also laid out.

Chapter 4 focused on the outcomes of the research. The results were presented and statistically analysed.

Chapter 5 concluded the study and discussed the recommendations for future research and practice.

1.13 CONCLUSION

MHealth is a new field that is developing and is being implemented in some sectors of the health domain in some countries. The current use and potential of mHealth in Zimbabwe was researched on. This chapter defined mHealth. The problem statement, aim and significance of the study were stated. The key concepts were defined and the research design was discussed in brief. Data collection and analysis was introduced
and the reliability and validity of the research instrument as well as ethics and research scope were briefly summarised. Chapter 2 will discuss the literature review in the context of mHealth.
CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review covered reports within the context of mHealth with particular focus to the following: functional areas, initiatives in Zimbabwe and other developing countries, benefits and challenges. The literature review covered the five year period from 2007-2012. The review aimed to establish on the knowledge and ideas available on the topic with the aim of identifying the gaps so that the research would not duplicate information but rather strengthen the available domain knowledge base.

2.2 TYPES OF MHEALTH

MHealth has been classified in many different terms by mHealth experts and institutions. Norris (2009:246) categorises mHealth applications as clinical or non-clinical. Mishra and Singh (2008:2) categorise mHealth systems according to target groups. The following are the target groups: hospital patients, healthy people and the chronically ill or vulnerable individual. The World Health Organization (WHO) Global Observatory for eHealth series (2011b:12), however, classified mHealth into six categories:

- Involving communication between individuals and hospitals or health care services.
- Involving communication between health care services and individuals.
- Involving consultation between the health care service providers.
- Related to dealing with emergencies.
- Monitoring and surveillance.
- Access to information at point of care in a hospital.
2.3 HOSPITAL-RELATED MHEALTH

Hospital-related mHealth was the focus of this study. Medical doctors working in hospitals are constantly on the move from one location to the other. They constantly require access to information about their work. This could be information to do with patients and medicines. The use of paper based medical records for information sharing by medical doctors is still common and paper based medical records have been failing to meet the needs of modern medicine (Shortlife & Cimino 2006:5). Mobile devices have the potential to improve accessibility to information by medical doctors. In an attempt to assess the evidence on the impact of mHealth on medical doctors’ work practices, Prgomet, Georgiou and Westbrook (2009:792- 901) carried a systematic review of available literature on mHealth and concluded that the following were existing application areas at hospitals:

- Wireless transmission of investigatory images and patient diagnosis.
- Communication.
- Mobile decision support systems to aid with patient medicines prescriptions.
- General access to patient and other work related data.

At Nakuru hospital in Kenya a research was carried out to answer the questions on whether concerned reproductive health stakeholders used mobile phones in reproductive health matters. It was observed that patients used mobile phones to consult from health providers and health providers rarely used them except only during emergency cases like deliveries (Ibembe 2011:10).

MHealth could improve the efficiency of medical doctors on patient care. In a systematic review on the use of electronic mobile handheld devices by medical doctors at hospitals in developed countries in order to examine evidence regarding its impact on the medical doctors’ work practices and patient care efficiencies the following were the outcomes:

2. In another study Prgomet et al (2009:795) compared transcription error rates when nurses used handwritten medical doctors’ prescriptions with errors when using PDAs. There were 8% errors made by nurses due to use of electronic
prescriptions compared to 22% when they used paper prescriptions. This showed that mHealth could help reduce error rates (Prgomet et al 2009:795).

2.4 BENEFITS OF MHEALTH

The introduction of mHealth in medical doctors’ work could improve the doctors’ efficiencies through rapid response and ease of communication, error prevention, and medical information accessibility. If a mobile device is interfaced with an electronic patient record, the available information improves patient management decisions by medical staff. Further, mobile phones function better than the traditional pagers due to the number of features they possess (Prgomet et al 2009:795).

MHealth when used together with electronic patient records can make hospital interdepartmental data be accessible from any point within a hospital. When used to provide treatment information to clinical staff within a hospital then the burden to memorise standard treatment guidelines is taken away from clinical staff as these become accessible from any point (Bateman 2011:2).

Remote patient monitoring has the potential of improving health outcomes and increasing access to treatment or care where transport availability is a problem, but very little has been done along those lines in developing countries. In this case the phone becomes a point of care device (Vital Wave Consulting 2009:14). In Tanzania, the Ministry of Health and Social Welfare concluded that the long distances to health facilities and lack of transport were the second and third barriers to access for health care services, the first being financial (Van Genuchten, Haring, Van Kassel & Yakubi 2012:6). MHealth could allow the better use of health care resources through remote consultation thereby allowing patients to receive healthcare from their locations. It mitigates the hardships due to travel requirements in resource limited settings. Furthermore, improvement in health outcomes is possible as patients can be diagnosed early since in certain instances they would not have to visit a medical doctor (Ganapathy & Ravindra 2008:2).
2.5 CHALLENGES OF MHEALTH

The acceptance of mHealth by end users and health care providers has been one major challenge particularly to the developing countries (Ganapathy & Ravindra 2008:2). The acceptance of the technology in the elderly is also questionable (Whittaker 2011:3).

The use of customised solutions also adds in to the concerns of rolling out mHealth in developing countries (Ganapathy & Ravindra 2008:2). Security in using mHealth applications where data being handled is of a confidential nature is also a challenge which has to be overcome (Mechael, Batavia, Kaonga, Searle, Kwan, Goldberger, Fu & Ossman 2010:29).

The mHealth field is relatively new and pilot projects are being implemented across the globe in an uncoordinated manner. Rosenberg (2013:1) reported that the implementation of pilot projects was not being well coordinated to the extent that in South Africa and Uganda the governments decided to put on hold further projects until a health strategy had been put in place that would define the working framework for these projects.

As it is a relatively new field, there is a lack of knowledge on key success factors for implementing mHealth to bring measurable health outcomes. The theory and evidence base is still to mature. Information on the working of mHealth on population targets, technology and content could steer future mHealth projects to success and point to potential areas where it should be targeted.

There is evidence of a lack of understanding of user requirements by device manufacturers. Smartphones are now coming embedded with mHealth applications but these have been criticised as having been developed with a lack of knowledge of what aspects of mHealth could work successfully (Whittaker 2011:3). Cummings (2011:5) mentioned the following as additional challenges to mHealth development:

- The non-use of indigenous languages in text messages.
- Inflexibility of the phone to send a number of characters that can allow the patient for example to describe his/her condition sufficiently.
- Unavailability of electricity.
There is a lack in availability of published information on mHealth initiatives in Zimbabwe. There are, however, mHealth initiatives on the ground according to the WHO Global Observatory for eHealth series (2011a:230), though not mentioned by name in the book. The WHO Global Observatory for eHealth series (2011b:12) reports that of all the mHealth implementations by its member states, only 12% have been evaluated.

The following were noted to be barriers to implementing mHealth in Zimbabwe: lack of policy framework, underdeveloped infrastructure and the perceived costs of implementation being too high (WHO Global Observatory for eHealth series 2011a:230).

2.6 MHEALTH INITIATIVES

2.6.1 A Global Bird’s Eye View

The WHO Global Observatory for eHealth series (2011b:9) in its survey on mHealth projects implemented worldwide by its country members states that 83% of the member states had at least one mHealth initiative in their countries, of this 83%, most (not substantiated) reported having initiated four or more types of mHealth. Of the low income countries, 77% (n=22) reported having at least four mHealth initiatives compared to 87% (n=29) of the high income countries. This shows more mHealth activities in higher income than low income countries. The four most frequently reported mHealth activities were: health call centers (59%), emergency calling (55%), managing disasters (54%) and telemedicine (49%). The least popular activities were: surveys (26%), surveillance (26%), awareness campaigns (23%) and decision support systems (19%).
2.6.2 MHealth – Zimbabwe

2.6.2.1 Mobile phone use statistics in Zimbabwe

Globally the total number of mobile cellular phone users reached almost 6 billion by end 2011, corresponding to a global penetration rate of 86%. Growth was driven by developing countries, which accounted for more than 80% of the 660 million new mobile cellular phone users added in 2011 (International Telecommunications Union 2012:1). In Zimbabwe the total number of mobile phone users increased by 10.65% to reach 10.91 million in the 2nd quarter of 2012 from 9.86 million recorded in the 1st quarter of 2012 (PORTRAZ 2012:2) (Caution: This does not translate to 10.91 million people with mobile cellphones, as many people have multiple cellular devices.). This corresponds to a penetration rate of 86%. This information highlights the continuing evolvement of the ubiquity and pervasiveness of mobile phones in communities in both the developing and developed world. The statistics could also suggest that mobile phone use will reach almost every household in the future.

2.6.2 MHealth initiatives

MOHCW Zimbabwe (2008:28) points out human resources and service delivery as some of the building blocks that are inadequate for the nation to have a functional
health care delivery system. Public sector Human Resources for Health vacancy levels (December 2008), are at unacceptable levels of 69% for doctors.

mHealth has emerged as a viable solution to serve the pressing health care needs through its high-reach and low-cost mechanism by making health care more accessible, affordable and effective across the developing world (Vital Wave Consulting 2009:36).

Mobile phones have been used in health in Zimbabwe, however, evidence based literature is difficult to find. The Zimbabwe Demographic and Health Survey (ZDHS) is a national exercise and the last one conducted in 2010 surveyed 11,000 households. ZDHS is an exercise that is held once in five years in Zimbabwe and its aim is to provide updated estimates of basic demographic and health indicators. This information is useful for policymakers, planners, researchers, and programme managers. In the previous years the exercise has been conducted using physical paper forms, however, the most recent one was successfully carried out using mobile phones (Zimbabwe National Statistics Agency 2010:15).

Mobile phones were also used during the 2008-2009 cholera epidemic. Individuals would send specific messages about cholera cases to established cholera response centres throughout the country (Ministry of Health and Child Welfare Zimbabwe 2013:2) and (WHO Global Observatory for eHealth series 2011b:22).

The WHO Global Observatory for eHealth series (2011b:25) also reports that mHealth follow up programmes for HIV/AIDS, TB and cholera patients were established for rural Zimbabwe.

### 2.6.3 MHealth initiatives in other countries

In 2009 the United Nations Vodafone Foundation Report profiled more than 50 mHealth projects taking place in the developing world. (Vital Wave Consulting 2009:5). In general high income countries have reported more mHealth use, 60%, when compared to countries in other income groups (WHO Global Observatory for eHealth series 2011b:16).
Figure 2.2  Adoption of mHealth initiatives and their phases, by World Bank income group

(WHO Global Observatory for eHealth series 2011b:17)

However, certain developing countries have embraced mHealth faster than others. Notably these are: South Africa, Rwanda, India, Uganda and Peru (Vital Wave Consulting 2009:9).
The literature review took a brief look into some of the documented mHealth projects in India, South Africa and Ghana. In line with this research, the focus was mHealth for medical doctors. There is evidence of numerous mHealth projects in both the developing and developed world but very few of those encountered in this review focused on hospital related mHealth.

2.6.3.1 India

The shortage of medical doctors in rural India implies deprivation of needed healthcare service for people in such settings. The Soros Foundation and Jiva Institute in India set up a mobile phone based application in 2003 that connected village based health
workers to urban doctors (TeleDoc). This facilitated remote diagnosis support and treatment. Medical doctors received real time diagnostic information from village health workers and were able to prescribe treatment. TeleDoc was expanded to 15 villages in Haryana, India with success (Vital Wave Consulting 2009:66).

2.6.3.2 South Africa

In South Africa a mHealth project was conducted at three major hospitals (joint initiative of the Eastern Cape Health Department, Mobile Telecommunications Network, Nelson Mandela University and global telecommunications company, Qualcomm Wireless). Smartphones were deployed in the hospitals for use by clinical staff providing them with clinical library and treatment guidelines data. The project was evaluated after 22 months. Results of the evaluation showed that 80% of the users had accepted the technology. Of the users 86.5% voted for the standard treatment guidelines available on the phone as their favourite folder. It is said that 90% of the users said it helped them improve on their knowledge of the management and treatment of various conditions. Clinical staff interviewed mentioned the immediate availability of treatment guidelines as a major benefit and in keeping up with fast changing ART guidelines, the project was relevant to the clinical staff needs (Bateman 2011:2).

2.6.3.3 Ghana

The Ghana Medical Association (GMA) with support from Switchboard a US based non-profit making organisation launched a mobile communication service for medical doctors in 2008. The network was called Mobile Doctors Network (MDNet). The service allowed medical doctors to communicate freely amongst themselves. The subscriber identity module (SIM) cards supplied with the phones would not allow the phones to call any other public phones but only those within the MDNet. They also launched a one way bulk short message service (SMS) which allowed GMA to send specified targeted messages to the health providers (WHO Global Observatory for eHealth series 2011b:36). A survey that assessed the benefits of this mHealth initiative is shown graphically below:
According to the survey, the MDNet was facilitating consultations between medical doctors. General medical practitioners could now easily contact specialists. Similarly less experienced medical doctors were now easily reaching out to advice from their experienced counterparts. Based on the success of this mHealth initiative in Ghana, Switchboard extended the project to Liberia in 2009 and also started to look at extending it to Kenya (WHO Global Observatory for eHealth series 2011b:38).

The acceptance of MDNet in Ghana could point to a potential area of mHealth use by medical doctors within hospitals.

### 2.7 MHEALTH KNOWLEDGE

According to the WHO Global Observatory on eHealth series (2011a:230), in Zimbabwe, knowledge about mHealth applications is not generally lacking. In a research conducted in Ethiopia to study the adoption of mHealth it was concluded that with particular focus to diagnosis and treatment, the majority of healthcare workers were not aware of the possibility of using mHealth to improve health care delivery. Even if the healthcare workers were not aware of the impact of mHealth, some were using it, only being unaware of the fact that they were actually practicing mHealth (Kumar & Svensson 2012:92).
2.8 CONCLUSION

Literature reviewed suggests a significant amount of work on research being done on the use of cellphones in public health. A much earlier research even suggests that cellphones have the potential to become a standard tool in healthcare (Boland 2007:129). Over 40% of the mHealth articles that the researcher came across focused on use of cellphones for massive data collection or surveillance. The second most common area was SMS use in medication uptake reminders. Of all the mHealth areas, these areas have been widely researched. Evidence on the ground on research on the actual use of mHealth by medical doctors in hospitals is not easily available. The success of mHealth in developing countries will be determined by the way it will address the needs of the healthcare providers and patients (Qiang, Yamamichi, Hausman, Miller & Altman 2012:24).

Most studies discussed in this chapter agreed that mHealth will significantly improve health outcomes in the coming years. The potential to reduce healthcare costs and improve accessibility to treatment by patients especially in remote areas has been mentioned. The success of mHealth in healthcare will depend on whether it will be embraced by the mHealth consumers (the patients and doctors/nurses). The research on the current utilisation rates and the potential of mHealth from the medical doctors or nurses or patients perspectives therefore becomes pertinent. This research will, however, not focus on patients.
CHAPTER 3

RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

The discussion from chapter 2 focused on the available literature on mHealth with a particular focus on mHealth for medical doctors. The available literature suggested a gap in documented knowledge of mHealth in Harare, Zimbabwe, with a particular focus on mHealth use by medical doctors. This chapter described the methodology used to gather data in the research setting. It further described the sampling method used, the population parameters and the ethical issues related to the study. The data collection instrument and method used were also discussed.

3.2 RESEARCH SETTING

The research was conducted at Harare Central Hospital (HCH).

3.3 RESEARCH DESIGN

The choice of a study design for any research is determined largely by the research question under consideration (Morroni & Myer 2007:77). The chosen design will direct the methodologies of population selection, sampling and data collection and analysis (Burns & Grove 2003:42). A quantitative, descriptive, cross-sectional and analytical design was chosen for this research.

3.3.1 Quantitative

A quantitative research is a process that seeks to generate numerical data that can be analysed using statistics for describing or explaining phenomena (Moule & Goodman 2009:177). This study collected data through self-administered questionnaires and the data was quantitatively analysed to explain the current mHealth utilisation and potential use rates by medical doctors at HCH.
3.3.2 Descriptive

A descriptive study is a non-experimental study with the purpose to observe describe and document aspects of a situation (Polit & Beck 2006:189). This study was therefore descriptive.

Descriptive studies allow researchers to discover new meaning, describe the frequency of occurrence of something and categorise information. The outcome of a descriptive study will allow the identification of relationships and hypothesis that can be relied on (Burns & Grove 2003:46). In this research new meaning on the relationship between mHealth utilisation and doctors’ gender, level and age was discovered and described. A descriptive study often takes the form of a survey and sets out to quantify the extent of a problem (Morroni & Myer 2007:78).

3.3.3 Cross-sectional

Data for the study were collected over a short period of time of approximately one month. According to Polit and Beck (2006:192), a cross-sectional study involves the collection of data at one point in time or within a short time period. The main advantage of a cross-sectional study is that it is economical and easy to manage.

In a cross-sectional study, the researcher usually selects the sample without reference to exposure; often the sample is drawn at random from a defined population (Morroni & Myer 2007:85). In this study there was no sampling as explained in section 3.4.1 of this chapter and data were collected from the entire population of medical doctors at the participating hospital.

3.3.4 Analytical

An analytical study aims to get to the root of the causes of problems by examining associations rather than by just describing the prevalence of a problem in a population (Morroni & Myer 2007:78). This study collected data analytically for two purposes. The purposes were to determine the existing mHealth utilisation rates and mHealth potential among medical doctors. The outcome variables were the “utilisation rates” and
“potential utilisation rates” and the exposure variables were the age, gender and employment categories of the responding doctors.

3.4 RESEARCH METHODOLOGY

This section covered information on the population selection, the population size choice and data collection.

3.4.1 Research population

According to Burns and Grove (2003:233), the target population is the entire set of individuals that meet the sampling criteria. In this study the population that met the sampling criteria comprised all medical doctors working at HCH during the months of August and September 2013. The population size was 116 medical doctors and this excluded 14 that had participated in the pre-testing (n=4) and reliability (n=10) testing of the instrument. The accessible population is the portion of the target population that will be available for participation to the study (Burns & Grove 2003:234). Therefore the accessible population were the medical doctors that were available during the data collection period of the months of August and September 2013 and the total was 104. This excluded the 14 medical doctors that participated to the pre-testing and reliability testing of the questionnaire as discussed in sections 3.4.2.1 and 3.5.1 below.

The use of a sampling frame that is a full list of the study population eliminates sampling bias (Joubert & Katzenellenbogen 2007:101). This study used the whole population and there was no sampling. There were no budgetary limitations in this research in distributing the questionnaires to the entire population. The data collection method as discussed in the section 3.4.3 below was cost effective and allowed the distribution of the questionnaires to the entire study population in an affordable way.

3.4.2 Characteristics of the data collection instrument

The instrument for this research, was the self-administered questionnaire, which was designed in consultation with a reputable statistician (refer to Annexure 2). The questionnaire was based on an in-depth literature review about the topic of mHealth.
3.4.2.1 Development and testing of the data collection instrument

In developing the questionnaire the following were taken into consideration:

- Development of questions that were within the scope of the research:
  Time is an external factor to any study and can influence the study results as well as the response rate (Polit & Beck 2006:194). Medical doctors are busy professionals and questions perceived to be irrelevant to the research topic might cause the doctors to spend more time trying to understand the questionnaire thereby causing them to lose interest and contribute to a low response rate.

- The questions were kept short but at the same time maintaining a balance between length of question and clarity of the meaning. Such a balance has been supported by Parahoo (2008:300).

- The sequence of the questions ensured a logical flow with demographic information coming first, questions revealing the specific objectives of the study progressively coming at the end to avoid influencing answers to earlier questions (Joubert & Katzenellenbogen 2007:113).

- Pre-testing the instrument, according to Parahoo (2008:305), enhances its validity and reliability. The questionnaire was pre-tested with four medical doctors each from the categories of 0 to less than 1 year experience, 1 to less than 3 years’ experience, over 3 years’ experience but excluding consultant medical doctors and over 3 years but consultant medical doctor category.

- The following recommendations gathered from the four medical doctors during the pre-testing of the questionnaire were taken into consideration and the instrument was revised accordingly:
  - The instrument was revised to include the mention of other devices rather than limit questions to cellphones only. These devices could be tablets and netbooks or other unspecified electronic mobile devices. The word “electronic mobile device (EMD)” was included and wherever the word cellphone was previously stated in the questionnaire, it was replaced with the word cell-phone/electronic mobile device (EMD).
  - The instrument was revised to eliminate some activity areas that were almost similar as these would have invariably been scored in the same way and therefore unnecessarily required more time for completing the questionnaire. One
doctor suggested further shortening of the questionnaire in section 3 and minimising the number of open ended questions as these would risk contributing to incomplete questionnaires. By eliminating similar activities, the questionnaire was further shortened.

The questionnaire had the following sections:

**Section 1: Demographic data**

This section contained basic demographic information that was used to contextualise the data relevant to gender, age and qualifications of the respondents.

**Section 2: Basic mHealth activities which the respondent has used previously**

This section requested information from respondents on prior experience in using some of the basic mHealth activities. The primary question was a closed ended question with a follow-up open ended question that requested for a short explanation to the preceding answer. According to Joubert and Katzenellenbogen (2007:111), such a stem and branch approach could help to avoid false negative responses.

**Section 3: Other mHealth areas**

This study narrowed the mHealth activities into those that fall into the categories of patient treatment and identification activities. There are 18 in total as shown in Annexure 1. This section requested information on the use of all the activities and used a Likert scale to gather information on the potential use of those activities. According to Moule and Goodman (2009:307), Likert scales are used where the information to be collected includes opinions or attitudes. The subject responses were scored from 1 to 5 with a high score being achieved both for agreement with a positive statement and disagreement with a negative statement.

**Section 4: Challenges**

Section 4 requested information on the challenges the respondent might have encountered in using mHealth. The responses were open ended.
The language of the instrument was English as this is the language of business communication in Zimbabwe and all medical doctors are expected to be fluent in English. The data collector was also fluent in English.

3.4.3 Data collection

Data were collected by one data collector appointed by the researcher. A graduate of social studies with experience in conducting research was identified as a data collector. The data collector was trained by the researcher in using the research instrument. Training of personnel involved in data collection is important for the quality of information and the training should include the nature and reason why the research is being conducted, furthermore the objectives should be clearly explained (Joubert & Katzenellenbogen 2007:122). The data collector’s’ training therefore covered an introduction to the subject of mHealth, the importance of mHealth as well as all the sections of the questionnaire so that the data collector was empowered to explain the questions on the questionnaire to the respondents. Data collection was done over a period of one month, from 26 August to 27 September 2013.

The data collector distributed and collected the questionnaires through the hospital’s various departments. This was per the hospital’s ethics department suggestion. These are the departments at HCH: surgery, paediatrics, obstetrics and medicine. Each department at HCH is headed by a medical consultant, called the Head of Department (HOD) who coordinates all medical doctors’ activities at the hospital. HOD’s at HCH hold meetings with medical doctors around 8:15 every morning before they allocate their daily duties. The data collector first made an appointment with the HOD. The purpose of an appointment was to ask permission to conduct the research with the medical doctors working under the particular department. The topic was introduced and the importance of the research topic was explained to the HOD. Permission was granted to meet the medical doctors in that particular department. The medical doctors were met in the meeting room before their meeting with the HOD. Introduction was done and the purpose of the research was explained. Consent forms were signed and questionnaires were handed over to the medical doctors. Clarification of questions were answered. This happened at around 8:00 every morning until all the medical doctors working in particular departments had received questionnaires.
The disadvantage of a low response rate for self-administered questionnaires can be minimised by using short message service (SMS) reminders (Hallberg 2008:180). The data collector recorded the names of the medical doctors after distributing the forms as well as their mobile phone numbers in a book provided by the researcher. The data collector used this record to send SMS reminders to the respondents as well as following up on non-returned questionnaires. To maintain anonymity this book was not returned to the researcher, but destroyed by the research assistant. During the period of data collection, the data collector managed to access and distribute the questionnaires to a total of 104 medical doctors out of a possible total of 116 medical doctors (refer to table 3.1 below). In total 48 completed questionnaires were returned to the data collector giving a response rate of 46%.

The table below summarises the population statistics:

**Table 3.1 Summary of population statistics**

<table>
<thead>
<tr>
<th>Number of respondents</th>
<th>Number of questionnaires distributed</th>
<th>Number of questionnaires returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>116*</td>
<td>104</td>
<td>48</td>
</tr>
</tbody>
</table>

*Excludes a total of 14 respondents that participated in pre-testing (n=4) and reliability testing (n=10) of the instrument

The data collector collected and returned the questionnaires plus consent forms in two separate batches of 20 and 28 forms. The completed questionnaires were collected in one bag and the signed consent forms were collected in another large bag, so that no questionnaire could be linked to any signed consent form thus ensuring the anonymity of the respondents. This nullified the possibility of the researcher being able to match the names on the consent forms with the questionnaires thus protecting the identity of the respondents. Coding was used to identify the forms. The codes had no logical meaning and could not be used to trace any questionnaire to a specific consent form to reveal respondent’s identity. Once the questionnaires were collected, no follow up of specific respondents was possible. Due to this reason, six questionnaires were rejected as being incomplete. During the data collection process, the researcher met with the data collector twice per week to discuss problems or issues that the data collector was encountering such as:
• The number of questionnaires distributed during that period.
• The number of questionnaires collected.
• Challenges faced by the data collector such as:
  - The medical doctors not sending back the consent forms as they preferred to maintain total anonymity.
  - The poor response rate.

In dealing with the above challenges the researcher accepted questionnaires that were returned without consent forms and SMS reminders were used to remind respondents to return the questionnaires to improve the response rate. Furthermore, the researcher was alert of any possible data fudging or data being made up by the data collector and worked thoroughly to check the received questionnaires to detect such possibilities. The collected questionnaires and consent forms were kept locked up in a cupboard at the researcher’s place of residency.

3.4.4 Data analysis

The purpose of data collection was to analyse and to describe relationships between variables. SPSS version 20.0 software application was used to analyse the data. Descriptive statistics were used to synthesise and describe data. Before analysis, the researcher checked the data for errors and completeness, rejecting those that were incomplete or had errors. The data on the questionnaires was mainly categorical with the exception of the “age” variable that was numerical. The researcher in consultation with the statistician summarised and represented the data in graphical form. Numerical variables when displayed, allow certain characteristics to be easily investigated such as the distribution and spread of the variables. Bar graphs and pie charts were used to represent the categorical variables. The categorical variables were summarised by numbers, percentages of the respondents and categories. The details of data are presented in chapter 4.
3.5 VALIDITY AND RELIABILITY

3.5.1 Reliability

According to Moule and Goodman (2009:186), reliability is the consistency with which an instrument measures what it is intended to measure. To enhance the reliability of the questionnaire, the following measures were taken:

- Avoided use of ambiguous questions as well as areas of overlap and non-discriminating items. "Non-discriminating items are those that are responded to in a similar fashion by both people who score high and people who score low on the overall scale" (Monette et al 2002:361).
- Questions were kept short at the same time making sure that meaning was not lost. A short explanation that goes with the question was included where necessary to clarify the meaning of that question. This allowed the respondents to have a common understanding whilst completing the questionnaire.
- After the instrument had been pre-tested as explained in section 3.4.2.1 above, it was revised to include suggestions from the respondents involved in the testing. Words and sentences that were not understood were reworded or reformulated. After that the modified instrument was then subjected to reliability testing through another pre-testing as explained below:
- For reliability testing, 10 questionnaires were distributed as a pre-test and collected from the targeted population. The results were used to test for the reliability of the questionnaire by calculating the Cronbach’s reliability coefficients. Cronbach’s coefficient assesses the internal consistency of a questionnaire. A Cronbach’s alpha of greater than 0.70 is generally acceptable and for a more established questionnaire a score of 0.8 is expected (Rattray & Jones 2007:235).

There are three sections on the questionnaire that measured different items and these had their Cronbach’s coefficients determined separately.

Section 2: Dichotomous variables assessing current mHealth status
Cronbach alpha = 0.73 was acceptable.
Section 3: Dichotomous variables assessing potential adoption rates
Cronbach alpha = 0.83 was acceptable.

Section 3: Likert scale assessing opportunities for mHealth,
Cronbach alpha = 0.72 was acceptable.

3.5.2 Validity

According to Joubert and Katzenellenbogen (2003:117), validity is the extent to which a measurement instrument measures what it is actually supposed to measure.

3.5.2.1 Face validity

Face validity is the extent to which the questions in the instrument make sense to those with the domain knowledge (Joubert & Katzenellenbogen 2007:120). To enhance the face validity of the instrument, the following was observed:

- The questionnaire was pre-tested with four medical doctors as mentioned above in section 3.4.2.1 and their recommendations were taken into account.
- The questionnaire was structured in a logical format, starting with the demographic section then the simple dichotomous questions and finally the Likert scale items.

3.5.2.2 Content validity

Content validity requires that the measure accounts for all the elements of the concept being investigated (Joubert & Katzenellenbogen 2007:120). Content validity requires the expert judgement of other experts in the field (Parahoo 2008:305). Key experts for this study were four medical doctors, a statistician as well as two mHealth professionals. The following measures were therefore taken to enhance content validity:

- A statistician was consulted in designing the questionnaire to structure and phrase the questions in a format that would facilitate data entry and analysis.
- The questionnaire was pre-tested with four medical doctors.
3.5.2.3 *Internal validity*

Internal validity refers to the extent to which it is possible to make an inference that the independent variable is truly causing or influencing the dependent variable (Polit & Beck 2006:199).

According to Polit and Beck (2006:199), selection biases are the most problematic threats to internal validity for studies similar to this one that are not using an experimental design. Selection bias for this study was eliminated by using the entire population.

3.5.2.4 *External validity*

External validity is the extent to which the study findings can be generalised beyond the sample used in the study (Burns & Grove 2003:483). The results of this study were only valid to HCH, and cannot be generalised to the medical doctors at other hospitals in Zimbabwe.

3.6 **ETHICAL CONSIDERATIONS**

3.6.1 *Research specific ethical considerations*

The permission to conduct the research was obtained firstly from the Higher Degrees Committee of the Department of Health Studies, University of South Africa (Unisa), HCH Ethics Committee and finally from the Medical Research Council of Zimbabwe (MRCZ). All approvals are attached in the annexures section of this document as follows:

- Annexure 4: Ethical Clearance Certificate from the University of South Africa.
- Annexure 6: Medical Research Council of Zimbabwe approval.
- Annexure 8: Harare Central Hospital approval.

Furthermore, the researcher observed that the following were key points to research excellence and in conducting this study adhered to this as recommended by UNISA:
• Plagiarism is not permitted in any research project.
• The results of the research were the true findings of the research and not fabricated data.
• The works of other authors or research scientists used were recognised through citing and proper mentioning of references.

3.6.2 Response specific ethical considerations

The rights of individuals to self-determination were protected by a consent form. The informed consent form gave the respondents adequate information regarding the research (Polit & Beck 2006:93). The informed consent form was customised from the MRCZ informed consent form template and was approved for distribution to the respondents by the MRCZ. According to Singh (2007:32), research individuals should be treated with autonomy and respect. In this study the consent form alerted the respondent about the risks and benefits of the research, and ensured that the respondent understood that he/she would not be coerced to participate in the research and would participate voluntarily. Furthermore, there would not be any financial benefits accruing to the respondents’ participation. By signing the consent forms, the respondents gave consent to participate to the study.

The right to protect the privacy of respondents should be considered in any research (Polit & Beck 2006:91). Respondents have the right to expect that any data they provide will be kept in the strictest confidence. In this research the following measures were taken to ensure privacy, anonymity and confidentiality of the respondents:

• Anonymity occurs when the data collected cannot be used to trace back the identity of the respondents (Polit & Beck 2006:95). The data collection process used codes for identifying the research instruments. These codes were not traceable to the consent forms since the consent forms were not numbered or coded.
• The data collected was kept in confidence by the researcher and was not shared with anyone else. Data collection forms were kept safely locked by the researcher.
• The signed consent forms collected were kept in a bag and the anonymously completed questionnaires were kept in another bag. This prevented the matching of any completed consent form with any completed questionnaire.

• Data collected were electronically transcribed onto a computer program to which only the researcher and statistician had access. The data was also safeguarded by a secure password known only to these two persons. One backup of the data and computerised analyses was kept on one CD to which only the researcher and statistician had access.

• After acceptance of the research report, the questionnaires and the computer data entries was destroyed.

3.7 CONCLUSION

This chapter outlined details on the research methodology, providing information on the sample site and the population. The method of data collection and instrument used in the data collection was discussed. Further information was provided on the features of the instrument. The chapter ended with details of ethical consideration. Chapter 4 will present the data analysis and discussion.
CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

Chapter 3 focused on the research design and methodology used in this study. This chapter presented and analysed the data collected in chapter 3, with the aim of addressing the study objectives.

The specific objectives of this study were to:

- Identify and describe the rate of utilisation of selected mHealth patient identification and treatment activities by medical doctors, at HCH.
- Identify and recommend opportunities for future mHealth activities in Zimbabwe’s healthcare services and the barriers to adoption.

4.2 DATA MANAGEMENT AND ANALYSIS

Data from the received questionnaires was first checked for errors and missing values. The data were then entered and analysed in consultation with a local statistician using the SPSS (version 20) statistical software. Descriptive statistics and exploratory data analysis were then used to summarise the data. Tables, graphs, bar and pie diagrams were used to present the data. Further analysis was performed using inferential statistics. Bivariate analysis, using Chi-square tests, were used to investigate for associations between the categorical variables. The extent of the analysis performed on the data was guided by the research questions that had to be addressed.

4.3 RESEARCH RESULTS

4.3.1 Sample characteristics

A total of 104 questionnaires were distributed to the entire accessible population of medical doctors working at HCH during the period of 20 August to 10 September 2013.
Collection of the questionnaires happened during the period of 10 to 26 September 2013. These were distributed by the data collector to the medical doctors in all the departments of the hospital. Distribution was through the departmental heads. The response rate is as shown in table 4.1:

Table 4.1 Distribution of questionnaires

<table>
<thead>
<tr>
<th>Number of questionnaires distributed</th>
<th>Number of questionnaires returned</th>
<th>Response rate</th>
<th>Number of returned usable questionnaires</th>
<th>Proportion of usable questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>104</td>
<td>48</td>
<td>46%</td>
<td>42</td>
<td>40%</td>
</tr>
</tbody>
</table>

Of those questionnaires returned, 6 questionnaires had incomplete data and were therefore rejected giving a final figure of 42 usable questionnaires or 40% of the population for analysis.

4.4 SECTION 1: DEMOGRAPHIC DATA

Section 1 of the questionnaire collected various demographics data of gender, age, employee category and type of cell phone or mobile device owned.

4.4.1 Gender

![Gender distribution of the respondents (N=42)](image)
Figure 4.1 shows that, from the total number of respondents, 61.9% (n=26) were males and 38.1% (n=16) were females. Thus, there were more male respondents than female respondents in this research. The information on the distribution by gender of the entire population of medical doctors at HCH could not be obtained as it was considered confidential by the hospital authorities. The findings on the above statistics could be reflective of the actual gender distribution in the medical doctors’ population distribution at HCH.

4.4.2 Age distribution

Table 4.2 Age distribution statistics (N=42)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>31.7</td>
</tr>
<tr>
<td>Median</td>
<td>29.0</td>
</tr>
<tr>
<td>Mode</td>
<td>29.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>25.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>50.0</td>
</tr>
<tr>
<td>25 percentile</td>
<td>27.0</td>
</tr>
<tr>
<td>50 percentile</td>
<td>29.0</td>
</tr>
<tr>
<td>75 percentile</td>
<td>32.5</td>
</tr>
</tbody>
</table>

Figure 4.2 Age distribution of the respondents (N=42)
A frequency distribution was used to summarise the quantitative data on age (Kirkwood & Sterne 2006:16). The mean age of the respondents was 32 years, the youngest was 25 years 12% (n=4) and the oldest was 50 years 2% (n=1). Table 4.2 shows that half of the respondents fell between the ages of 27 and 32 years. Certain age groups were not represented in the age range as shown in the figure 4.2. Age groups not represented were 34 to 38 and 42 to 44 years. The 28 to 30 year group constituted the largest number of respondents (n=12) followed by the 26 to 28 year group (n=10).

### 4.4.3 Employee category

**Table 4.3 Employee distribution (N=42)**

<table>
<thead>
<tr>
<th>Level</th>
<th>Experience (years)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>0-1</td>
<td>12</td>
<td>28.6</td>
</tr>
<tr>
<td>Level 2</td>
<td>1-3</td>
<td>15</td>
<td>35.7</td>
</tr>
<tr>
<td>Level 3</td>
<td>3 plus</td>
<td>10</td>
<td>23.8</td>
</tr>
<tr>
<td>Level 4</td>
<td>Consultant</td>
<td>5</td>
<td>11.9</td>
</tr>
</tbody>
</table>

![Employee category distribution](image)

Table 4.3 shows the number of respondents per employee category. Level 2 category (1 to less than 2 years’ experience) contributed the largest number of respondents 35.71% (n= 15) while level 4 category (consultants) contributed the least respondents 11.9% (n=5).

Thus a total of 64.29% (n=27) of the respondents in this study were from level 1 and level2 categories (0 to 2 years’ experience) as per figure 4.3. These are junior doctors and the reason for such a high response from this group could be because junior
doctors are not as busy as their seniors and would therefore have time to respond to the survey forms.

Figure 4.4 shows the distribution of the respondents’ responses by the employee category with a trend line super imposed. There is an observed downward trend in the response rate from level 1 to level 4. This can be attributed to the anticipated population of senior medical doctors that is expected to be much less than that of the lower level medical doctors since high level medical doctors manage lower level medical doctors. The results of this study were therefore largely influenced by the input of lower level medical doctors.

4.4.4 Age and employee category

The mean age per employee category superimposed by a trend line is represented by a bar graph in figure 4.5.
The trend line in figure 4.5 is showing an increase in age from level 1 category as the employee category increases to level 4 category. This was expected since the employee work experience in general increases with increasing age.

**4.4.5 Cellphone type**

Of the total respondents, 90.5% (n=38) owned a smartphone compared to 9.5% (n=4) who owned a basic cellphone. The type of cellphone used in this study therefore does not present itself as a significant confounding variable to mHealth use since 90.5%
(n=38) of the respondents used similar devices. The high rate of smartphone ownership reflects the gaining popularity of smartphones. Mobile applications are easier to handle on smartphones compared to when accessing them on the basic phones.

4.5 SECTION 2: MHEALTH ACTIVITIES IN USE

Section 2 of the questionnaire collected information about the usage of the simple basic mHealth activities by the respondents. The respondents were asked about their use of the mHealth activity and they have provided a dichotomous answer of Yes/No. A follow up question would clarify the reason for the Yes/No answer provided. This section was used to determine the current mHealth utilisation rates at HCH. A summary of the results is shown in table 4.4.

Table 4.4 Current mHealth usage rates by area of use

<table>
<thead>
<tr>
<th>Item</th>
<th>MHealth activity</th>
<th>% Total use rate</th>
<th>% use (within male)</th>
<th>% use (within female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting up any health and work related appointment reminders</td>
<td>81.0</td>
<td>84.6</td>
<td>75.0</td>
</tr>
<tr>
<td>2</td>
<td>Support for the chronically ill</td>
<td>40.5</td>
<td>57.7</td>
<td>12.5</td>
</tr>
<tr>
<td>3</td>
<td>Internet medical/clinical research</td>
<td>90.5</td>
<td>84.6</td>
<td>100.0</td>
</tr>
<tr>
<td>4</td>
<td>Seeking patient consent</td>
<td>9.5</td>
<td>15.4</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>Medical doctor location by the hospital</td>
<td>90.5</td>
<td>100.0</td>
<td>75.0</td>
</tr>
<tr>
<td>6</td>
<td>Remote consultation (Telemedicine)</td>
<td>76.2</td>
<td>84.6</td>
<td>62.5</td>
</tr>
<tr>
<td>7</td>
<td>Diagnostic Support</td>
<td>76.2</td>
<td>76.9</td>
<td>75.0</td>
</tr>
</tbody>
</table>

4.5.1 Most used mHealth activities

From the results in table 4.4, the most common mHealth activities at HCH are:

Medical doctors location and Internet medical research which scored 90.5% (n=38) of mHealth utilisation rate each). All the male respondents 100% (n=26) compared to 75% (n=12) of the female respondents have used their cellphones/EMD in a work related call activity (table 4.4). This could indicate that male medical doctors are more accessible to work calls than their female counterparts.
All the female respondents 100% (n=16) used their cellphones/EMD to conduct medical research over the Internet compared to 84.6% (n=22) of the male respondents. It should be noted however that statistics according to the “ICT facts and figures” report by the International Telecommunications Union (2013:2) report that in the developing world 16% fewer women than men use the Internet. This difference in use rates between male and female is in contrast to the results of this study.

Table 4.5  Internet medical/clinical research activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research on management of diseases</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>Search for information on side effects of medicines</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Searching for literature reviews</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Accessing Medscape reference</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

Respondents claimed to have researched using their mobile devices in the areas highlighted in table 4.5.

Respondents did not mention the names of the sites that they accessed in conducting research on management of diseases and medicinal side effects but only a few 7% (n=3) specifically mentioned the Medscape reference site. The Medscape reference is a free online application for use by physicians that provides in depth information to support the diagnosis and treatment of diseases and is accessible through desktop as well as mobile devices (Medscape 2014:1).

The use of cellphones/EMD for research has become possible with the advent of smartphones and 90.5% (n=38) of respondents in this study owned or used smartphones as shown in figure 4.6. According to the ITU (2011:1), many people are now accessing the Internet through the cellphone rather than through desktop or laptop devices. With lower prices of smartphones and internet bandwidth expected as the technologies mature, the smartphone could become an important working tool for medical doctors for conducting research while on the job. The potential of mHealth in this field will improve with improved availability of reliable internet sites housing information on medicines side effects, management of diseases and other handy information that medical doctors may require to access while on duty. In South Africa a
project that focused on providing electronic information to medical staff while on duty had an acceptance rate of over 80%. This project provided online information to medical staff like standard treatment guidelines and management of diseases (Bateman 2011:2).

Table 4.6  Internet medical research challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet band with issues making it impossible at times to access vital information or internet pages taking longer to load</td>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>Small cellphone screen size</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Cost of mobile internet still high</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 4.6 lists the challenges mentioned by the respondents in using cellphones/EMD for medical related internet research. Bandwidth availability was mentioned by 29% (n=12) of the respondents as one of the reasons for failure to access medical related internet research. Access to internet pages is slow and unreliable to warranty the internet as a reliable source of information. In relation to this technical limitation, 21% (n=9) of the respondents also mentioned the small screen size of cellphones/EMD as a challenge to mHealth use. This finding is in agreement with the findings by the WHO Global Observatory for eHealth series (2011b:35). This finding and the challenge could be short lived since the screen sizes of smartphones have been increasing recently especially with the emergency of touch screen devices.

### 4.5.2 Least used mHealth activities

Activities that involve medical doctors having to contact patients are not used most often by medical doctors at HCH. These activities are: support for the chronically ill, 40.5% (n=17) and seeking patient consent, 9.5% (n=4). This agrees with another study done at Nakuru hospital in Kenya in which it was observed that patients used mobile phones to consult health providers and health providers rarely used cell phones except during emergency cases like deliveries (Ibembe 2011:10). This is important for mHealth implementers as this result shows that activities that involve medical doctors initiating contacts with patients may be the least favourable by medical doctors and therefore least likely to be successful or will not be easily adopted by medical doctors.
With respect to supporting the chronically ill, the respondents mentioned two activities they have been involved in. They are indicated in table 4.7:

**Table 4.7 Supporting chronically ill activities**

<table>
<thead>
<tr>
<th>Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storing patients’ results</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Calling relatives of the patient</td>
<td>10</td>
<td>24</td>
</tr>
</tbody>
</table>

Patient data in wards at HCH is currently collected using patient charts on clipboards. These manual data collection systems have the disadvantages among others of being not easily accessible when needed. The mention of use of mHealth in “storing data” for chronically ill patients by some of the respondents 12% (n=5) shows the opportunity for mHealth in this area. However, the storing of patient data on personal cellphones comes with some confidentiality issues as there may be need for patient consent. Electronically stored data is portable and highly accessible.

Respondents have also used their cellphones (with relation to the chronically ill) in making contacts with the patients relatives 24% (n=10).

The challenges mentioned by the respondents for use of mHealth in supporting the chronically ill are indicated in table 4.8:

**Table 4.8 Supporting chronically ill challenges**

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of awareness and knowledge</td>
<td>21</td>
<td>50</td>
</tr>
<tr>
<td>Absence of patient emotions</td>
<td>23</td>
<td>55</td>
</tr>
</tbody>
</table>

Half of the respondents 50% (n=21) either lacked the knowledge or were not aware of the use of mHealth in supporting the chronically ill. In contrast to the finding of a lack of mHealth awareness among the respondents mentioned in table 4.8, according to the WHO Global Observatory on eHealth series (2011a:230), in Zimbabwe, knowledge about mHealth applications is not generally lacking.
However, the results of this study in this particular aspect are synonymous to those of a research that was conducted in Ethiopia to study the adoption of mHealth and it was concluded that with particular focus to diagnosis and treatment, the majority of healthcare workers were not aware of the possibility of using mHealth to improve health care delivery. Even if the healthcare workers were not aware of the impact of mHealth, some were using it, only being unaware of the fact that they were actually practicing mHealth (Kumar & Svensson 2012:92).

Akter and Ray (2010:79) in their study on the developments in mHealth also support that the majority of mobile users are not aware of mHealth services.

The absence of personal emotions mentioned by 55% (n=23) of the respondents in table 4.8 shows the unwillingness of medical doctors to support a chronically ill patient remotely as this would eliminate the opportunity to physically assess the progress of the patient. Weight loss, skin condition and other physical appearance disorders are some of the symptoms that a remote support system would hide from an assessing physician.

Table 4.9 lists the challenges mentioned by the respondents for not adopting mHealth in seeking patient consent:

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not comfortable exposing own cellphone number to patients - confidential</td>
<td>13</td>
<td>31</td>
</tr>
<tr>
<td>Not ethical, concerned about patient confidentiality</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>The activity is not financially supported by the hospital</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>There is a need for the patient to sign for the consent form in person</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

A relatively high number of respondents 31% (n=13) mentioned the issue of confidentiality with their mobile phone identities as a hindrance to using remote patient consent. They preferred not to have their phone numbers known by their patients. This could imply that mHealth activities that expose health practitioners’ mobile numbers to patients could face the highest resistance in adoption. They also mentioned patient confidentiality as one of the challenges to patient consent 26% (n=26). Further the issue of ethics and the need for a signature 17% (n=7) on the consent papers could mean...
that mHealth activities involving patient signatures could also face high adoption resistance by medical personnel and have the least potential.

4.5.3 Other activities in use

The following activities were widely adopted at HCH: setting up any health and work related appointment reminders 81% (n=34), remote consultation 76.2% (n=32) and diagnostic support 76.2% (n=32).

In setting up reminders the respondents have specifically been involved in the areas as indicated in table 4.10:

Table 4.10 Setting up reminders’ activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing personal work calendar, setting reminders</td>
<td>12</td>
<td>29</td>
</tr>
<tr>
<td>Alerting patients about surgery dates</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

A number of respondents 29% (n=12) use their cellphones/EMD for managing their personal work calendar and pertaining to this activity specifically mentioned the use of electronic reminders to remind them of the dates when they are on duty.

The challenges for setting up health and work related reminders are indicated in table 4.11:

Table 4.11 Setting up reminders’ challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is a cumbersome process</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Lack of awareness and knowledge</td>
<td>6</td>
<td>14</td>
</tr>
</tbody>
</table>

A few respondents 7% (n=3) felt that setting up reminders was a cumbersome process. This could be due to the lack of knowledge as shown in table 4.11 14% (n=6) on the existence of such a tool or on how reminders are set up. Cellphones now come with a graphical calendar that easily allows the setting up of reminders.
The respondents mentioned no specific activities under “remote consultation” but table 4.12 lists the challenges that were mentioned to adoption of mHealth in remote consultation:

Table 4.12  Remote consultation activities challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of awareness and knowledge</td>
<td>16</td>
<td>38</td>
</tr>
<tr>
<td>Face to face consultation experience with the patient preferred</td>
<td>17</td>
<td>40</td>
</tr>
</tbody>
</table>

The mention of a “face to face” patient consultation experience in table 4.12, 40% (n=17) is in agreement with the challenge of “absence of personal emotions” mentioned by a number of respondents 55% (n=23) under the “supporting chronically ill” activity, in table 4.8. This suggests a lack of confidence by medical doctors in remote mHealth activities that entail remote patient interaction. In their research Vital Wave Consulting (2009:14) mention that remote consultation has the potential of improving health outcomes and increasing access to treatment or care where transport availability is a problem, but very little has been done along those lines in developing countries. Further remote consultation would mitigate the hardships due to travel requirements in resource limited settings and patients can be diagnosed early as they do not have to travel always to see the doctor (Ganapathy & Ravindra 2008:3). The mention of a “lack of awareness and knowledge” by the medical doctors 38% (n=16) also implies a lack of awareness of the benefits of the mHealth activity. The success of this activity in the future could therefore rely more in educating medical doctors on its public health benefits.

Lack of knowledge and awareness of mHealth was mentioned in two of the mHealth activities as a barrier to mHealth use. This result is similar to that of a study conducted in Ethiopia to study the adoption of mHealth. It was concluded that with particular focus to diagnosis and treatment, the majority of healthcare workers were not aware of the possibility of using mHealth to improve health care delivery. Even if the healthcare workers were not aware of the impact of mHealth, some were using it, only being unaware of the fact that they were actually practicing mHealth (Kumar & Svensson 2012:92). Another study conducted in Uganda to determine the barriers to
implementation of mHealth also mentioned that 41% (N=146) of the respondents lacked knowledge on mHealth (Stephen, Mayoka, Rwashana & Mbarika 2011:310).

In diagnostic support, the respondents have applied mHealth in the activities listed in table 4.13:

Table 4.13 Diagnostic support activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching information on dosage of medicines</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Verifying diagnostic results with a superior medical doctor</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Quick references</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

The Essential Drugs List and Standard Treatment Guidelines Zimbabwe (EDLIZ) book comes in hard copy and also as an electronic portable document file (pdf) file that can be loaded onto a smartphone. It contains information on essential medicines and the standard treatment guidelines for the most common health conditions in Zimbabwe (Ministry of Health and Child Welfare of Zimbabwe 2006:6). It is the only book for reference of medicines and standard treatment guidelines produced by the MOHCW Zimbabwe. Medical doctors refer to it most often during treatment of patients. The mention of the search for dosages of medicines by 21% (n=9) as well as quick references by 17% (n=7) of the respondents possibly suggests the use of the electronic format of the EDLIZ. The search for information on dosage of medicines was one of the primary areas of success in a project that was implemented in South Africa. With 80% of the users accepting the project (Bateman 2011:2). A local treatment guidelines hospital database accessible by medical doctors through a wireless local area network connection could therefore improve the adoption of this mHealth activity.

Cellphones/EMD are also being used to communicate patient diagnostic results and to confirm these with superiors 12% (n=5). The medical doctors are now consulting each other easily. In Ghana a project called MDNET allows doctors to consult one another by paying for intra-doctor mobile voice and SMS communications. The project implemented in Ghana in 2008 was successful to the extend that it had follow on implementations in Kenya and Liberia (WHO Global Observatory for eHealth series
2011b:38). No specific challenges were mentioned in adopting mHealth for diagnostic support.

### 4.5.4 General challenges

At the end of the questionnaire the respondents were asked to mention in general the challenges to mHealth use. Table 4.14 summarises the mentioned challenges that have not been discussed in the preceding sections:

**Table 4.14 Other mHealth use challenges**

<table>
<thead>
<tr>
<th>Challenge</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of smartphones still high</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Lack of relevant information on the internet that pertain to the local context</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Absence of an official mHealth programme at HCH</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Lack of willingness to learn new things</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Lack of trust in use of technology in health service provision</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Lack of knowledge and awareness on the existence of the mHealth activities</td>
<td>17</td>
<td>40</td>
</tr>
</tbody>
</table>

The lack of an official mHealth programme at HCH was mentioned as one of the hindrances to mHealth use 21% (n=9). This is because some of the mHealth activities under this study would require infrastructure to be set up by the hospital. Related to this challenge was the “lack of willingness” to learn new things 14% (n=6). This challenge could be overcome with the presence of a proper official mHealth programme at HCH and users undergoing training.

The cost of smartphones 7% (n=3; table 4.14) as well as bandwidth accessibility 29% (n=12) in table 4.6 mentioned by the respondents in this study is in agreement with the research by the WHO which mentioned that high costs of implementation were some of the barriers to implementing mHealth in Zimbabwe (WHO Global Observatory for eHealth series 2011a:230).

Some respondents 12% (n=5) mentioned a lack of trust in the technology. This is in agreement with earlier challenges mentioned under the “patient consent” activity where respondents said that with relation to patient consent they did not trust the technology.
4.5.5 “Basic mHealth” associations

4.5.5.1 Gender

Compared with females, male respondents had a generally higher mHealth utilisation rate in six of the seven mHealth activities as shown in figure 4.7. These are: Setting up any health and work related appointment reminders (male=84.6%, female=75%), support for the chronically ill (male=57.5%, female=12.5%), seeking patient consent (male=15.4%, female=0%), medical doctor location by the hospital (male=100%, female=75%), remote consultation (male=84.6%, female=62.5%) and diagnostic Support (male=76.9%, female=75%). Females had a higher use rate in the internet research activity (female=100%, male=84.6%).

Using the Chi-square test, the hypothesis that there is no association between gender and any one of the activities was tested and the following two activities returned significant results:

Gender versus “chronically ill” returned a P value of 0.004 suggesting that gender is associated with this activity. The reason for this association is not apparent. Gender versus “locating medical doctor” returned a P value of 0.007 suggesting that gender is associated with the activity. Referring to figure 4.7 all males have used their phones with this activity. This result could be a result of female medical doctors not as free as
male medical doctors to disclose their mobile cellphone numbers for official hospital use.

4.5.5.2 Employee category

The table 4.15 and the bar graph, figure 4.8 show the results of utilisation rates within employee category.

Table 4.15 Current utilisation rate by employee category (N=42)

<table>
<thead>
<tr>
<th>Area</th>
<th>Level 1 (%)</th>
<th>Level 2 (%)</th>
<th>Level 3 (%)</th>
<th>Level 4 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment reminders</td>
<td>83.3</td>
<td>100.0</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Support for the chronically ill</td>
<td>16.7</td>
<td>53.3</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Internet medical/clinical research</td>
<td>83.3</td>
<td>100.0</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Seeking patient consent</td>
<td>0.0</td>
<td>26.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Doctors location using pager/mobile device</td>
<td>100.0</td>
<td>86.7</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Remote consultation</td>
<td>66.7</td>
<td>86.7</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Diagnostic Support</td>
<td>66.7</td>
<td>86.7</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

The table of results (table 4.15) shows no clear trend/association in mHealth use as the employee category or years of experience increases. All respondents scored similarly on the activity of remote consultation and diagnostic support. Level 1 respondents scored very low 16.7% (n=2) on using mHealth to support the chronically ill. This could be due to their minimal lack of experience and exposure.

Only level 2 respondents 26.7% (n=4) contributed to the score recorded for use of mHealth in patient consent, all other categories scored zero on patient consent. Patient consent possesses the lowest opportunity to mHealth.

Table 4.16 shows the position of the mHealth use mHealth area and employee level.
Table 4.16  MHealth use rates positions

<table>
<thead>
<tr>
<th>Area</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment reminders</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Support for the chronically ill</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Internet medical/clinical research</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Seeking patient consent</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Doctors location using pager/mobile device</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Remote consultation</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Diagnostic Support</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Position total</strong></td>
<td><strong>19</strong></td>
<td><strong>12</strong></td>
<td><strong>25</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

From table 4.16 the following can be deduced:

- Compared to all the levels, level 4 had the highest mHealth utilisation rates (lowest total position score of 8). This could be related to the fact that years of experience are correlated to the level of exposure.
- Compared to all the levels, level 3 medical doctors had the lowest mHealth utilisation rates (highest total position score of 25).

The position rating though cannot be completely relied on with relation to level 4 medical doctors due to their fewer number 12% (n=5) (table 4.3).

A Chi-square test was used to test the hypothesis that there is no association between employee category and mHealth use and the following were the results:

- There is an association between employee category and utilisation of cellphones/EMD in setting up work reminders (P=0.001).
- There is an association between employee category and utilisation of cellphones/EMD in seeking patient consent. In this study only level 2 medical doctors used cellphones in seeking patient consent (P=0.047).
- There is no association between employee category and the remainder of the mHealth activities.
4.6 SECTION 3: OPPORTUNITIES FOR MHEALTH

4.6.1 Potential use rates

This section analyses the data on the potential of suggested mHealth activities in improving service delivery at the hospital. Respondents would answer Yes/No for each mHealth activity on whether they thought they would adopt the activity if implemented at the site. If that activity was already implemented, then they would indicate on whether that activity presented opportunities for improving service delivery at the hospital. However, from the respondents’ responses, the hospital is not officially using any mHealth activity.

MHealth use at HCH by medical doctors is therefore due to the self-initiative by the medical doctors as there is no official mHealth programme at the hospital. The group of activities with results shown in section 4.5 above do not require an official mHealth programme to start using but can be adopted by medical doctors upon the self-realisation of the opportunities they present.

Table 4.17 Potential rates of adoption

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Adoption of activity</th>
<th>Male % of total</th>
<th>% within male</th>
<th>Female % of total</th>
<th>% within female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Internet medical/clinical research</td>
<td>95.20%</td>
<td>57.1</td>
<td>92.3</td>
<td>38.1</td>
<td>100.0</td>
</tr>
<tr>
<td>2</td>
<td>Diagnosis support</td>
<td>95.20%</td>
<td>57.1</td>
<td>92.3</td>
<td>38.1</td>
<td>100.0</td>
</tr>
<tr>
<td>3</td>
<td>Allergy alert service for asthmatics (short message service and global positioning system)</td>
<td>95.20%</td>
<td>61.9</td>
<td>100.0</td>
<td>33.3</td>
<td>87.5</td>
</tr>
<tr>
<td>4</td>
<td>Medication compliance monitoring</td>
<td>90.50%</td>
<td>61.9</td>
<td>100.0</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>5</td>
<td>Heart rate monitoring</td>
<td>90.50%</td>
<td>61.9</td>
<td>100.0</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>6</td>
<td>Appointment reminders</td>
<td>88.10%</td>
<td>50.0</td>
<td>80.8</td>
<td>38.1</td>
<td>100.0</td>
</tr>
<tr>
<td>7</td>
<td>Remote consultation (Telemedicine)</td>
<td>88.10%</td>
<td>54.8</td>
<td>88.5</td>
<td>33.3</td>
<td>87.5</td>
</tr>
<tr>
<td>8</td>
<td>Medical data on SIM Card</td>
<td>85.70%</td>
<td>61.9</td>
<td>100.0</td>
<td>23.8</td>
<td>62.5</td>
</tr>
<tr>
<td>9</td>
<td>Accessing electronic patient records through a mobile device</td>
<td>85.70%</td>
<td>57.1</td>
<td>92.3</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>10</td>
<td>Monitoring for asthma sufferers</td>
<td>85.70%</td>
<td>57.1</td>
<td>92.3</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>11</td>
<td>Blood glucose monitoring</td>
<td>85.70%</td>
<td>57.1</td>
<td>92.3</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>12</td>
<td>Support for the chronically ill</td>
<td>83.30%</td>
<td>50.0</td>
<td>80.8</td>
<td>33.3</td>
<td>87.5</td>
</tr>
<tr>
<td>13</td>
<td>Doctors location using pager/mobile device</td>
<td>83.30%</td>
<td>45.2</td>
<td>73.1</td>
<td>38.1</td>
<td>100.0</td>
</tr>
<tr>
<td>14</td>
<td>Accessing laboratory results through a mobile device</td>
<td>83.30%</td>
<td>54.8</td>
<td>88.5</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>15</td>
<td>Patient identification (radio frequency identification)</td>
<td>73.80%</td>
<td>45.2</td>
<td>73.1</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>16</td>
<td>Skin cancer monitoring</td>
<td>69.00%</td>
<td>45.2</td>
<td>73.1</td>
<td>23.8</td>
<td>62.5</td>
</tr>
<tr>
<td>17</td>
<td>Access to patient X-ray images</td>
<td>66.70%</td>
<td>38.1</td>
<td>61.5</td>
<td>28.6</td>
<td>75.0</td>
</tr>
<tr>
<td>18</td>
<td>Seeking patient consent</td>
<td>42.90%</td>
<td>28.6</td>
<td>46.2</td>
<td>14.3</td>
<td>37.5</td>
</tr>
</tbody>
</table>
The results showing the scored potential rates of adoption of the mHealth activities are as indicated in table 4.17 and these are shown in descending order with the most favoured being “internet medical research”, 95.2% (n=40) on top and the least favoured being “patient consent”, 42.9% (n=18).

4.6.2 High potential activities

The following activities were awarded the highest points by the respondents as providing greatest opportunities to improve health service delivery at HCH:

- Internet medical/clinical research 95.20% (n=40).
  All female respondents, 100% (n=16), agreed that this activity presented opportunities for improving health service delivery compared to 92.3% (n=24) male.
- Diagnosis support 95.2% (n=40).
  All female respondents agreed that this activity presented opportunities for improving health service delivery compared to 92.3% (n=24) male.
- Allergy alert service for asthmatics 95.2% (n=40).
  All male respondents agreed that this activity presented opportunities for improving health service delivery compared to 87.5% (n=14) female.

There is a general agreement between the male and female scores for all the activities above implying that the two groups agree in the potential to use these activities if HCH were to implement them. A mHealth programme at HCH focusing on these would therefore most likely be accepted by medical doctors, assuming all other mHealth implementation factors are favourable.

4.6.3 Low potential activities

While male and female respondents differed on the order of the most important mHealth activities, they generally agreed on the on the least important or those presenting the least opportunities to improve service delivery. This list in descending order is constituted of the activities listed in table 4.18.
Table 4.18  MHealth activities with least potential to adoption by medical doctors at HCH

<table>
<thead>
<tr>
<th>Activity</th>
<th>Score (%)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient identification (radio frequency identification)</td>
<td>74</td>
<td>31</td>
</tr>
<tr>
<td>Skin cancer monitoring</td>
<td>69</td>
<td>29</td>
</tr>
<tr>
<td>Access to patient X-ray images</td>
<td>67</td>
<td>28</td>
</tr>
<tr>
<td>Seeking patient consent</td>
<td>43</td>
<td>18</td>
</tr>
</tbody>
</table>

More than half of the respondents 43% (n=18) agreed that using mHealth in seeking patient consent presented the least opportunities to improve health service delivery. This was the only activity that had an overall score below 50% (n=21). Patient consent therefore presents the least potential to the success of mHealth activities and any mHealth implementers could face the greatest challenge in this area. This is in agreement with the results discussed earlier under section 4.5.2 on patient consent.

4.6.4 Gender distribution across mHealth activities

A graph showing the distribution of ‘potential use rates’ with gender is as shown in figure 4.8. Further analysis of the results shown in the graph was performed using chi-square in the sections that follow.
Figure 4.8 Within gender distribution of potential mHealth utilizations
4.6.5 Gender and mHealth activity

A Chi-square test to determine any associations between the potential mHealth use and gender was conducted for all the mHealth activities represented in figure 4.9 the following were the results:

- There was an association between gender and the potential use of the following mHealth activities:
  
  - Locating staff through electronic device (P=0.023), all female medical doctors thought that this activity presented an opportunity to improve service delivery compared to 73.1% (n=19) of the males.
  
  - Medical data on SIM Card (P=0.001), all male medical doctors thought that this activity presented an opportunity to improve service delivery compared to 62.5% (n=10) of the females.
  
  - Medication compliance monitoring (P=0.007), all male medical doctors thought that this activity presented an opportunity to improve service delivery compared to 75% (n=12) of the females.
  
  - Heart rate monitoring (P=0.007), all male medical doctors thought that this activity presented an opportunity to improve service delivery compared to 75% (n=12) of the females.
  
- Medical data on sim card, medication compliance monitoring and heart rate monitoring are all high end technology activities and in this study they are all strongly correlated to males.

- There is no association between gender and potential of mHealth adoption of all the other activities shown in table 4.19:
### Table 4.19  Activities with no association to gender

<table>
<thead>
<tr>
<th>Activity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet medical/clinical research</td>
<td></td>
</tr>
<tr>
<td>Diagnosis support</td>
<td></td>
</tr>
<tr>
<td>Allergy alert service for asthmatics</td>
<td></td>
</tr>
<tr>
<td>Appointment reminders</td>
<td></td>
</tr>
<tr>
<td>Remote consultation</td>
<td></td>
</tr>
<tr>
<td>Accessing electronic patient records through a mobile device</td>
<td></td>
</tr>
<tr>
<td>Monitoring for asthma sufferers</td>
<td></td>
</tr>
<tr>
<td>Blood glucose monitoring</td>
<td></td>
</tr>
<tr>
<td>Support for the chronically ill</td>
<td></td>
</tr>
<tr>
<td>Accessing laboratory results through a mobile device</td>
<td></td>
</tr>
<tr>
<td>Patient identification</td>
<td></td>
</tr>
<tr>
<td>Skin cancer monitoring</td>
<td></td>
</tr>
<tr>
<td>Access to patient X-ray images</td>
<td></td>
</tr>
<tr>
<td>Seeking patient consent</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.20 lists the distribution of the “mHealth potential use” rates by employee level.

### Table 4.20  “MHealth adoption potential” distribution within respondent category

<table>
<thead>
<tr>
<th>MHealth activity</th>
<th>% within level 1</th>
<th>% within level 2</th>
<th>% within level 3</th>
<th>% within level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Setting up health or any work related appointment reminders</td>
<td>83.3</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>B Any support for the chronically ill rendered through a mobile device</td>
<td>83.3</td>
<td>66.7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>C Internet medical/clinical research through mobile device</td>
<td>83.3</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>D Obtaining patient consent</td>
<td>33.3</td>
<td>66.7</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>E Locating staff through electronic device</td>
<td>66.7</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>F Remote consultation (Telemedicine)</td>
<td>83.3</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>G Diagnosis support</td>
<td>100</td>
<td>86.7</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>H Medical data on SIM Card</td>
<td>83.3</td>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>I Accessing electronic patient records through a mobile device</td>
<td>83.3</td>
<td>86.7</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>J Allergy alert service for asthmatics (short message service and global positioning system)</td>
<td>83.3</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>K Monitoring for asthma sufferers</td>
<td>83.3</td>
<td>86.7</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>L Blood glucose monitoring: A blood glucose monitor works with a smartphone and can send the results to a website.</td>
<td>66.7</td>
<td>100</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>M Medication compliance monitoring</td>
<td>83.3</td>
<td>100</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>N Heart rate monitoring (uses an application installed on a cellphone and patient can press finger on cellphone camera and the heart rate is read)</td>
<td>83.3</td>
<td>100</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>O Patient identification (radio frequency identification)</td>
<td>83.3</td>
<td>86.7</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>P Accessing laboratory results through a mobile device</td>
<td>83.3</td>
<td>100</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Q Access to patient X-ray images: Patient takes a picture of an X-ray image by cellphone and then send it to a specialist by phone mail or multimedia messaging</td>
<td>83.3</td>
<td>53.3</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>R Skin cancer monitoring (involves patient taking images of skin and sending them for analysis)</td>
<td>83.3</td>
<td>53.3</td>
<td>80</td>
<td>60</td>
</tr>
</tbody>
</table>
A chi-square test to determine the association between the “mHealth activity potential adoption” and employee level was performed and the results showed that for all the activities there was no association with any level of employee. Thus, the success of any of the mHealth activities being adopted by a medical doctor if implemented by the hospital is not dependent on the employee level of that medical doctor.

4.7 CONCLUSION

This chapter focused on the analysis and interpretation of the research findings. Data was presented using table, diagrams and graphs. Descriptive and inferential statistics were used for the deeper analysis. The results of the research revealed that there are opportunities to utilise mHealth activities and in general medical doctors would like to try certain mHealth activities. The results also indicated that there are significant barriers to adoption that have to be overcome for mHealth to significantly contribute to service delivery.

Chapter 5 will conclude this study with the discussion of the findings, the limitations and recommendations.
CHAPTER 5

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter 4 presented, described and analysed the data collected in this study. This chapter will summarise the study, report on the conclusions of the research in relation to the research questions as well as the problem statement. The limitations of the research will also be discussed as well as the recommendations for further research.

5.2 SUMMARY OF THE DISCUSSION OF THE FINDINGS

The aim of the research was to identify the status of selected mHealth activities used by medical doctors at HCH as well as the future opportunities and potential of those mHealth activities at HCH.

A questionnaire was designed and distributed to all the medical doctors that were available at HCH. Data collection was done from 20 August 2013 to 26 September 2013. The data were collected and analysed with the help of a statistician using SPSS version 20 software. The results were presented in the preceding chapter 4.

5.2.1 MHealth utilisation and barriers to utilisation

Internet medical research and medical doctors' location using cellphones/EMD were the most common mHealth activities at HCH. The mentioned areas of research were: management of diseases, side effects of medicines, literature reviews, and accessing the Medscape reference. The current unfavourable cost of internet bandwidth as well as the price of smartphones were some of the reasons why medical doctors were not using their cellphones/EMD for research. The unavailability of contextual content on the internet was also a challenge faced by medical doctors.
Most of the respondents 90.5% (n=38) owned smartphones although the cost of owning a smartphone was raised as one of the barriers to mHealth use and cellphones with small screen sizes did not promote mHealth use as well. The use of the cellphone for work related calls has also been adopted, however, with more males 100% (n=26) than females 75% (n=12) using cellphones for work related calls.

The high popularity of internet research activity could also suggest that mHealth activities that involve access to information if implemented have a high probability of success. The costs of internet bandwidth are expected to go down as the mobile phones technology penetration rate continues to grow locally. It is also estimated that smartphones will continue to decline in price according to technology market-research firm International Data Corporation (International data Corporation 2013:1). Internet medical research by medical doctors has therefore more potential for growth and the availability of useful content that will be readily accessible to medical doctors could improve the medical doctors’ efficiencies. This content could take the form of standard treatment guidelines, dosages and diagnostics support (Bateman 2011:12-13).

Even though internet research and medical doctor location were the most used mHealth activities at HCH, there were others which were also fairly used by the medical doctors. These were: setting up any health and work related appointment reminders, remote consultation (Telemedicine) and diagnostic support. Medical doctors used their phones to search for information on dosages, verifying diagnostics results as well as for other quick references. There is, however, evidence of a resistance to using mHealth in remote consultation as medical doctors fear the loss of the human experience. Furthermore, a lack of awareness and knowledge on the existence of mHealth by the medical doctors is another barrier to mHealth use.

Better mHealth use by medical doctors in the future could be guaranteed by the implementation of advocacy programmes from the hospital or Ministry of Health. The evidence of resistance on some of the activities as mentioned could suggest that mHealth’s full potential needs to be demonstrated to potential users and its evolution could take a while without the proper existence of official mHealth programmes. Some medical doctors also expressed lack of confidence in mHealth’s capability to improve health service delivery as well as the lack of a willingness to do things differently. The
lack of an official mHealth programme at HCH also presented significant barriers to adoption of mHealth.

Using mHealth to support the chronically ill as well as seeking patient consent were the least used mHealth activities at HCH. In supporting the chronically ill, medical doctors have used their phones to store the patient results but the lack of confidence in the reliability of mHealth in remote patient support was one of the barriers to mHealth use in supporting the chronically ill.

The low rate of utilisation of mHealth in supporting the chronically ill is in agreement with a study by Ibembe (2011:10) who mentioned that health providers rarely used phones in contacting patients. This finding could suggest that mHealth activities that involve doctors contacting patients by phone may have the least potential and for mHealth implementers this could imply a high level of effort could be required in implementing related activities compared to the other activities mentioned before.

5.2.2 MHealth potential

Internet medical/clinical research, diagnosis support and allergy alert service for asthmatics have a higher potential of adoption if implemented at HCH. In general the respondents agreed that all mHealth activities with the exception of the “patient consent” activity presented opportunities to improve health service delivery. Even for the “supporting chronically ill” activity which was one of the least used activities at HCH 40.5% (n=17), the majority of respondents 83.3% (n=35) still believed that it presented opportunities to improve service delivery.

Medical doctors at HCH accepted that mHealth presented them with opportunities to improve service delivery. The non-engagement in mHealth activities was due to the factors that include lack of awareness, confidence in the technology, cost and the absence of an official mHealth programme at HCH.

5.2.3 MHealth distributions

The findings of this study show that male respondents had a higher mHealth utilisation rate compared to their female counterparts. This result is in agreement with another
study, “understanding gender differences in m-health adoption” which also concluded that males have a higher-level adopt intention of m-health when compared with females (Zhang, Xitong, Kee-hung, Fen & Chenlei 2014:44).

There were no gender-mHealth type associations for all mHealth activities with the exception of the “locating medical doctor” activity. Significant differences between male and female respondents were found in current usage of mHealth. This could suggest that female medical doctors are late adopters of mHealth. The highest concentration of mHealth use was found in the higher experienced medical doctors.

5.3 SCOPE AND LIMITATIONS OF THE STUDY

- This study was conducted at one central hospital in the country out of the available five. The results cannot therefore be generalised to the entire population of medical doctors at Zimbabwe central hospitals.
- In depth qualitative reviews with the respondents might have provided more information on the respondents’ responses.
- The study could not cover all possible mHealth activities as this was not possibly achievable within the time limitations and scope of this study.
- The focus of the study was only medical doctors but the possible list of mHealth users could include nurses, pharmacists, lab technologists, radiologists and patients, to mention the common ones.

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Future research could focus in the areas below to improve domain knowledge on mHealth progress and challenges in the field. Due to the inherent rapidity of change in technology, there is a need for constant research in order to scan for new areas of opportunities that mHealth will most likely be presenting:

- The study focused on one central hospital and therefore the results cannot be generalised to the whole country. The research could be performed on the other hospitals.
• The higher concentration of mHealth users in the more experienced and senior medical doctors group suggest that future studies on the challenges to adoption of mHealth should concentrate more on these senior medical doctors.
• The negative response of the respondents with respect to the utilisation and potential of the “patient consent activity” is remarkable in this study and further research is recommended to determine the underlying reasons for such a high rejection of the mHealth activity.
• Some respondents mentioned low confidence in the potential of mHealth. Further qualitative research is needed to get an in depth understanding of the source of the low confidence as well as what the medical doctors might perceive as key success pre-requisites for mHealth.
• With the increasing smart phones penetration rate and rapidly increasing mobile applications on smartphones, a revision to this study will be necessary in the near future to determine the status and progress of mHealth to both healthcare providers and healthcare consumers.

5.5 RECOMMENDATIONS FOR PRACTICE

The recommendations for mHealth practice are as follows:

• MHealth activities that involve the medical doctor having to initiate a call to the patient had the least potential of adoption by the medical doctors. Such activities may therefore be implemented or introduced to an institution not as maiden mHealth activities but rather the institution should start with the introduction of high potential mHealth activities and then as the use of these mature and mHealth is generally accepted the lower potential areas can be tried or piloted.
• Knowledge about the existence of mHealth is generally lacking among medical doctors at HCH. The successful use of mHealth by medical doctors to improve health outcomes will require the institution to educate the doctors on the benefits of mHealth as well as advocating for innovative use of mobile technology in medical practice.
• Male medical doctors at HCH are early adopters of mHealth compared to their female counterparts and higher level medical doctors have mostly been involved in at least a mHealth activity. A successful mHealth programme for medical
doctors should therefore contain a higher proportion of male medical doctors compared to female doctors. Further in planning the introduction of a mHealth programme at a health facility, assistance and advice should be sought from senior medical doctors who might have more information and experience in the particular mHealth area.

5.6 CONCLUSION

MHealth being a new area in health is promising to provide solutions to some of the areas of the health domain that currently provide challenges to both patient and health provider. Being new, information on mHealth evolution progress and barriers is lacking. This study addressed the information gap that is existing in Zimbabwe with particular focus to one central hospital, HCH. The objectives of the study were to identify and describe the rate of mHealth utilisation as well as opportunities for mHealth and the barriers to use have been met. The study showed that the selected mHealth activities the rate of usage of these by medical doctors. It identified and separated the most used and least used activities. The future potential of the mHealth activities was also assessed from the medical doctors’ point of view. The current usage and future potential of these was also analysed by various demographic factors. In general it was concluded that mHealth has potential to be used by medical doctors to improve health service delivery though information and knowledge about its existence is also lacking.
LIST OF REFERENCES


Dhanraj, AP. 2011. Mobile for Health (mHealth) in developing countries: application of 4 Ps of social marketing. Journal of Health Informatics in Developing Countries 5:1-10.


Kumar, V & Svensson, J. 2012. Is mHealth viable in Ethiopia. Proceedings of M4D 2012, 28-29 February 2012, Karlstad University, New Delhi, India.


ANNEXURE 1

Patient identification and treatment mHealth activities
## Patient identification and treatment mHealth activities

<table>
<thead>
<tr>
<th>Use</th>
<th>mHealth Activities That could be self-driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting up of any health related work appointment reminders</td>
</tr>
<tr>
<td>2</td>
<td>Support for the chronically ill rendered through a mobile device</td>
</tr>
<tr>
<td>3</td>
<td>Internet medical/clinical research through mobile device</td>
</tr>
<tr>
<td>4</td>
<td>Patient consent</td>
</tr>
<tr>
<td>5</td>
<td>Locating Staff using electronic devices (pagers/cellphones)</td>
</tr>
<tr>
<td>6</td>
<td>Remote consultation (Telemedicine)</td>
</tr>
<tr>
<td>7</td>
<td>Diagnosis support</td>
</tr>
<tr>
<td></td>
<td><strong>Other mHealth Activities That could be adopted with availability of funding</strong></td>
</tr>
<tr>
<td>1</td>
<td>Medical data on SIM Card</td>
</tr>
<tr>
<td>2</td>
<td>Accessing electronic patient records through a mobile device</td>
</tr>
<tr>
<td>3</td>
<td>Allergy alert service for asthmatics (short message service and global positioning system)</td>
</tr>
<tr>
<td>4</td>
<td>Monitoring for asthma sufferers</td>
</tr>
<tr>
<td>5</td>
<td>Blood glucose monitoring: A blood glucose monitor works with a smartphone/EMD and can send the results to a website.</td>
</tr>
<tr>
<td>6</td>
<td>Medication compliance monitoring</td>
</tr>
<tr>
<td>7</td>
<td>Heart rate monitoring (uses an application installed on a cellphone/EMD and patient can press finger on cellphone/EMD camera and the heart rate is read)</td>
</tr>
<tr>
<td>8</td>
<td>Patient identification (radio frequency identification)</td>
</tr>
<tr>
<td>9</td>
<td>Accessing laboratory results through a mobile device</td>
</tr>
<tr>
<td>10</td>
<td>Access to patient X-ray images: Patient takes a picture of an X-ray image by cellphone/EMD and then send it to a specialist by phone mail or multi-media messaging</td>
</tr>
<tr>
<td>11</td>
<td>Skin cancer monitoring (involves patient taking images of skin and sending them for analysis)</td>
</tr>
</tbody>
</table>
ANNEXURE 2

Research Instrument
Research instrument

A questionnaire prepared for the partial fulfillment of the thesis subject: Utilisation of mHealth In Zimbabwe

Researcher – Chester Marufu

1. RESPONDENT’S BIOGRAPHICAL DATA

<table>
<thead>
<tr>
<th>1.1</th>
<th>Respondent’s code (To be completed by researcher only)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1.2</th>
<th>Employee Category</th>
<th>Level1(&lt;1yr)</th>
<th>Level2(&lt;3yrs)</th>
<th>Senior (3 yrs and over)</th>
<th>Consultant/Qualified Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3</th>
<th>Gender of the respondent</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.4</th>
<th>How old are you?</th>
<th>Years</th>
</tr>
</thead>
</table>
1.5 Type of cellphone/electronic mobile device (EMD) you use

<table>
<thead>
<tr>
<th>Basic functionality</th>
<th>Smartphone</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

1.6 If other then specify

2. BASIC MHEALTH ACTIVITIES THAT YOU MAY HAVE USED OR ARE USING

2.1 Have you used your cellphone/electronic mobile device (EMD) in setting up any health and work related appointment reminders?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

2.11 If answer to 2.1 is NO then could you explain the reasons for not using the phone for the mentioned use:

If yes how?

2.2 Have you used your cellphone/EMD in support for the chronically ill?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

2.21 If answer to 2.2 is NO then could you explain the reasons for not using the phone for the mentioned use:

If yes how?

2.3 Have you used your cellphone/EMD for internet medical/clinical research

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

2.31 If answer to 2.3 is NO then could you explain the reasons for not using the device for the mentioned use:

If yes how?
### 2.4 Have you used your cellphone/EMD to seek patient consent

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If answer to 2.5 is NO then could you explain the reasons for not using the device for the mentioned use:

If yes how?

### 2.5 Has the hospital used a mobile device or pager in locating you?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2.6 Have you used your cellphone/EMD in remote consultation (Telemedicine)?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If answer to 2.6 is NO then could you explain the reasons for not using the phone for the mentioned use:

### 3. OTHER MHEALTH AREAS

If the following mHealth activities are introduced at the hospital I will adopt them as opportunities for improving service delivery. If they are already used at the hospital please also indicate on whether you think they present opportunities for improving service delivery.

<table>
<thead>
<tr>
<th>Activity</th>
<th>I will adopt this activity</th>
<th>I think this activity present opportunities for improving service delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>a  Setting up health or any work related appointment reminders</td>
<td>Yes</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>b  Any support for the chronically ill rendered through a mobile device</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>c  Internet medical/clinical research through mobile device</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>d  Obtaining patient consent</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>e  Locating staff through electronic device</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>f</td>
<td>Remote consultation (Telemedicine)</td>
<td>Yes</td>
</tr>
<tr>
<td>h</td>
<td>Medical data on SIM Card</td>
<td>Yes</td>
</tr>
<tr>
<td>i</td>
<td>Accessing electronic patient records through a mobile device</td>
<td>Yes</td>
</tr>
<tr>
<td>k</td>
<td>Monitoring for asthma sufferers</td>
<td>Yes</td>
</tr>
<tr>
<td>l</td>
<td>Blood glucose monitoring: A blood glucose monitor works with a smartphone/EMD and can send the results to a website.</td>
<td>Yes</td>
</tr>
<tr>
<td>m</td>
<td>Medication compliance monitoring</td>
<td>Yes</td>
</tr>
<tr>
<td>n</td>
<td>Heart rate monitoring (uses an application installed on a cellphone/EMD and patient can press finger on cellphone/EMD camera and the heart rate is read)</td>
<td>Yes</td>
</tr>
<tr>
<td>o</td>
<td>Patient identification (radio frequency identification)</td>
<td>Yes</td>
</tr>
<tr>
<td>p</td>
<td>Accessing laboratory results through a mobile device</td>
<td>Yes</td>
</tr>
<tr>
<td>q</td>
<td>Access to patient X-ray images: Patient takes a picture of an X-ray image by cellphone/EMD and then send it to a specialist by phone mail or multi media messaging</td>
<td>Yes</td>
</tr>
<tr>
<td>r</td>
<td>Skin cancer monitoring (involves patient taking images of skin and sending them for analysis)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
4. CHALLENGES

4.1. In point form please list below the challenges or obstacles that you have encountered in trying to use mHealth:

........................................................................................................................................................................................................................................................................................................
........................................................................................................................................................................................................................................................................................................

THANK YOU VERY MUCH FOR AGREEING TO PARTICIPATE AND ASSISTING IN THIS IMPORTANT RESEARCH TOPIC
ANNEXURE 3

Respondent informed consent form
INFORMED CONSENT FORM

PROJECT TITLE:
Utilisation Of mHealth In Zimbabwe

Principal Investigator : Mr. Chester Marufu
Phone number(s): +263772165570

What you should know about this research study:
• We give you this consent so that you may read about the purpose, risks, and benefits of this research study.
• The main goal of research studies is to gain knowledge that may help future patients.
• We cannot promise that this research will benefit you.
• You have the right to refuse to take part, or agree to take part now and change your mind later.
• Whatever you decide, it will not affect your employment.
• Please review this consent form carefully. Ask any questions before you make a decision.
• Your participation is voluntary.

PURPOSE
You are being asked to participate in a research study of “The status of mHealth in Zimbabwe”. The purpose of the study is to expose the status of mHealth adoption at Harare Central Hospital. You were selected as a possible respondent in this study because you are currently working at Harare Central Hospital as a medical doctor. All the medical doctors from all levels at Harare Central hospital have been selected to participate in this research.
PROCEDURES AND DURATION
If you decide to participate, you will be asked to complete the questionnaire attached. To ensure confidentiality and anonymity, you will not have direct contact with the researcher but a data collector will distribute and collect the questionnaire.

RISKS AND DISCOMFORTS
There are no risks or discomforts expected from this research.

BENEFITS AND/OR COMPENSATION
The research will have no direct benefit to the respondent but aims to contribute to health service delivery in the following ways:

- Provide knowledge on adoption of electronic mobile device use activities at Zimbabwe’s central hospitals profiling the usage by gender and employee levels.
- It also aims to contribute to availability of information on the barriers to adopting mHealth activities from the medical doctors perspective. This information will be valuable for future mHealth implementers/funders in Zimbabwe.
CONFIDENTIALITY
If you indicate your willingness to participate in this study by signing this document, we plan to disclose this information to the UNISA University, Medical research council of Zimbabwe and Harare Central Hospital Chief Executive Officer. Any information that is obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission. Codes will be used to identify you on the instrument.

ADDITIONAL COSTS
There will be no costs to be borne by the respondent.

VOLUNTARY PARTICIPATION
Participation in this study is voluntary. If you decide not to participate in this study, your decision will not affect your future relations with the researcher or your employer. If you decide not to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty.

OFFER TO ANSWER QUESTIONS
Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

AUTHORIZATION
You are making a decision whether or not to participate in this study. Your signature indicates that you have read and understood the information provided above, have had all your questions answered, and have decided to participate.

Name of Research Respondent (please print)  Date

______________________________  ________________________
Signature of Respondent  Time

YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

If you have any questions concerning this study or consent form beyond those answered by the investigator, including questions about the research, your rights as a research respondent or research-related injuries; or if you feel that you have been treated unfairly and would like to talk to someone other than a member of the research team, please feel free to contact the Medical Research Council of Zimbabwe on telephone 791792 or 791193 and cell phone lines (insert physical location).
ANNEXURE 4

Ethical Clearance Certificate from the University of South Africa
UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE

HSHDC/130/2013

Date: 23 January 2013
Student No: 4340-182-1

Project Title: Utilisation of Mobile health in Zimbabwe.
Researcher: Chester Marufu
Degree: Masters in Public Health

Supervisor: Mrs KA Maboe
Qualification: MA in Health
Joint Supervisor: -

Code: DIS4953

DECISION OF COMMITTEE

Approved [x] Conditionally Approved [ ]

Prof L Roets
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE

Dr MM Moleki
ACTING ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRIES
ANNEXURE 5

Application to Medical Research Council of Zimbabwe to conduct study
APPLICATION TO CONDUCT HEALTH/MEDICAL RESEARCH

This form must be completed by all persons/teams intending to conduct health/medical research in Zimbabwe. Upon completion by the investigator(s) it should be submitted to the Institutional Review Board (IRB) of the institution in which/under which the research is to be conducted. Upon completion of the relevant section by the IRB, the form should be submitted to the Secretary, Medical Research Council of Zimbabwe, P O Box CY 573, Causeway, Harare.

Protocol Version Number: 

Details of Research Team

<table>
<thead>
<tr>
<th>Name of Principal Investigator (P.I.)</th>
<th>Chester Marufu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationality of P.I.</td>
<td>Zimbabwean</td>
</tr>
<tr>
<td>Existing Qualifications</td>
<td>B.Sc. Electrical Engineering Honours</td>
</tr>
<tr>
<td>Academic Title</td>
<td>Mr.</td>
</tr>
<tr>
<td>Institution &amp; Dept.</td>
<td>University of South Africa, Department of Health Studies</td>
</tr>
<tr>
<td>Postal address</td>
<td>2081 New Bluffhill, wetsgate Area D</td>
</tr>
<tr>
<td>E-mail address</td>
<td><a href="mailto:chestermarufu@gmail.com">chestermarufu@gmail.com</a></td>
</tr>
<tr>
<td>Telephone No.</td>
<td>263 772 292 806</td>
</tr>
<tr>
<td>Is this research expected to lead to the award of a higher degree? (Yes/No)</td>
<td>Yes</td>
</tr>
<tr>
<td>University/Institution where registered</td>
<td>University Of South Africa</td>
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</table>

<table>
<thead>
<tr>
<th>Co-investigators Names</th>
<th>Qualifications</th>
<th>Institution/Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Details of Research Coordinator

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Postal Address</td>
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</tr>
<tr>
<td>E-mail Address</td>
<td></td>
</tr>
<tr>
<td>Telephone Number</td>
<td>263-36-28</td>
</tr>
<tr>
<td>Mobile Number</td>
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</table>
**Details of the Proposed Research**

<table>
<thead>
<tr>
<th>Title of proposed research</th>
<th>Utilisation of Mobile health in Zimbabwe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed starting date</td>
<td>01 May 2013</td>
</tr>
<tr>
<td>Proposed ending date</td>
<td>31 Dec 2013</td>
</tr>
<tr>
<td>Performance site(s) in Zimbabwe</td>
<td>Harare Hospital</td>
</tr>
<tr>
<td>Performance sites (outside Zimbabwe)</td>
<td>None</td>
</tr>
<tr>
<td>Total number of study personnel</td>
<td>1</td>
</tr>
<tr>
<td>Budget (state currency)</td>
<td>US$1000</td>
</tr>
<tr>
<td>Name and address of Funding agency</td>
<td>Self</td>
</tr>
<tr>
<td>Status of funding:</td>
<td>a) Submitted for funding</td>
</tr>
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</table>

**Collaborating Institutions**

<table>
<thead>
<tr>
<th>1st</th>
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<tbody>
<tr>
<td>2nd</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td></td>
</tr>
</tbody>
</table>

**Population: Proposed inclusion criteria (Check all that applies)**

- Males: ☒
- Females: ☐
- Adolescents (12 - 17 years): ☐
- Children (Under 12 years of age): ☐
- Pregnant women: ☐
- Foetuses: ☐
- Elderly (over 65 years): ☐
- Prisoners: ☐
- Cognitively impaired: ☐
- Hospital inpatients: ☐

**Type of study (check all that applies)**

- Survey: ☒
- Secondary data: ☐
- Program Project: ☐
- Clinical community trial: ☐
- Case control: ☐
- Longitudinal study: ☐
- Record review: ☐
- Course activity: ☐
- Other (specify): ☐

**Consent Process (Check all that applies)**

- Written: ☒
- English: ☒
- Local Language: ☐

**Proposed sample size**: All medical doctors working at Harare Hospital......

**Reading level of consent document**

- Below Grade 3: ☐
- Below Grade 6: ☒
- Below Form 2: ☐
- Below Form 4: ☐
- Above O level: ☐
- Graduate level: ☒

**Determination of Risk (Check all that applies)**

<table>
<thead>
<tr>
<th>Does the research involve any of the following</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human exposure to ionizing radiation</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>Fetal tissue or abortus</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>Investigational new drug</td>
<td>☐</td>
<td>☒</td>
</tr>
<tr>
<td>Investigational new device</td>
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Do you consider the proposed research
A) greater than minimal risk ☐
B) minimal risk ☐
C) no risk ☒

Minimal risk is a risk where the probability and magnitude of harm or discomfort anticipated in the proposed research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical, psychological examinations or tests. For example, the risk of drawing a small amount of blood from a healthy individual for research purposes is no greater than the risk of doing so as part of routine physical examinations.

☐ Do any of the participating investigators and/or their immediate families have an equity relationship with the sponsor of the project or the manufacturer or owner of the drug or device under investigation or serve as a consultant to any of the above?
YES ☐ NO ☒

If yes, please submit a written statement of disclosure to the Chairperson of the MRCZ.

RESEARCH PROPOSAL SUMMARY

It is the MRCZ requirement that the composition of the Institutional Review Board (IRB) include individuals with varied backgrounds and education. Investigators are therefore required to attach (5) copies of a (maximum 4 pages) Research Proposal Summary using the headings provided below in terminology that is understandable across disciplines.

1. RESEARCH QUESTION TO BE ADDRESSED BY THIS PROPOSAL
1. What are the most common mHealth utilisation areas by medical doctors at Zimbabwe’s central hospitals?
2. Is there any correlation between utilisation and gender/age/employee class?
3. What are the barriers to mHealth utilisation?
4. Where do the opportunities and potential to mHealth utilisation fall, from the medical doctors perspective and which are the most preferred areas?

2. RATIONALE FOR RESEARCH
- Describe briefly the background of the study, and state reasons for conducting it.

The emergence of the mobile phone as a ubiquitous device for communication has brought thought innovations for many sectors of society, including medical doctors. A comprehensive report from the wireless industry (Wireless Healthcare 2005) lists 101 specific health-related activities that can be conducted using mobile phones. Despite this list being seven years old, some of the items on the list remain speculative and/or in the early phases of research. Although there is evidence of an increased mobile communication penetration rate in Zimbabwe, there is no evidence of mHealth utilisation or the progress thereof. This research looks at “patient identification and treatment activities” of the 101 suggested uses of the mobile phone in health and investigates to find out which ones have been adopted by medical doctors at one major hospital in Zimbabwe and what the adoption rates are. There are a total of 18 “patient identification and treatment” mHealth activities/uses that can be identified from that list. (Please refer to annexure 1 for the list). In most developing countries, mHealth has been initiated and supported by international donors. In Zimbabwe, three pilot projects supported by international Non Governmental Organisations (NGOs), are known. These are the use of cell phones to:
- send images of completed anti-retroviral (ARV) drugs consumption data forms once every reporting period from the health facility level to the central level.
• gather quarterly data on the use of malaria drugs using the magni(episurveyor) application
• report weekly on incidences of disease outbreaks such as diarrhoea.

Most mHealth pilot projects, implemented worldwide, are used for data/information management. Few of them are concerned with actual patient treatment or care. According to an Indian newspaper (Economic News 2011.02), a doctor from India’s Apollo Telemedicine Networking Foundation said: “... there is a need for mobile healthcare to be driven by the needs of patients and doctors, and not by whatever the technologists are currently working on”.

- State objectives of study.
  1. find out the rate of utilisation of mHealth activities by medical doctors, at one hospital – Harare, Zimbabwe
  2. Establish any relationship between utilisation rates and gender/age/employee level
  3. To determine the opportunities for future mHealth activities in patient identification and treatment areas

3. METHODS
The study aims to quantify answers to questions and derive statistical conclusions and therefore a quantitative non-intervention research method will be used. Data will be collected about medical doctors’ utilisation of mHealth and analysed against variables of gender, age and medical doctors’ categories. mHealth prevalence among medical doctors will be estimated. The study will therefore employ a cross-tabulatory analytical and descriptive design.

Self administered questionnaires will be used to collect data. The questionnaires will be distributed to the entire population of medical doctors at one central hospital.

Site sampling Technique:
There medical doctors working at Harare central hospital will be split into the following categories:
1. first level junior(0-1 year post graduate experience),
2. second level (1-2 years post graduate experience),
3. senior(3 years post graduate experience and above) and
4. consultants

The research will target the entire population of available medical doctors at Harare Central hospital.

Site sample size:
No sampling will take place; questionnaires will be handed out to the entire population of medical doctors at the central hospital.

Data collection:
The researcher will employ self administered questionnaires. The researcher will obtain the names of medical doctors and the shift register list from the hospital administration. This will be used as a guide to distribute the questionnaires to the medical doctors. The questionnaires will be distributed and collected from hospital wards. The researcher will not distribute and collect the questionnaires himself, but will employ a “data collector”. The data collector will distribute the questionnaires to the medical doctors and also collect them from the medical doctors for submission to the researcher. The data collector will submit the questionnaires back to the researcher in batches of a minimum quantity of twenty forms. This ensures anonymity and the researcher will not know the names of the medical doctors submitting the questionnaires.

RISKS / BENEFITS TO PARTICIPANTS
• Assess potential benefits to be gained by the individual participants and explain why the benefits outweigh the risks. There will not be any anticipated risks that the participants could be exposed to. By participating the participants will contribute to the evidence of mHealth utilisation of which mHealth is expected to be a significant tool that will ease the lives of both the medical practitioners and the patient in the near future. The gain therefore lies into the future.

• Assess benefits which may accrue to society in general as a result of the planned work. The research aims at contributing to the evidence-base for future decision making on mHealth at Zimbabwe’s central hospitals.

   1) Provide knowledge on adoption of “patient identification and treatment” mHealth activities at Zimbabwe’s central hospitals.
2) Provide information on how gender, age and employee class factors are related to embracing mHealth.

3) Provide information on the barriers to adopting mHealth activities from the users perspective. This information will be valuable for future mHealth implementors in Zimbabwe.

4) Provide information on the available opportunities and potential of mHealth

COSTS AND COMPENSATION

- Will participants receive any compensation, monetary or other? If monetary, how much? Will participants be asked to assume any out-of-pocket costs for participating in the research? If yes, what? Identify expenses such as additional transportation, laboratory tests, supplies, cost of study drug if it becomes commercially available, etc.

There will not be any compensation to participants neither will participants be expected to suffer any financial loss by participating to the research.

CONFIDENTIALITY ASSURANCES

Describe any means by which the participant's personal privacy is to be protected and confidentiality of data maintained. Include information on the following:

- Any sensitive information that will be gathered.
- Plans for record keeping
- Location of the data
- Data security
- Person responsible and telephone number
- Who will have access to the data
- Plans for disposal of the data upon completion of the study

The Department of Health Studies Higher Degrees Committee (UNISA) has already approved this proposal.

The research will make every effort in protecting the rights of the medical doctors who will be interviewed. The research will publish the results of the research once permission has been sought from and granted by the hospital as well as MOHCW.

The names of the medical doctors that will participate in the research will be kept in anonymity. Coding will be used on the questionnaires to identify the names. All documents and instruments used will be kept in confidence.

CONFLICT OF INTEREST (real or apparent)

- Other than the normal scholarly gains, are there any other gains you might receive from taking part in this study?
  There will be no other gains.

COLLABORATIVE AGREEMENTS

- Provide letters of approval from collaborating institutions' IRBs and from other local IRBs from other sites.

ENDED USE OF RESULTS

- Include plans for dissemination and utilization of study results

OTHER INFORMATION:

- Any other information.

FULL RESEARCH PROPOSAL

Attach 5 COPIES of the full research proposal. The full proposal should include the following: Title, objectives, background and literature review, methodology (to include research design, participants and methods, ethical considerations, timetables etc. references, budget etc. Investigators may submit the full proposal in the funding agency format as long as it covers the above headings.
ANNEXURE 6

Medical Research Council of Zimbabwe approval
MRCZ APPROVAL LETTER

Ref: MRCZ/B/519

28 June, 2013

Chester Marufu
MOHCW DPS
Harare Regional Stores
Lobengula Road
Southerton
Harare
Zimbabwe

RE: UTILISATION OF MOBILE HEALTH IN ZIMBABWE

Thank you for the above titled proposal that you submitted to the Medical Research Council of Zimbabwe (MRCZ) for review. Please be advised that the Medical Research Council of Zimbabwe has reviewed and approved your application to conduct the above titled study. This is based on the following documents that were submitted to the MRCZ for review:

a) Study proposal.
b) English and Shona Consent Forms

APPROVAL NUMBER: MRCZ/B/519

This number should be used on all correspondence, consent forms and documents as appropriate.

- APPROVAL DATE: 28 June, 2013
- EXPIRATION DATE: 27 June, 2014
- TYPE OF MEETING: EXPEDITED REVIEW

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted one month before the expiration date for continuing review.

- SERIOUS ADVERSE EVENT REPORTING: All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices.
- MODIFICATIONS: Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- TERMINATION OF STUDY: On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices.
- QUESTIONS: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw.

Other

- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

[Signature]

MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH
ANNEXURE 7

Letter to Harare Central Hospital ethical committee requesting permission
The Chairman  
Harare Central Hospital Ethics Committee  
Harare  
Zimbabwe  

Monday, May 20, 2013  

Re: Request For Permission To Conduct Study at Harare Central Hospital  

STUDY TITLE: Utilisation of mHealth in Zimbabwe  

Dear Sir/Madam  

I kindly hereby apply for permission to conduct a study with the title as mentioned above at your health institution, Harare Central Hospital. I am currently employed as an MIS advisor to the Directorate of Pharmacy Services, MOHCOW by John Snow Incorporated.  

I am a Masters of Public Health student with UNISA specializing in medical informatics and am seeking approval to conduct the said study in which I would like to solicit for information from all medical doctors currently working at Harare Central Hospital. I intend to use a self-administered questionnaire as attached.  

The objectives of the study are as follows:  

1. find out if there are any mHealth activities that are being utilised by medical doctors at the hospital,  
2. if there is utilisation then what is the rate of utilisation  
3. Establish any relationship between utilisation rates and gender/age/employee level  
4. To determine the opportunities for future mHealth activities at a typical central hospital in Zimbabwe.  

This study aims to expose and document the status and potential of mHealth in Zimbabwe’s central hospitals. I have attached to this letter a brief summary of the research proposal.  

Yours Sincerely  

Chester Marufu  
(Researcher)
ANNEXURE 8

Harare Central Hospital approval
19 June 2013

Chester Marufu
MOHCW DPS
Harare Regional Stores
NatPharm
Lobengula Road, Southerton
HARARE

Dear Chester,

REF: UTILISATION OF MOBILE HEALTH IN ZIMBABWE

I am glad to advice you that your application to conduct a study entitled: Utilisation Of Mobile Health In Zimbabwe, has been approved by the Harare Hospital Ethics committee.

You are advised to avail the results of your study whether positive or negative to the hospital through the committee for our information.

Chairman Harare Central Hospital Ethics Committee
ANNEXURE 9

Letter from statistician
Letter from statistician

University of Zimbabwe

Department of Statistics

Department Contact Details - Phone: 263-04-303211 ext 1636  E-mail: statistics@science.uz.ac.zw

To whom it may concern

4 November 2013

Re: Offer of statistical Services to student Chester Marufu

STUDY TITLE: Utilisation of Mhealth in Zimbabwe

Please be advised that I have entered into an agreement to assist Chester Marufu with statistical services in the analysis of data for his thesis with the theme as mentioned above. I am lecturer in the department of statistics at the University of Zimbabwe.

For any further enquiry please contact me on the following email address: amachisvo@science.uz.ac.zw or albertmachisvo@gmail.com

Yours Sincerely

[Signature]

Albert Machisvo
MBA (UZ), MSc Statistics (UZ),

+263773041600
ANNEXURE 10

Letter from the editor
To whom it may concern

8 May 2014

Re: Editing thesis for student Chester Marufu

STUDY TITLE : Utilisation of Mhealth In Zimbabwe

Please be advised that I have entered into an agreement to assist Chester Marufu with the editing of his thesis with the theme as mentioned above. I am lecturer in Logistics at the University of Zimbabwe.

For any further queries please contact me on the following email address: tapiwa.mukwashi@gmail.com

Yours Sincerely

[Signature]

Tapiwa Mukwashi
ANNEXURE 11

Electronic sources