

**IMPROVING HEALTH CARE DELIVERY IN RURAL COMMUNITIES
THROUGH THE USE OF MOBILE PHONES: A CASE STUDY IN
WINDHOEK**

by

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DEDICATION

This dissertation is dedicated to God for giving me the grace to complete this study and to my supervisor, Prof. Alfred Coleman for his continual support, supervision and for sharing his knowledge and experience with me.

I also dedicate this dissertation to my parents, Mr. and Mrs. Iyawa for their unconditional love and support.

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- My supervisor Prof. Alfred Coleman for his continuous support, guidance and encouragement throughout this study.
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ABSTRACT

Poor health care delivery in rural communities is a major problem facing the health sector in Namibia. Patients who visit rural communities often wait on queues for several hours every day before they can be examined by a medical practitioner. This is detrimental to the health care process and impacts negatively on the efficiency and effectiveness of the sector. Mobile phones can however be employed as tools to improve work processes in such hospitals and as a result improve health care delivery in rural communities.

The purpose of this study was to investigate the health care services provided to patients at Outpatient Departments (OPDs) in rural hospitals through the use of data collection instruments such as interviews, questionnaires, document analysis, expert validation and photographs in order to compile a Mobile Health Service Framework (MHSF) to improve healthcare delivery processes in OPDs. From an interpretive paradigm perspective, the qualitative design was used together with a case study approach. Three hospitals in rural communities were used as case studies. These were Okuryangava Hospital, Katutura Hospital and Khomasdal Hospital. Interviews were conducted and questionnaires distributed to the participants. The findings revealed that there is a high concentration of mobile phone usage in rural communities and there is a high usage of the SMS feature on such mobile phones.

Key terms:

M-health, mobile phones, health care delivery, information and communication technology, out-patient departments, framework, activity theory, technology acceptance model, case study, rural hospitals.

Student number: 50862979

DECLARATION

I declare that, **IMPROVING HEALTH CARE DELIVERY IN RURAL COMMUNITIES THROUGH THE USE OF MOBILE PHONES: A CASE STUDY IN WINDHOEK** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete reference.

November 2013

SIGNATURE
(Ms. GE Iyawa)

DATE

TABLE OF CONTENTS

TABLE OF CONTENTS.....	VI
LIST OF TABLES.....	XIII
LIST OF FIGURES.....	XIV
LIST OF ACRONYMS.....	XVI
CHAPTER 1 INTRODUCTION.....	1
1.1 Background to the research.....	2
1.2 Contextual setting.....	3
1.3 Research problem.....	3
1.3.1 Research question.....	4
1.3.2 Aims and objectives of the study.....	4
1.3.3 Rationale and purpose of the study.....	5
1.3.4 Study delimitation.....	5
1.4 Literature review.....	5
1.5 Theoretical framework.....	6
1.6 Research methodology.....	6
1.7 Definition of key terms and concepts.....	6
1.8 Ethical considerations.....	7

1.8.1 Confidentiality.....	7
1.8.2 Informed consent.....	7
1.9 Chapter outlines.....	8
1.10 Conclusion.....	9
CHAPTER 2 LITERATURE REVIEW.....	10
2.1 Introduction.....	11
2.2 Sources for a literature review.....	12
2.2.1 Primary sources.....	12
2.2.2 Secondary sources.....	13
2.2.3 Tertiary sources.....	13
2.3 Purpose of the literature review.....	13
2.4 Mobile phones.....	14
2.4.1 The importance of mobile phones.....	14
2.4.2 Penetration of mobile phones in rural communities.....	15
2.4.3 The evolution of mobile phones	16
2.5 The role of mobile phones in providing health care delivery services at OPDs.....	20
2.5.1 M-health definition.....	20
2.5.2 The goals of m-health.....	23

2.6	Healthcare delivery at OPDs.....	25
2.7	Vital signs checking.....	26
2.8	The health sector in Namibia.....	28
2.9	The usage of mobile phones in Windhoek.....	28
2.10	Barriers to using technology in healthcare.....	28
2.11	Increasing quality.....	28
2.12	Waiting times in Canadian hospitals.....	29
2.13	Theoretical framework underpinning the research.....	29
2.13.1	Activity Theory (AT).....	29
2.13.2	Technology Acceptance Model (TAM).....	30
2.13.3	Lazy User Model (LUM) of Solution Selection.....	33
2.14	Theoretical framework for this study.....	34
2.15	Conclusion.....	38
 CHAPTER 3 RESEARCH METHODOLOGY.....		 39
3.1	Introduction.....	40
3.2	Purpose of the research and research objectives.....	40
3.3	Philosophical assumptions underlying research	41
3.3.1	Positivist philosophy.....	42
3.3.2	Interpretive philosophy.....	42

3.3.3 Critical philosophy.....	43
3.4 Research design.....	43
3.4.1 Qualitative research.....	43
3.5 Research approach.....	45
3.5.1 Case study approach.....	45
3.5.2 Procedures for conduction case study research.....	45
3.5.3 Entry into the site of the study.....	47
3.5.4 Research methods.....	48
3.6 Data collection methods.....	48
3.6.1 Triangulation.....	50
3.6.2 Research population and sampling.....	51
3.7 Data analysis techniques.....	52
3.7.1 Activity Theory (AT).....	52
3.7.2 Technology Acceptance Model (TAM)	52
3.7.3 Hermeneutic approach.....	52
3.8 Measures to ensure trustworthiness.....	55
3.9 Conclusion.....	56
CHAPTER 4 RESEARCH FINDINGS AND DATA ANALYSIS.....	58
4.1 Introduction.....	59

4.2	Contextualising the research question.....	60
4.2.1	The research respondents.....	61
4.2.2	Issues addressed by the various research instruments.....	62
4.2.2.1	Group interviews.....	62
4.2.2.2	The questionnaire.....	64
4.2.2.3	Photographs.....	68
4.3	Results dealing with sub-research question 1 and 2.....	68
4.3.1	Study location and context.....	69
4.3.1.1	Descriptions of Katutura hospital.....	69
4.3.1.2	Descriptions of Khomasdal hospital.....	71
4.3.1.3	Descriptions of Okuryangava hospital.....	72
4.3.2	Group interview findings.....	74
4.3.3	Summary of the group interview response.....	77
4.3.4	Questionnaire findings.....	79
4.3.5	Summary of questionnaire findings.....	82
4.4	Analysis and interpretation.....	83
4.4.1	Services provided to patients at hospital OPDs.....	83
4.4.2	Level of mobile phone penetration and usage by patients.....	85
4.4.2.1	Perceived ease of use.....	86

4.4.3	Health professionals and patients' satisfaction.....	86
4.4.3.1	Perceived usefulness (PU).....	87
4.5	Compiled mobile health service framework (MHSF).....	88
4.5.1	Aims and objectives of MHSF.....	88
4.5.2	Processes for the MHSF.....	88
4.5.3	Guidelines for implementation.....	91
4.5.4	Expert Validation.....	94
4.6	Conclusion.....	95
 CHAPTER 5 SUMMARY, RECOMMENDATIONS AND CONCLUSION.....		96
5.1	Introduction.....	97
5.2	Review of how the research study answered the research question.....	98
5.3	Contribution made by the research study.....	100
5.3.1	Theoretical contribution.....	100
5.3.2	Practical contribution.....	100
5.4	Research presentation.....	100
5.5	Limitations of the research study	101
5.6	Further research.....	102
5.7	Reflection.....	102

5.8 Conclusion.....103

REFERENCES.....105

APPENDICES

APPENDIX A: Questionnaire for patients.....118

APPENDIX B: Questionnaire for nurses.....120

APPENDIX C: Interview questions for nurses and doctors.....122

APPENDIX D: Ethics approval letter from UNISA.....123

APPENDIX E: Ethics approval letter from MoHSS.....124

APPENDIX F: Expert validation letter.....126

LIST OF TABLES

Table 2.1	Evolution of mobile phones from 1999 to 2005.....	20
Table 3.1	Healthcare institutions.....	47
Table 3.2	Questionnaire distribution table.....	49
Table 3.3	Category of participants (n = 18)	52
Table 4.1	Data collection instruments.....	60
Table 4.2	Rural hospitals.....,.....	62
Table 4.3	Objectives of the interview questions.....	64
Table 4.4	Objectives of the questionnaire instruments administered to patients.....	66
Table 4.5	Objectives of the questionnaire instruments administered to nurses.....	68
Table 4.6	Summarized responses to interview questions.....	77
Table 4.7	Summary of questionnaire findings for patients.....	80
Table 4.8	Summary of questionnaire findings for nurses.....	82
Table 5.1	Chapters in which the research and sub-research questions were addressed ...	97

LIST OF FIGURES

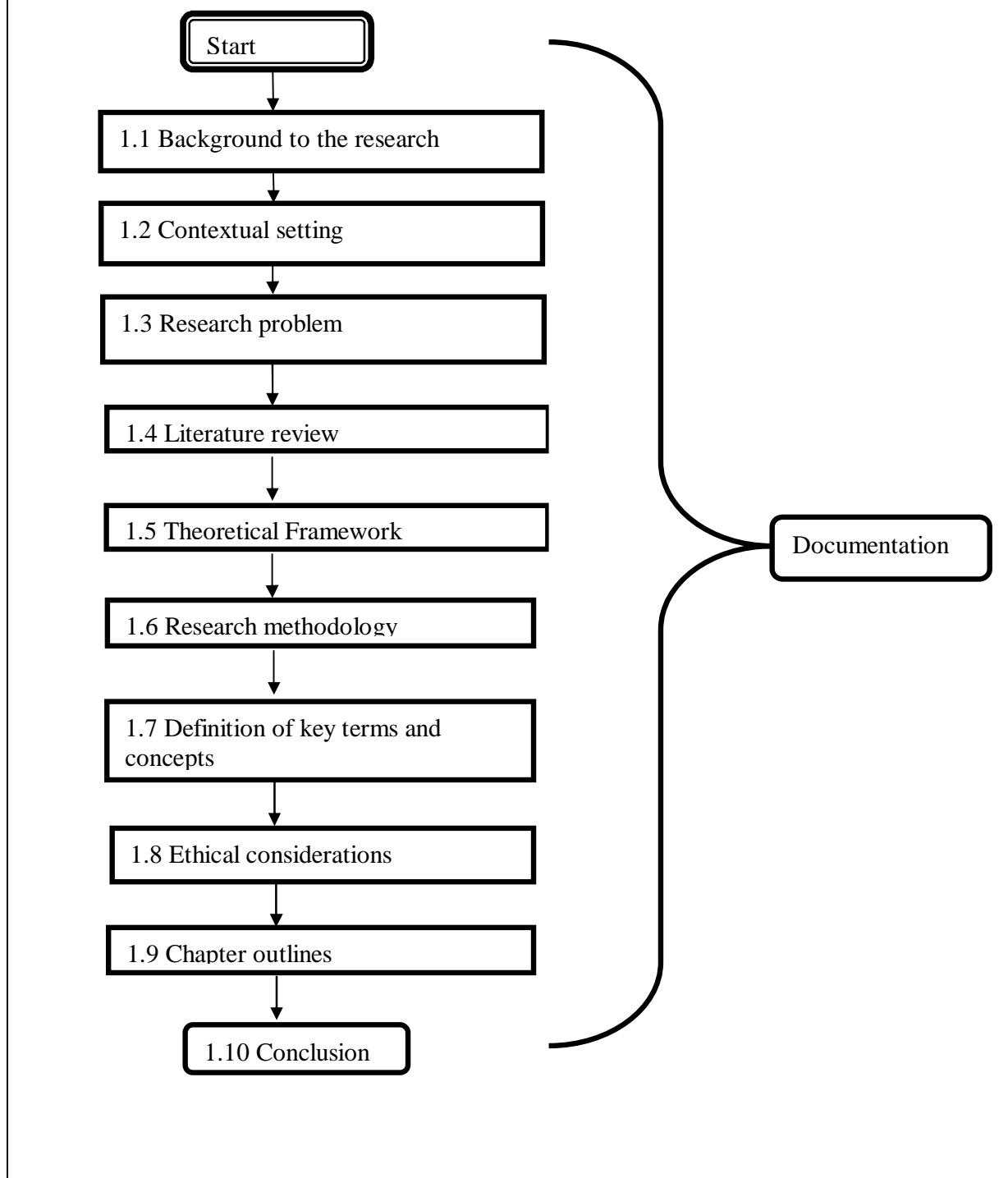
Figure 1.1 Chapter outlines.....	8
Figure 2.1 Definition of m-health.....	23
Figure 2.2 Ratio of under-five mortality rate.....	25
Figure 2.3 The Namibian health system.....	27
Figure 2.4 Engeström’s expanded Activity Theory Model.....	30
Figure 2.5 Technology acceptance Model.....	31
Figure 2.6 Technology acceptance Model 2.....	32
Figure 2.7 Technology acceptance Model 3.. ..	33
Figure 2.8 The lazy user model of solution selection.....	34
Figure 2.9 The AT model for this study	35
Figure 2.10 TAM for this study.....	37
Figure 3.1 The research process onion.....	41
Figure 3.2 Epistemological assumptions for qualitative research... ..	42
Figure 3.3 A case study process.....	46
Figure 3.4 Map of Windhoek.....	48
Figure 3.5 The hermeneutic circle.....	53
Figure 4.1 Steps for analysing data collected.....	59

Figure 4.2 Rural hospitals.....	69
Figure 4.3 Katutura hospital.....	70
Figure 4.4 Khomasdal hospital.....	71
Figure 4.5 Okuryangava hospital.....	73
Figure 4.6 Services provided to patients at OPDs.....	84
Figure 4.7 Mobile phone usage among patients who visit rural hospitals.....	85
Figure 4.8 SMS competencies among patients who visit rural hospitals.....	86
Figure 4.9 Mobile health service framework for improving health care delivery in rural communities in Windhoek.....	90

LIST OF ACRONYMS

AT	Activity Theory
E-health	Electronic Health
GUI	Graphic User Interface
ICT	Information and Communication Technology
IHCIMS	Integrated Health Care Information Management System
IPD	Inpatient Department
LUM	Lazy User Model
MoHSS	Ministry of Health and Social Sciences
M-health	Mobile Health
OPD	Outpatient Department
SMS	Short Message Service
TAM	Technology Acceptance Model
TAM 2	Technology Acceptance Model 2
TAM 3	Technology Acceptance Model 3
PDA	Personal Digital Assistant
PEOU	Perceived Ease of Use
PU	Perceived Usefulness

CHAPTER 1: INTRODUCTION



CHAPTER 1

INTRODUCTION

1.1 Background to the research

In the last few decades, information technology has played a significant role in making access to information and communication easier (West, 2012). The health care sector is no exception to this innovation. In a research conducted by Party, Morris and Leatherman (2010), they emphasized that in the last few years, there have been changes made in the healthcare sector. According to Majerowicz and Tracy (2010), the emergence of ICT in healthcare can improve the way health care delivery is administered to patients. However, due to the inadequate Information and Communication Technology (ICT) infrastructure in rural communities, inhabitants of rural communities have limited access to online facilities provided by internet and mobile technologies.

World Health Organisation (2012) describes Mobile Health (m-Health) as an area of electronic health (e-Health) which provides health services and information through the use of mobile technologies such as mobile phones and Personal Digital Assistants (PDAs). Mobile phones have become a necessity for many people throughout the world. With mobile phones in place, people keep in touch with family, business associates and are able to access email facilities (Kingston, 2011). According to Royal Tropical Institute (2012), internet technologies are not fully accessible to rural communities; however, the mobile phone is the first ICT tool that has been widely adopted in rural communities. It has been reported that the number of subscribers of mobile networks has surpassed the number of subscribers of fixed-line connections in rural communities (Royal Tropical Institute, 2012). The increase in the number of mobile networks can be used to facilitate new changes to improve health care delivery services in rural communities (Royal Tropical Institute, 2012). Researchers have elaborated on why mobile phones can be used to improve health care delivery services in rural communities as compared to internet technologies (Novak, 2012). Novak (2012) further explains that mobile technology provides the people who live in rural communities the opportunity to connect with healthcare workers in major cities. Mobile technology is affordable and accessible to individuals in rural communities; mobile phones can be used as a tool for patients in hospitals located in rural hospitals to access health care facilities in a timely manner.

This study focuses on investigating the health care delivery services provided to patients at OPDs in rural hospitals and how these health care delivery services can be improved through the use of mobile phones.

1.2 Contextual setting

This study was conducted at selected rural hospitals located in Windhoek rural communities. According to (National Geographic, 2014), rural communities are areas with less building infrastructure and lower cost of living compared to the urban areas. Rural communities are more densely populated, basic amenities and health care facilities provided in these areas are limited. Unlike the urban areas, where there is industrialization, rural areas do not have industries and companies where huge business activities are carried out. Windhoek, which is the capital city of Namibia has attained a high level of industrialization, hence can be considered as an urban area, however in the city of Windhoek, there are locations that do not meet the characteristics of an urban area. These locations still lack the high level building infrastructures located in urban areas, these areas have not been fully industrialised and do not have efficient health care services like the ones provided in the urban areas. These locations include Katutura, Okuryangava, Khomasdal, Greenwell, Havana, Hakahana and Wanaheda. These rural communities consist of 58% of Windhoek's population (Smit, 2012). For this study, the rural hospitals where the study was conducted are: Katutura hospital, Khomasdal hospital and Okuryangava hospital

1.3 Research problem

Kandjeke (2012) states that the health care sector in Namibia is faced with the problem of providing adequate health care services at OPDs in many rural hospitals. Health care services received at OPDs in Windhoek rural hospitals are far below the patients' expectation (Informate, 2009). Patients wait on queues for several hours every day before they can be examined by a medical practitioner. The process of vital signs checking and recording at OPDs in rural hospitals before being examined by a medical practitioner is rigorous. First, they have to wait on the queue for at least two hours to get their health card stamped for approval in order to begin the health care delivery process. After the stamping of health cards have been completed, patients are referred to another section of the OPD for vital signs checking. The vital signs checking process could take about two hours to complete. After the vital signs checking process has been completed, patients are referred to a medical practitioner and a

pharmacist and these processes could take another three hours to complete.

The problem is, patients who visit rural hospitals in Windhoek spend too much time in OPDs to have their vital signs (blood pressure, temperature and sugar level) checked and recorded before they are examined by a medical practitioner. As a result, patients who live in rural communities avoid going to the hospital to get medical treatment due to the delay in the process of getting health care services at OPDs. This means that patients only decide to visit the hospital when they are very sick. However, there is a great potential of using mobile phones to alleviate such delays at OPDs in rural hospitals.

1.3.1 Research question

The main research question is: How can mobile phones be used to improve health care delivery services at OPDs in rural hospitals in Windhoek?

In order to answer the main research question, the following sub-research questions need to be answered:

- What health care services are provided to patients at OPDs in rural hospitals?
- What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?
- How can a compiled mobile health service framework improve health care service delivery to patients at OPDs?

1.3.2 Aims and objectives of the study

The aim of this study is to investigate how mobile phones can be used to improve health care delivery services in rural hospitals, the sub-objectives will include:

- To investigate the health care services provided to patients at OPDs in rural hospitals in Windhoek.
- To investigate the penetration level of mobile phone usage in rural communities.
- To provide a mobile health service framework based on the findings to improve health care delivery services at OPDs in rural hospitals.

1.3.3 Rationale and purpose of the study

Patients who live in rural communities in Windhoek need health care services delivered in a timely manner, but due to the high number of patients and inadequate infrastructure in place, it is difficult for them to access OPD services. The rationale for this study was to explore how mobile phones as a tool can be used to expedite work processes at OPDs to meet patients' health care delivery needs. This study provides the framework and guidelines to ensure that patients in these communities have access to a timely health care delivery service when they visit their local hospitals.

1.3.4 Study delimitation

This study is restricted to patients who visit rural hospitals in Windhoek.

1.4 Literature review

This study focuses on two dimensions in the literature review namely:

- Mobile phones, vital signs checking in hospitals
- The role of mobile phones in providing health care delivery services at OPDs

The two dimensions in the literature review will be discussed in chapter 2. The literature review focuses on the following areas:

- Importance of mobile phones
- Penetration of mobile phones in rural communities
- The evolution of mobile phones
- M-health
- Goals of m-health
- The health sector in Namibia
- Health care delivery at OPDs
- The usage of mobile phones in Windhoek
- Barriers to using technology in healthcare
- Increasing quality
- Waiting times in Canadian hospitals
- Theoretical frameworks underpinning the research

1.5 Theoretical framework

This study is based on the constructs of two theoretical frameworks, which are

- Activity Theory (AT) and
- Technology Acceptance Model (TAM)

The theoretical frameworks will be discussed in Chapter 2

1.6 Research methodology

According to Saunders, Lewis and Thornil (2000), the research onion describes the various phases of a research process which includes the research philosophy, research design, research approach, data collection methods and data analysis techniques. The research philosophy for this study is the interpretive research paradigm. With the interpretive research paradigm, the feelings of the participants can be properly conveyed (Klotz and Lynch, 2007). The primary design for this study is a qualitative survey of patients' usage of mobile phones and their perceived needs. This research strategy was based on a case study method. Case study approach was used to conduct an in-depth investigation at the selected hospitals. Case study research was also involved in assessing the *subjects* which are the patients being studied, the *object* refers to the work process and the *tool* which is the mediating device by which the action is executed, in this case, the mobile phone (Hyland, 1998). A case study is an extensive study of separate cases with the purpose of representing a bigger population in related scenarios (Gerring, 2004).

The case study approach was appropriate for this study because the limited number of cases had to be analysed intensively. A case study research design was used in order to maximize the specificity of information to be obtained from and about the unit of study.

In addition, the researcher used interviews, questionnaires, document analysis, expert validation and photographs as data collection instruments for this study.

1.7 Definition of key terms and concepts

Outpatient Department (OPD) refers to a department in a hospital where health care services are

administered to patients with the intention of rendering health services for a limited period of time.

Inpatient Department (IPD) refers to a department in a hospital where health care services are delivered to patients with the intention of rendering health services on a long-term basis while patients are admitted in the hospital.

Healthcare delivery is the process of administering health care services to patients who visit a health centre.

Mobile Health (m-Health) refers to an “area of electronic health (e-Health) and it is the provision of health services and information via mobile technologies such as mobile phones and Personal Digital Assistants” (World Health Organization, 2012).

1.8 Ethical considerations

This study complies with the UNISA (2007) research ethics policy.

1.8.1 Confidentiality

Data collected for this study was treated as confidential, hence, participants’ identities were not revealed.

1.8.2 Informed consent.

Formal permission was obtained from the management of selected rural hospitals in order to carry out the study. Participants involved in the data collection process signed an informed consent.

1.9 Chapter outlines

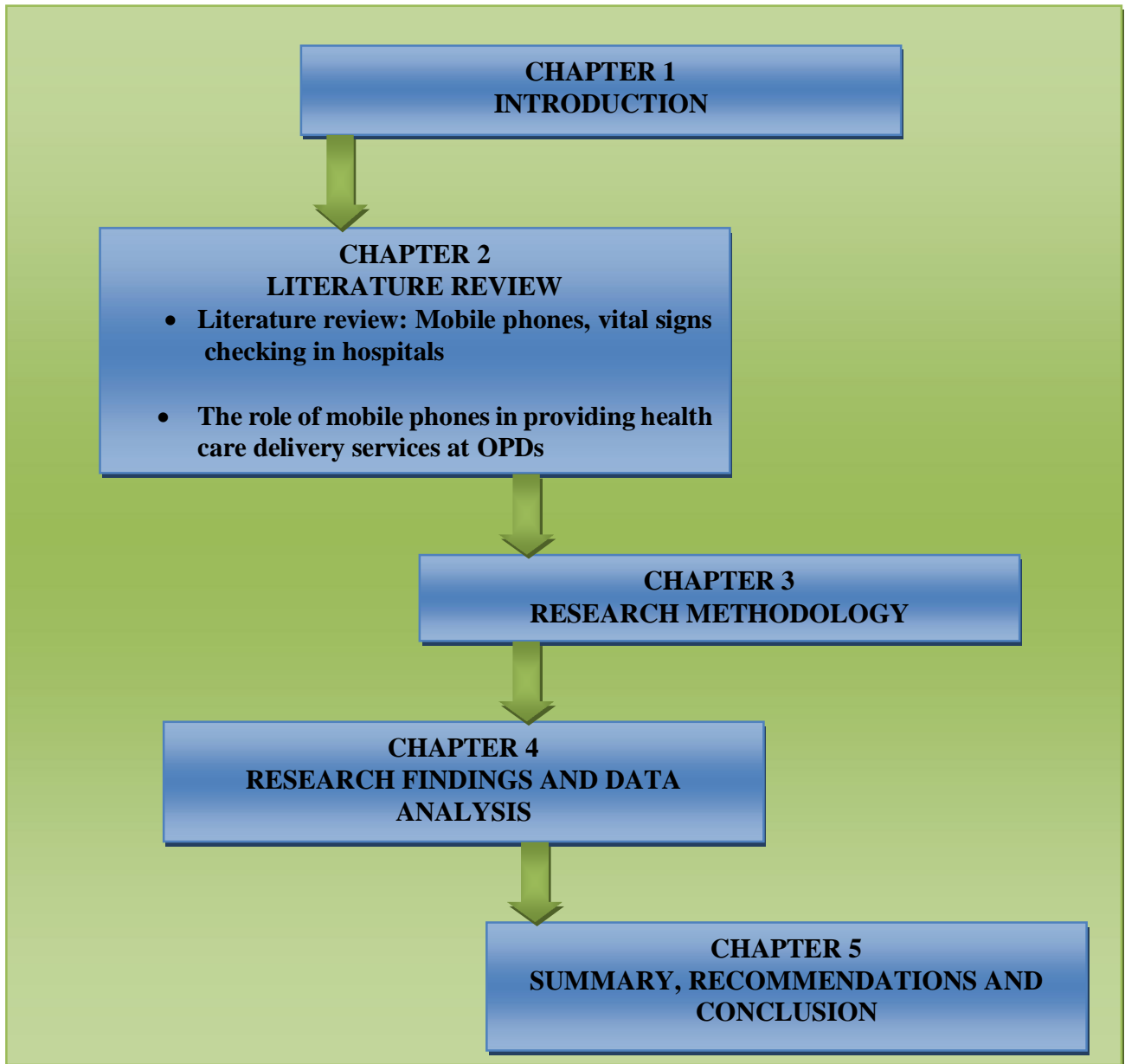


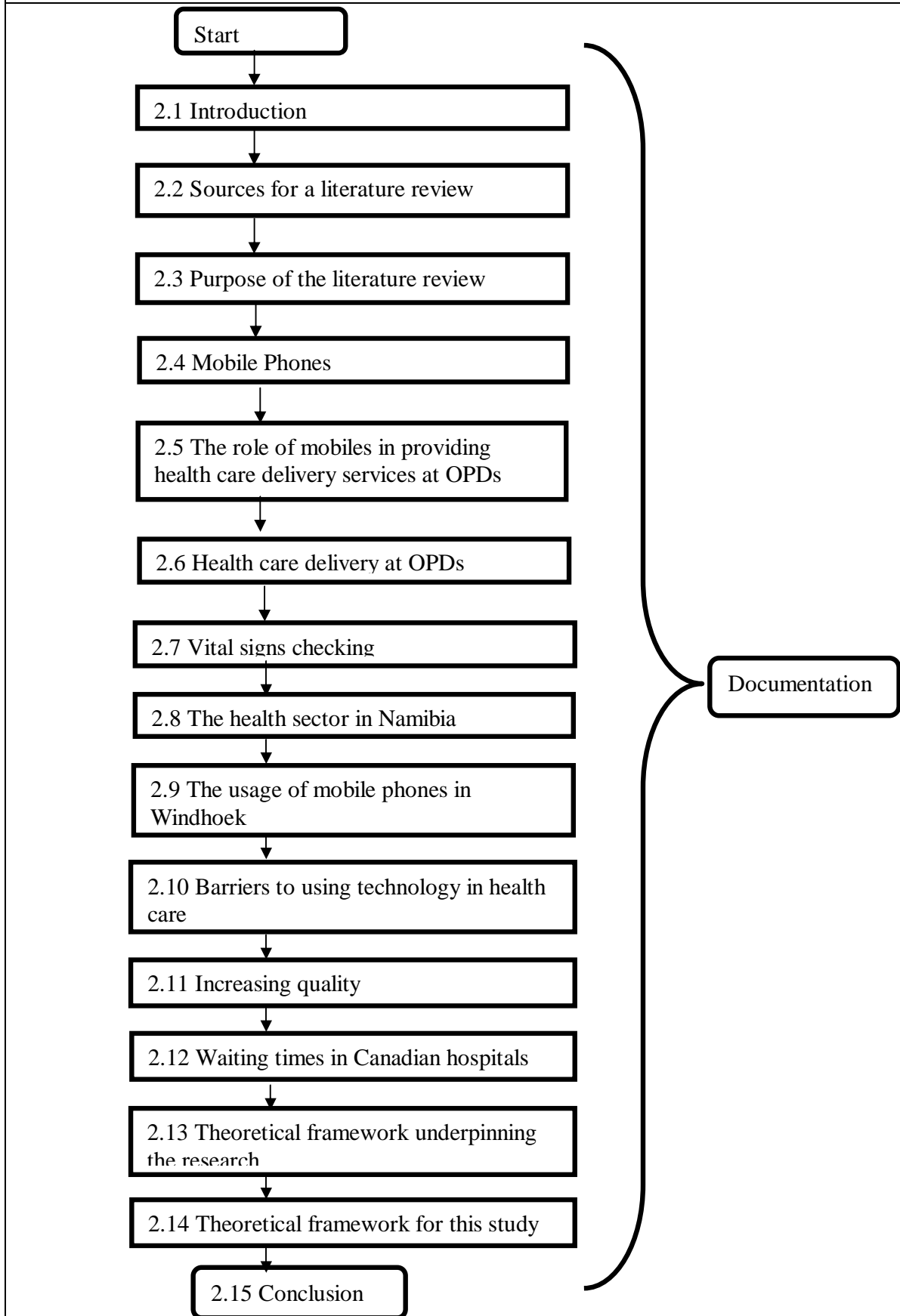
Figure 1.1 Chapter outlines

Chapter 1 gave a detailed background of the research study. Chapter 2 focuses on the literature review relevant to the study. Chapter 3 explains the research methodology used for the study. Chapter 4 discusses the findings and data analysis of the research. Chapter 5 summarises the research study.

1.10 Conclusion

This chapter has provided the background to the research study, stating the research problem, research questions, aim and objectives of the study, research design, research process, preliminary literature review, the purpose of the study, limitations, ethical considerations and the chapter outlines. In conclusion, this chapter has outlined the problems encountered in rural hospitals in Windhoek. The next chapter focuses on the literature review, emphasising on the existing theoretical frameworks in the Information Systems (IS) field and how it can be applied in the research study.

CHAPTER 2: LITERATURE REVIEW



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The background study of the research was introduced in Chapter 1. The chapter also stated the research question, objectives and significance of the study. Literature review can be defined as an analytical and detailed evaluation of research that has been previously done, which summarises a particular research area, allowing researchers to establish a particular area which is being conducted (Shuttleworth, 2009). This chapter focuses on the literature review, purpose of the literature review, a brief overview of mobile phones, key features of mobile phones, vital signs checking in OPDs, the role of mobile phones in providing health care delivery at OPDs, health care delivery at OPDs, the mobile phone usage in Windhoek, the barriers of using technology in health care, waiting times in Canadian hospitals, increasing quality and the theoretical framework underpinning the research. The literature review in this chapter is guided by the guidelines for writing a systematic literature review which are described as follows: Okoli and Scrhbram (2010).

1. **Purpose of the literature review:** The first step in any review requires the reviewer to clearly identify the purpose and intended goals of the review. This is necessary for the review to be explicit to its readers.
2. **Protocol and training:** For any review that employs more than one reviewer, it is critical that the reviewers have to be completely clear and in agreement about the detailed procedure to be followed. This requires both a written, detailed protocol document, and training for all reviewers to ensure consistency in the execution of the review.
3. **Searching for the literature:** The reviewer needs to be explicit in describing the details of the literature search and needs to explain and justify how the comprehensiveness of the research was assured.
4. **Practical screen:** Also known as screening for inclusion, this step requires the reviewers to be explicit about what studies were considered for review, and which ones were eliminated without further examination. For excluded studies, the reviewer must state what the practical reasons were for their non-consideration, and justify how the resulting review can still be comprehensive, given the practical exclusion criteria.
5. **Quality appraisal:** Also known as screening for exclusion, the reviewer needs to explicitly

spell out the criteria for judging which articles are of insufficient quality to be included in the review synthesis. All included articles need be scored for their quality, depending on the research methodologies employed by the articles.

6. **Data extraction:** After all the studies that should be included in the review have been identified, the reviewers need to systematically extract the applicable information from each study.
7. **Synthesis of studies:** Also known as analysis, this step involves combining the facts extracted from the studies using appropriate techniques, whether quantitative, qualitative, or both.
8. **Writing the review:** In addition to the standard principles to be followed in writing research articles, the process of a systematic literature review needs to be reported, insufficient details of the review can be independently reproduced.

2.2 Sources for a literature review

An important part of any literature review is the source used for the literature. Visser (2011) emphasised that it is also important for the researcher to use the appropriate sources when conducting a literature review. The main sources used in a literature review are the primary sources, secondary sources and tertiary sources which are discussed in the next sections (Lee, 2013).

2.2.1 Primary sources

Thomas (2013) defines primary sources as “the original first-hand account of an event or time period, which is usually written or made during or close to the event or time period, and these sources are usually factual and not interpretive”. University of Maryland (2013) further describes primary sources as “research materials on which other research is based, which are usually the first formal appearance results in physical, print or original format and represent original thinking, report a discovery or share new information”. Examples of primary sources of information include artefacts, audio recordings, diaries, internet communication or email, interviews, journal articles published in peer reviews, letters, newspaper articles written at a time, patents, photographs, proceedings of meetings, conferences and symposia, speeches, survey research, video recordings, work of art, architecture or literature, original documents such as birth certificates, will, marriage, licence and trial transcript University of Maryland (2013).

2.2.2 Secondary sources

Secondary sources can be defined as “published or unpublished work that is one step removed from the original sources, which provides criticism or interpretation of the original source” (University of Victoria Library, 2013). Secondary sources most often give bias information of the primary source. Examples of secondary sources of information include bibliographical works, commentaries, criticisms, dictionaries, encyclopaedias, dictionaries, journal articles, magazines and newspaper, monographs and text books (Library and Archives Canada, 2010).

2.2.3 Tertiary sources

A tertiary source seldom contain original materials which are usually presented as concise versions of original materials which points to references made from the primary and secondary sources (VirginTech University Libraries, 2013). Tertiary sources serve as a repository to look up facts or get a general overview of a particular subject; examples of tertiary sources include dictionaries, encyclopaedia and handbooks (VirginTech University Libraries, 2013).

2.3 Purpose of the literature review

There are many reasons why a literature review is done for a research study. Those reasons include the researcher being able to carry out investigations and findings on a specific research area. Boote and Beille (2005) emphasized that there should be a connection between the study and the literature review and not just putting information together.

In addition, the purpose of the literature review is to review what has been previously done in the research field. Hart (1998, p. 27) explains that the literature review helps the researcher to determine already existing findings and gaps in a particular research area, in order to identify what is pertinent to the research.

The purpose of the literature review for this study was to learn more about the history of mobile phones, penetration of mobile phones in rural communities, making use of existing knowledge in the m-health field, emphasize the significance of the problem and investigate the existing theories used in the m-health field to determine what is needed in the design of the MHSF to improve healthcare delivery services in rural communities in Windhoek.

2.4 Mobile phones

WiseGeek (2013) defines mobile phones as “a wireless electronic device used for telephone and multimedia communications which is used to make and receive calls, send and receive text messages”. Mobile phones allow mobility which means users are able to move from one place to another with their mobile phones irrespective of their location.

The evolution of mobile technology has made a huge impact in all sectors (Asfahaanulah, 2008). Asfahaanulah (2008, p.7) further explains that “mobile phones with wireless technology facilitate m-computing, m-communication, m-health and m-commerce”. Internet technologies are not fully accessible to rural communities; however, the mobile phone is the first ICT tool that has been widely adopted in these communities (Royal Tropical Institute, 2012). The unequal access of ICT in developing countries can be addressed with the use of mobile phones (James and Veerstag, 2007).

2.4.1 The importance of mobile phones

Mobile phones have become a part of everyday life and as a result it has become an important item for every individual. Mobile phones are very important tools for communication and it has also helped in the improvement of developing countries where there is no access to telephone line networks (James and Veerstag, 2007).

Mobile phones provide functionalities such as emailing facilities, other than the traditional messaging and chatting system (Cathieforuni, 2010). James and Veerstag (2007) further explain how mobile phones have increased the GDP growth rate in developing countries. Laptops are increasingly being substituted with mobile phones, since mobile phones also have the facilities provided by a laptop such as internet and messaging with the mobility feature (Alexander, 2008). Using mobile phones as a means of communication is the most preferred means of communication as Lenhart, Ling, Campbell and Purcell (2010) explain that mobile phones have become essential devices among teens and “as a result 75% of 12-17 year old own cell phones up from 2004”.

The increased use of mobile phones in today’s economy is enough evidence of how important mobile phones have become. In the past few years, there have been great developments in the usage of mobile phones in Africa (Aker and Mbiti, 2010). Mobile phones have bridged the gap between the rural and urban communities thereby influencing communication between individuals and businesses

(Aker and Mbiti, 2010). Aker and Mbiti (2010) reports that the mobile phone is the first ICT tool to reach rural communities in Africa. Aker and Mbiti (2010) further explain that mobile phones have “greatly reduced communication costs, thereby allowing individuals to send and to obtain information quickly and cheaply”.

Mpofu and Warikandwa (2012) state that the gap between rural and urban communities have made the rural communities obliterated from the national advancement scheme in which South African nationals from rural communities are treated as inferior nationals by the South African nationals from urban areas. Mpofu and Warikandwa (2012) emphasize that mobile phone technology could resolve the disparity between the rural and urban communities as mobile phone technologies would provide opportunities and improvement in rural communities.

In a research conducted by Sife, Kiondo and Lyimo-Macha (2010), it shows that rural communities can benefit from mobile phone technology as rural farmers use mobile phones to disseminate business related information which would lead to low cost of goods and services. Sife, Kiondo and Lyimo-Macha (2010) suggest that mobile phones could be an enhancement to rural communities to reduce their poverty level thereby creating opportunities in these rural communities. Sife, Kiondo and Lyimo-Macha (2010) conducted a research which reveals that 72% of the respondents who participated in their research believed that mobile phones improved their ability to deal with “emergency situations” as mobile phones were used to alert the appropriate crime control authorities and they were able to contact health professionals when they had problems with their livestock.

FAO (2009) reports that mobile phones are relatively cheap to obtain and easy to adapt and as a result the “mobile phone technology can be used to create economic opportunities and strengthen social networks in rural areas”.

2.4.2 Penetration of mobile phones in rural communities

In a research conducted by FAO (2009), it shows that developing countries contributed for 70 percent of mobile phone usage. According to James and Versteeg (2007) the method used to determine the penetration of mobile phones is often determined by the data on the mobile phone usage, but in Africa, mobile phone usage is not only dependant on the number of mobile phone subscribers, people who live

in rural communities share their mobile phones with non-mobile phone subscribers. Mobile phone usage in rural communities has increased over the years, which suggests that there are more mobile phones users in rural communities FAO (2009).

Jingting (2013) reports that there are currently 1.1 billion mobile phones users in China and as result China is the first country to attain this level of mobile phone penetration in the world. Mobile phone penetration in China keeps increasing and it is estimated to surpass the estimated “120 percent rate” (Jingting, 2013).

In a research conducted by the National Institute of Statistics of Rwanda (2013), it shows that there have been huge increases in the use of mobile phone technologies exceeding the number of telephone line subscriber. The percentage of households which own at least a mobile phone also increased in urban areas “from 26.5% in 2005/2006 to 71.5% in 2010/2011” as well as in rural areas “from 2.2% in 2005/2006 to 40.6% in 2010/2011” National Institute of Statistics of Rwanda (2013). In terms of mobile phone subscribers, the number has also increased from “2009 to 2011” (National Institute of Statistics of Rwanda, 2013).

(Index Mundi, 2012) further explains that the “mobile cellular per capita” for Namibia has reached 72.9 as compared to most developing countries in Africa, such as Burundi, Ethiopia, Tanzania, Niger, Djibouti, Malawi and the Democratic Republic of Congo (DRC), Liberia, Burkina Faso, Sudan, Zambia, Togo, Guinea, Uganda, Chad, Rwanda, Mozambique, Lesotho and Sierra Leone where the mobile cellular per capita is less than 50.

Krishnan (2013) concludes that Namibia currently has “2.35 million mobile subscribers and 550,000 internet users”, which infers that the number of mobile phone users has by far surpassed the number of internet users.

2.4.3 The evolution of mobile phones

This section shows the evolution of mobile from 1999 till 2012 as shown on the next page in Figure Table 2.1 (Timeline, 2011).

Year of evolution	Evolution Title	Evolution Description
1999	Introduction to blackberry	The BlackBerry phone is a wireless handheld device introduced in 1999 which supports push e-mail, mobile telephone, text messaging, internet faxing, web browsing and other wireless information services. The original BlackBerry device had a monochrome display, but all current models have colour displays.
2000	Introduction to smart phones	Early Smart Phone: Kyocera QCP6035 (2000). The company's QCP6035 smart phone, which hit the retail market in early 2001 and cost between \$400 and \$500 (depending on the carrier), was the first Palm-based phone to be widely available to users. It included a measly 8MB of memory, and sported a bland monochrome display, but it paved the way for future products.
2000	3G and standard standardization	Not long after the introduction of 2G networks, projects began to develop third generation (3G) systems. Inevitably there were many different standards with different contenders pushing their own technologies

Year of evolution	Evolution Title	Evolution Description
2001	Combining the PDA with the cell phone	PDA to Phone: Handspring Treo 180 (2001). More PDA than phone, the Treo 180 came in two versions: one with a QWERTY keyboard for typing (pictured), and another (the Treo 180g) that used Graffiti text input instead.
2002	Swivel fashion – intro to IT phone	While its voice capabilities were only mediocre, this was one of the first devices to offer truly functional mobile Web browsing, e-mail access, and instant messaging. Plus, it pioneered that nifty swiveling design.
2002	Cell camera	In 2002, Sanyo and Sprint debuted the Sanyo SCP-5300 PCS phone, which they claimed was the first mobile phone available in America with a built-in camera. At its highest resolution, it captured VGA (640 by 480) images.
2005	The music cell phone	The Motorola Rokr, released in September 2005, was the first music phone to incorporate Apple's music software. It allowed users to transfer songs purchased from iTunes to the phone for listening on the go.

Year of evolution	Evolution Title	Evolution Description
2006	Cell Phone Design	In 2006, the trend for stylish gadgets became very common. Fancy cell phone designs were made. The LG Chocolate, was a great example of how cellphone designers are putting style in the forefront of cell phone design.
2007	Apple iphone	In 2007, Apple Inc unveiled the Apple iPhone, which was the world's first advanced touchscreen smartphone. It's the first phone to have an operating system, the iOS, and by enabling apps to run on the phone, it had allowed cell phones to become the primary mobile device of use. Having an iPhone became a source of pride.
2008	Querty keyboard	In 2008, as dependence on the laptop as a necessary tool for work increase, mobile phones undergo transformation to become the device to have with you on-the-go. The HTC G1, which was a slider cell phone that hides a full QWERTY keypad beneath its large screen, runs on the Android OS.

Year of evolution	Evolution Title	Evolution Description
2012	Touchscreen	2011 marked the return of the touchscreen which dominated the mobile gadget scene with its powerful hardware and sleek looks.
2013	Samsung Galaxy S4 and Blackberry 10	In March, 2013. Samsung announced a new model of Galaxy series named Galaxy S4. They started selling Galaxy S4 in April 2013 worldwide and made a hit of 20 million selling mark within only 2 months. It was the record breaking mark of the history. Blackberry also tried to back in the race with Blackberry 10.

Table 2.1 Evolution of mobile phones from 1999 to 2005 (Timeline, 2011)

2.5 The role of mobile phones in providing health care delivery services at OPDs.

This section focuses on the role of mobile phones to improve health care delivery services at OPDs.

2.5.1 M-health definition

Ganapathy and Rivandra (2008) describe m-health as “mobile computing, medical sensor, and communications technology for healthcare”. Cameron (2009) defines m-health as the “delivery of healthcare services via mobile communication devices such as cell phones and applications of m-health range from targeted text messages to promote healthy behaviour to wide-scale alerts about disease outbreaks”. HIMSS (2012) defines m-health as “the use of mobile networks and devices in supporting e-care which emphasizes leveraging health-focused applications on general-purpose tools such as smartphones and Short Message Service (SMS) messaging to drive active health participation by consumers and clinicians”. HIMSS (2012) further defines m-health as “the ubiquity of mobile devices in the developed or developing world to present the opportunity to improve health outcomes through

the delivery of innovative medical and health services with information and communication technologies to the farthest reaches of the globe”. Aljazeera (2013) defines m-health as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, tablets, personal digital assistants (PDAs), and other wireless devices”.

In a study conducted by Majerowicz and Tracy (2010), it shows that the emergence of ICT in health care can improve the way health care delivery is administered to patients. Hence, the need to access the internet has become increasingly important. However, rural communities still lack the appropriate infrastructure to provide these online facilities (Haynes, 2010). Hence, the need to adopt mobile phones in providing health care services. Mobile phones provide easy access to information, anywhere and anytime which makes mobile phones part of everyday life. Mobile phones facilitate the uses of the Short Message Service (SMS) feature which allows the sending of SMS messages to other mobile phone users (Horstmanshof and Power, 2005). A patient who has a mobile phone connected to a mobile network in turn has access to communicate with other people.

In a research conducted by ICIA (2012), it was stated that mobile phones are accessible by both the young and the old. Patients who visit rural hospitals in Windhoek fall within this age category. Current survey done on the number of active mobile phone subscribers in Namibia reveals that there are “2.35 million” active mobile phone subscribers surpassing the total number of people in the country, “2.1 million” which infers that individuals have more than one mobile phone (GovTechnology, 2012). Since mobile phone penetration in Namibia has surpassed the “110% mark” with 2.3 million active mobile phone users, mobile phones can be used as a platform for improving health care delivery services in rural communities in Windhoek (GovTechnology, 2012). World Data Atlas (2010) estimated the mobile cellular subscription in Namibia and reported that it had risen from “4.3 in 2000 to 67.2 in 2010”, which implies that the growth of mobile phone usage is expected to increase over the next few years. As World Data Atlas (2010) suggests, Namibia has a high number of mobile phone penetration, mobile phones should be given priority consideration as a platform for improving health care delivery services in rural communities.

As development in the health field is increasing, traditional ways of providing health care delivery services cannot compete with new development to provide better health care delivery services. Through the use of mobiles phones in providing health care delivery at OPDs, the amount of time

spent at OPDs will drastically reduce. With mobile phones, patients will be able to send their health information directly to the hospital at a remote location (Haider, 2008). In this regard, when patients visit rural hospitals, they do not have to wait in the queue for a long time before they are examined by a medical practitioner.

As shown in Figure 2.1 on the next page, Doherty (2011) suggests that m-health must have mobile communications technology that facilitates the gathering and the transmission of information with a dedicated medical system with a health focus. Pitchforks (2012) emphasises that mobility in mobile health facilitates the movement of patients outside the hospital and still remain connected to the hospital's health care services. For this research, m-health is defined as the use of mobile phones to provide efficient and effective health care delivery to patients. The goals of m-health are defined in the next section.

Scientia View of mHealth and adjacent spaces

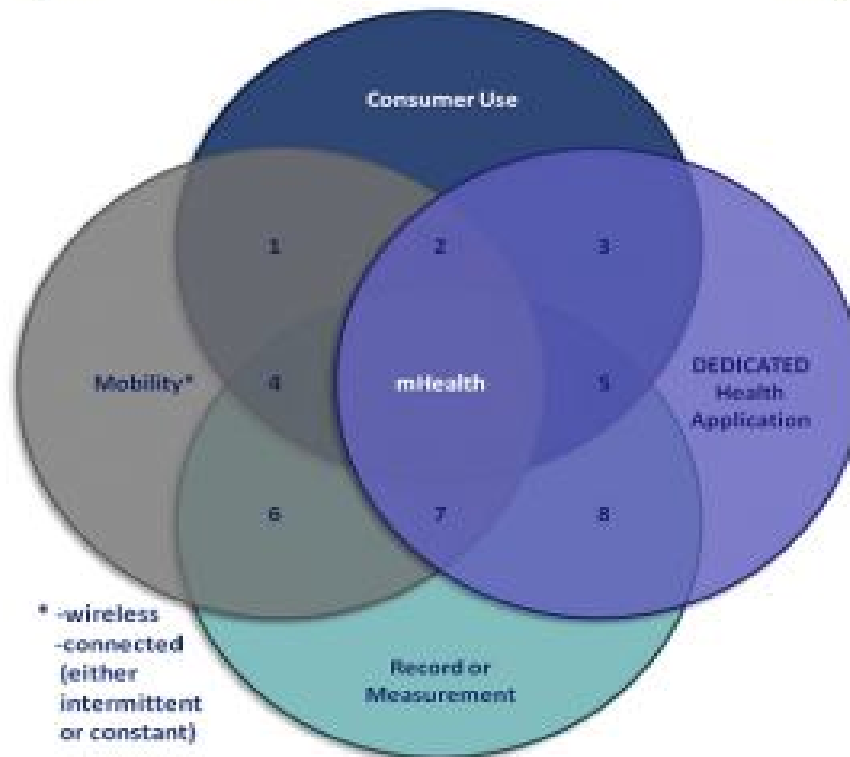


Figure 2.1 Definition of m-health (Doherty, 2011).

2.5.2 The goals of m-health

Figure 2.1 explains the definition of m-health. M-health revolves around mobility, where patients are given access to health care services irrespective of their location. Patients do not have to be physically present in the hospital to access health care facilities. Dedicated m-health applications are very important in order to establish a link between the hospital health care system and patients' mobile phone. Dedicated applications keep track of patients' health record. With the three requirements in place, m-health services can be provided for consumer use.

- **Improve efficiency of health service delivery**

Researchers believe that there would be an improvement in the way health care is delivered to patients in rural communities if the use of mobile technologies is incorporated in health care delivery, which includes patient diagnosis (Free, Phillips, Watson, Galli, Felix, Edwards, Patel, and Haines, 2013). One

of the goals of m-health is to ensure that patients and medical practitioners are equipped with the necessary details to take appropriate measures in providing health care delivery services which includes, “healthy living habits” and “monitoring of diseases” Aylward (2011). Aylward (2011) further explains that with m-health in place, patient health information can be easily complied to facilitate the identification of diseases, prescription of the right medications, improving learning and research in rural communities.

- **Reduce child and maternal mortality and morbidity in millennium villages.**

In a research conducted by WomenWatch (2012), when comparing the rural and urban communities, it reveals that a large number of women in rural communities lose their lives on a yearly basis as a result of low quality health care delivery services provided to women in rural communities as shown in Figure 2.2., the report compares the death rate of women and children in rural and urban communities, as shown in Figure 2.2., the under-five mortality rate for each country indicates that the death rate of children in rural communities is higher compared to the death rate of children in urban areas. The second chart also indicates that many regions have a high death rate of children as the scale is greater than 1. WomenWatch (2012) suggests that if m-health was implemented in rural hospitals there would be a reduced number of death rate among women and children in rural communities.

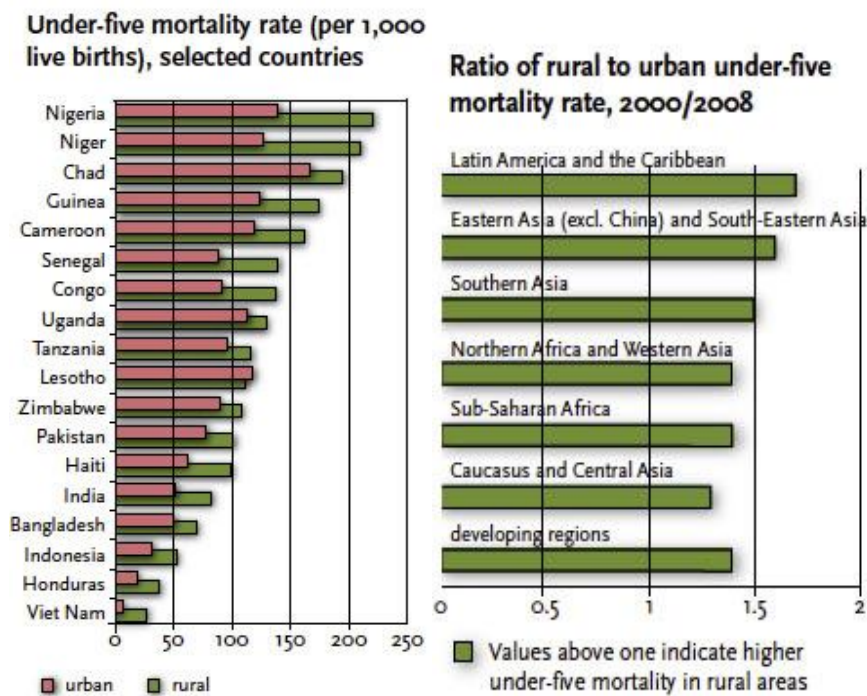


Figure 2.2 Ratio of under-five mortality rate Women Watch (2012)

- **Close patient-health professional relationship**

Goold and Lipkin (1999) state that the relationship between patients and medical practitioners is very important in the healthcare delivery process because this serves as a platform where medical practitioners are able to gain access to patient health records in details and medical practitioners are properly acquainted with the patient. The goal of m-health is to ensure that patients and doctors are able to communicate effectively to help the doctors provide better health care services to patients' Free et al. (2013). Free et al. (2013) further explains that "mobile technologies" can be used in the administration of health care services to patients in rural communities with shortage of medical practitioners by notifying patients of their next appointments with medical practitioners and remotely notifying patients of the outcome of their health examination.

2.6 Health care delivery at OPDs

The formal definition of an OPD as provided by the ISD Scotland Dictionary (2005) is "a department in a hospital which is primarily designed to enable consultants and members of the medical team to see outpatients at consultant clinics". There have been improved changes which has made the recording of patients health information in an "electronic record management system" Carrol, Edwards and Rodin (2012). However, they do not take into consideration, the delay in the process of capturing patients' basic information.

Recent research on OPDs in hospitals shows that oftentimes patients are faced with delays at OPDs as there are many processes that need to be completed (Aravind Communications, 2007). Although patient records have been computerised in certain parts of the world but little has been done in improving the healthcare delivery process with mobile phones (Kibbe and Bard 1997). One approach that could improve the healthcare delivery in OPDs is the use of mobile phones to accelerate the health care delivery process in order to provide a faster access to health care delivery services.

2.7 Vital signs checking

Cleveland Clinic (2010) defines vital signs checking as "measuring the body's basic functions, where these measurements are taken to help assess the general physical health of a person, give clues to

possible diseases, and show progress toward recovery”. Dugdale (2011) states that vital signs include “heartbeat, breathing rate, temperature and blood pressure and these signs may be watched, measured and monitored to check an individual’s level of functioning”.

In a research done by Aravind Communications (2007), it shows that the first point of attention when a patient visits the hospital is the OPD and as such these areas usually over capacitated. Vital signs checking and recording are done at OPDs. This is the stage where the medical practitioners determine the severity of the ailment and decide whether the patient should be treated immediately or admitted to the IPD for close medical observation.

One approach that could improve the health care delivery in OPDs is the use of mobile phones to accelerate the health care delivery process in order to provide a faster access to health care delivery services.

2.8 The health sector in Namibia

In a research conducted by World Health Organization (2013, p. 1), it there have been transformations made in the health sector since Namibia gained her independence which includes the establishment of “265 clinics, 44 health centres, 1150 outreach points, 30 district hospitals, three intermediate hospitals, one national referral hospital, 13 MoHSS regional directorates and 34 districts and various social welfare service point”. Stiftung (2012) further explains that there are problems facing the Namibian health care sector which includes the HIV/AIDS epidemic, high mother- infant death rate amongst many others. There have been disparities between the rural and urban communities as there was a vivid division of the health care system at independence leaving the rural communities with inadequate health care facilities (Stiftung, 2012). Stiftung (2012) further explains that it is difficult for the nation to put into action health policies, keep in touch with medical practitioners located in rural communities where there are less infrastructure as majority of its nationals reside in rural communities. 15% of the public depend on medical aid for medical services, while the remaining 85% of the public depend on the government to provide health care delivery services. As shown in Figure 2.3. The Namibian health care sector is driven by the Ministry of Health services Stiftung (2012).

THE NAMIBIAN HEALTH SYSTEM IS DRIVEN BY THE MINISTRY OF HEALTH & SOCIAL SERVICES AS THE PUBLIC SYSTEM IS RESPONSIBLE FOR 85% OF THE POPULATION

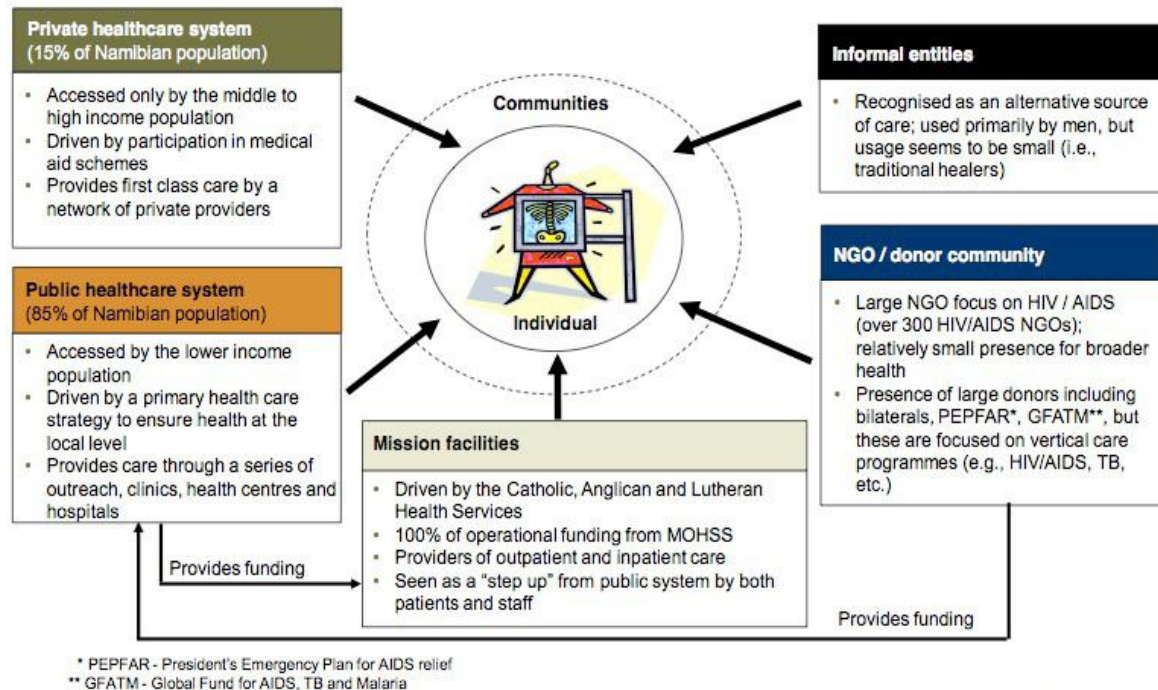


Figure 2.3 The Namibian health system (Stiftung, 2012).

2.9 The usage of mobile phones in Windhoek

Simbira (2013) reports that the usage of mobile is increasingly high in rural communities in Windhoek and majority of mobile phone users in these rural communities have never used a computer. Simbira (2013) also reports that the use of mobile phones have increased rapidly in the past 12 years, going from 1% in 2000 and 54% in 2012.

2.10 Barriers to using technology in healthcare

The implementation of healthcare technology is not so easy to implement. Clearly, if technology has reached its full latent in this arena, there must be some obstacles to its deployment. Perhaps the largest current barrier is a lack of standards. Hospitals are afraid to commit to investing in specific

technologies for fear that they may someday grow old-fashioned and not be interoperable with what is in use by the majority of hospitals.

Garret, Brown and Rudman (2006) reported that operational costs as well as maintenance costs are major obstacles in the application of ICT in the provision of healthcare services. It has been explained that technology is not solely responsible for the improvement of medication error report, but the care with which technology is implemented including the considerable time to prepare end users, the inclusion of end users in the establishment of workflow processes and the attention to site-specific concerns strongly pose a big barrier to using technology in healthcare.

2.11 Increasing quality

High quality is repeatedly producing the right outcome. Quality is setting standards and obviously meeting it. Quality consists of “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes (quality principles), are consistent with current professional knowledge (professional practitioner skill), and meet the expectations of healthcare users (the marketplace)” Buttel, Hendler and Daley (2008). Quality has been important in health care, Simpson(2003) explained that in 3000 B.C, “the code of Hammurabi” governed the health sector as mistakes made medical professionals had consequences. Grobler and Warnish (2006) articulate that quality means “conforming to customer requirements, preventing errors and accidents and determined towards error free output”. The challenge lies in the fact that unlike other industries, such as automobile and electronics industries which conscientiously use quality metrics like Six Sigma Soković, Pavletić and Krulčić (2006). The healthcare industry has no well-delineated system for plummeting defects in healthcare and as a result poor quality care can cost lives.

2.12 Waiting times in Canadian hospitals

In a research conducted by Day, Esmail ,Globerman and Henderson (2013, p.1), it reveals that Canadians are satisfied with the health care services provided to patients, however they are not satisfied with the amount of time people wait to receive medical services. The government of Canada have attempted several times to reduce waiting times by increasing funds provided to health care systems and implementing policies using “bureaucratic management approaches” Day et al (2013, p.1). However, cost issues have limited the implementation of the policies put in place to reduce

waiting times in Canadian hospitals. The use of mobile phones can be used to reduce waiting times in Canadian hospitals in an effort to reduce the cost associated with implementing new policies.

2.13 Theoretical framework underpinning this research

This dissertation aims to develop a mobile health service framework (MHSF) that will reduce the waiting times in out-patient departments which will improve health care service delivery to patients at OPDs. This section examines the existing theoretical frameworks in the Information Systems (IS) field.

2.13.1 Activity Theory (AT)

The fundamental nature of activity theory emanates from the analysis of the individual in engaging in their activity and objective through an examination of their tools and its mediation through the rules, community and history Hyland (1998) and Verenikina (2001). Figure 2.4 illustrates the activities involved in AT as explained by Engeström (2001).

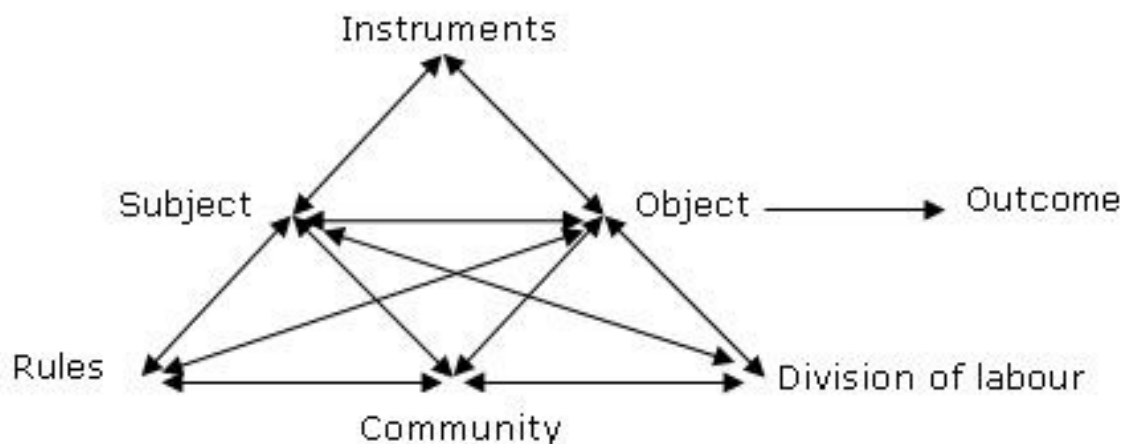


Figure 2.4 Engeström's expanded Activity Theory model (Engeström, 1987).

The fundamental concept is the emphasis on “activity” which focuses on the interaction between the “subjects and the objects” (Kaptelinin, 2013). Activity theory has been applied in various disciplines which include psychology, education, management, culture and information systems where these disciplines link to the interaction between humans (Hashim and Jones, 2007).

A key characteristic of activity theory is its focus on the opinionated investigation on the interaction

between humans and their mediated tools which are guided by human activities (Hashim and Jones, 2007). In AT, “activity” is a very important factor as these activities work towards achieving the goals and objectives of the research.

(Hyland, 1998) emphasises that AT focuses on using human activities in investigating research findings in which these findings are divided into “subject, tools and object” where subject refers to the participants involved in the research, the object refers to the activities carried out by the participants and the tool refers to the mediating device by which the action is executed. The altered version of AT done by Engeström (2001) includes “rules” which “determine how and why individuals may act and are as a result of conditioning” Hyland (1998) and Verenikina (2001). The alteration of the original AT model also includes “community”, in which “groups of activities and teams of workers are anchored, and can be analysed” and the “division of labour” where activities are broken into smaller units to be undertaken by the participants making up the community Hyland (1998) and Verenikina(2001).These concepts are illustrated in Figure 2.4.

2.13.2 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was proposed by Davis in 1989 (Chen, Li and Li, 2011). Technology Acceptance Model (TAM) has become a widely used theory in the information systems (IS) field (Chen, Li and Li, 2011). Chen, Li and Li (2011) further explained that the technology acceptance model (TAM) provides two constructs which are the *perceived usefulness* and the *perceived ease of use*. The technology acceptance model is shown on Figure 2.5.

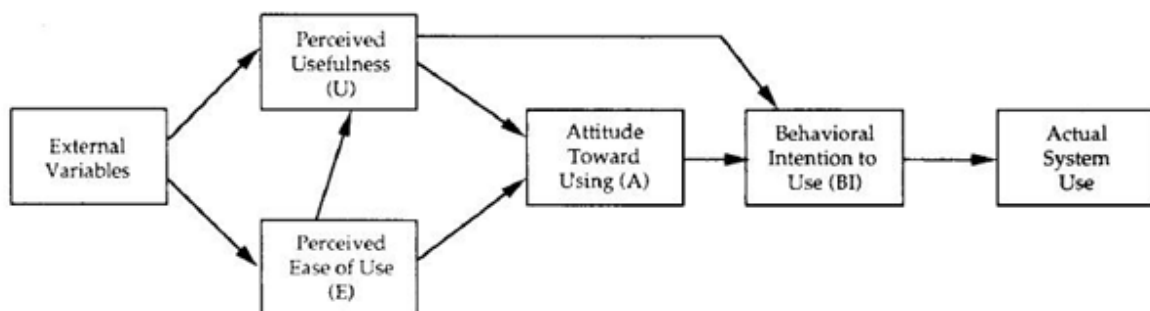


Figure 2.5 Technology Acceptance Model Hubona and Geitz (1999)

However, Davis (1989) emphasizes that there is more than one factor that is used to determine how a

user will perceive a new technology. Davis (1989) further explains TAM in the diagram shown in Figure 2.5, the external variable represents the system user, they are linked to two constructs which are the perceived usefulness (PU) and the perceived ease of use (PEOU), these variables determine the level of the PU and PEOU. Once these two factors have been determined, the user begins to form a certain attitude towards the system. Behaviour intention to use (BI) is determined by the attitude towards using the system. In otherwords, if the users feel the system is useful and it is relatively easy to use, they will have a certain attitude towards using the system which in turn influences the BI and as a result, leads to the actual system use. The user begins to see how useful a system is when the user is aware of the capabilities of the technology (Thode, 2013).

The technology acceptance model was revised, reviewed and expanded by Vankatesh and Davis (2000) which led to the creation of the TAM2 model. In the TAM2 model, the attitude component was replaced with the “perceived technology characteristics” which greatly contributed to the user’s decision to use the system in accordance with the “subjective norm, image” and user’s job relevance importance of the system, result of using the system, user experience and willingness to use the system, with all these factors put together, it will be able to determine the perceived ease of use and perceived usefulness of the system Vankatesh and Davis (2000). In TAM2, the intention to use is a result of the perceived usefulness and the perceived ease of use, rather than the attitude toward using the system Vankatesh and Davis (2000). The illustration of TAM2 is shown in Figure 2.6.

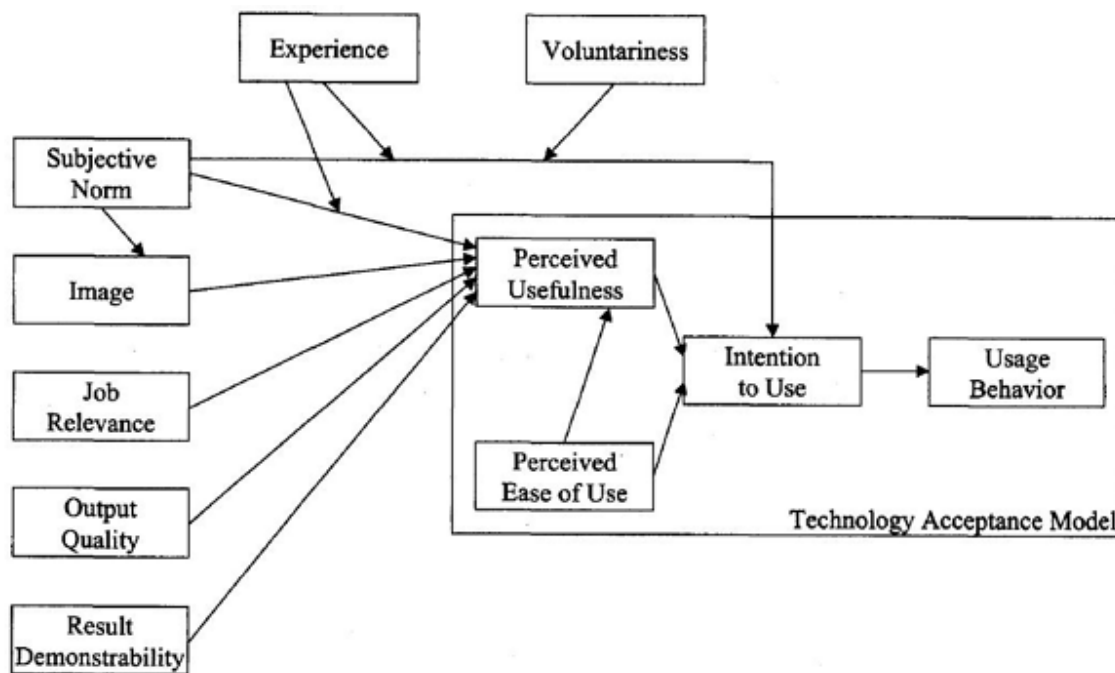


Figure 2.6 Technology Acceptance Model 2 Vankatesh and Davis (2000)

Vankatesh and Bala (2008) expanded the TAM2 model which led to TAM3. (Vankatesh and Bala, 2008) states that “TAM3 presents a complete network of the determinants of individual’s IT adoption and use”. Vankatesh and Bala (2008) further describe the TAM3 model as a model which comprises of the “perceived usefulness”, “computer anxiety” and “perceived ease of use” and “behaviour intentions” as show in Figure 2.7 on the next page. This model explains that the perceived usefulness depends on many factors which include the user’s voluntariness, experience, subjective norm, image, job relevance, output quality and result demonstrability. These factors are put into consideration before a user can perceive a system as useful. The nurses and doctors who will interact with the system will only perceive the system as useful, when they know that the proposed m-health application will improve health care delivery services to patients who visit these rural hospitals. The experience of the nurses and doctors is also a determining factor because if they have experience using a mobile phone in doing other transactions such as e-commerce, banking and have experienced the benefits of mobile phones in conducting such transactions, their perception of the system’s usefulness will be positive. The TAM 2 model also consists of many factors that determine the perceived ease of use such as computer self-efficacy, when nurses and doctors are computer literate, learning how to use a health application will be very easy, other factors include, perception of external control, computer

anxiety, computer playfulness, perceived enjoyment, objective usability. The perceived usefulness and perceived ease of use determine the behavioural intention which produces the use behaviour

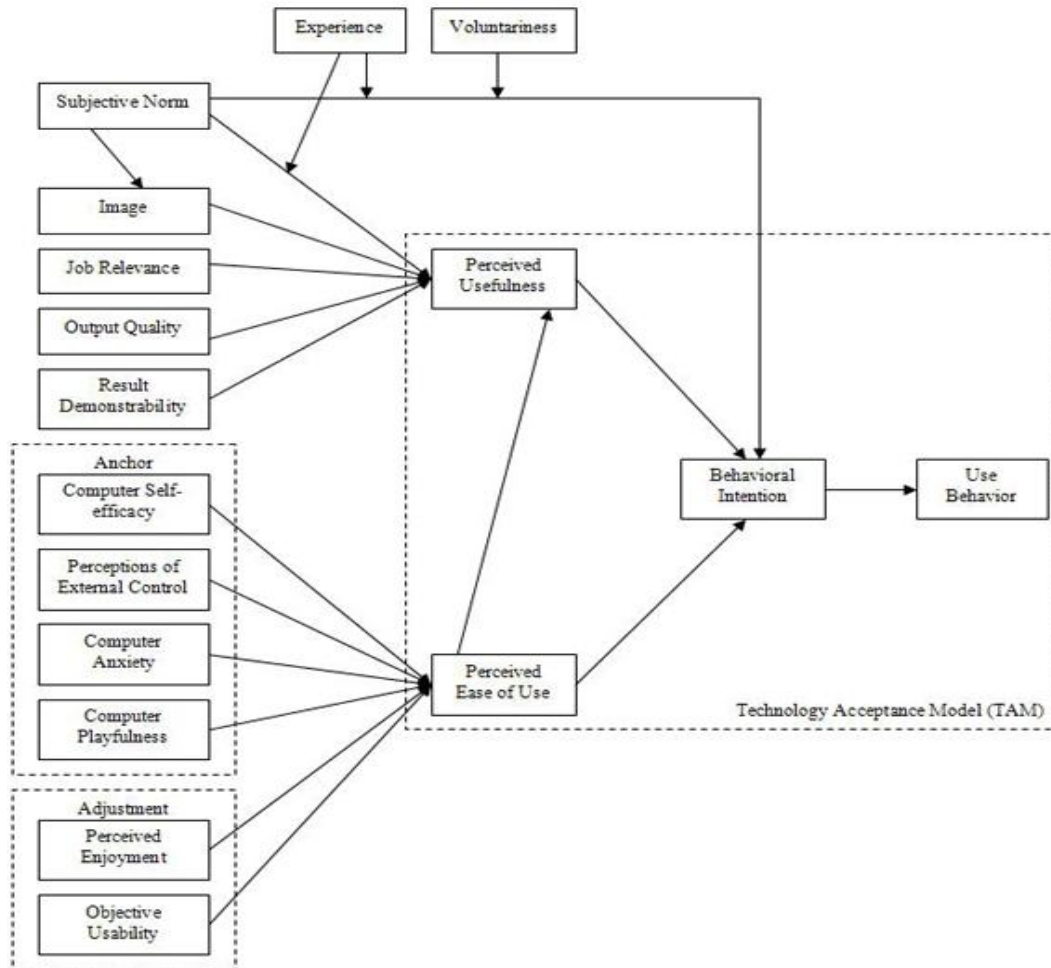


Figure 2.7 Technology acceptance Model 3 Vankatesh and Bala (2008)

2.13.3 Lazy User Model (LUM) of Solution Selection

The Lazy User Model (LUM) of Solution Selection was developed by Tetard and Collan (2011). LUM is a theory that explains users' method of selecting solutions when poised with a new system (Tetard and Collan, 2011). The goal of LUM is user focus rather than technology focus, because it evaluates the best possible solution that meet the customer's requirements (Tetard and Collan, 2011). As shown in Figure 2.8, user requirements are presented with a solution set that best meets his/her

requirements.

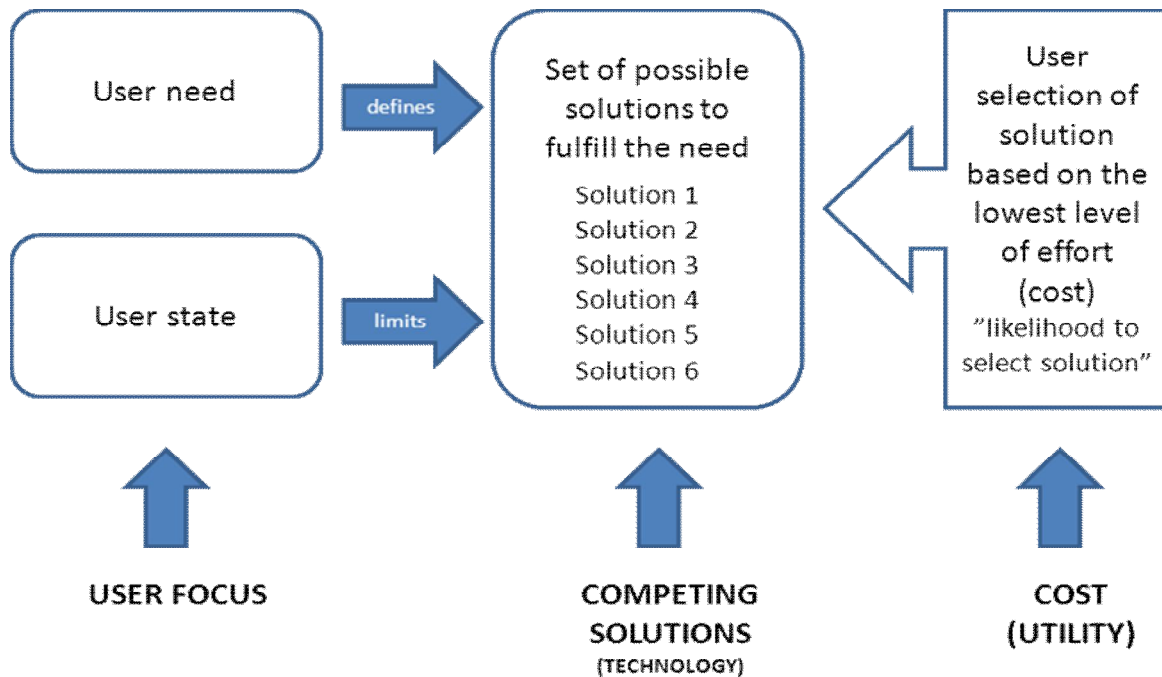


Figure 2.8 The Lazy User Model of Solution Selection (Tetard and Collan, 2011)

2.14 Theoretical framework for this study

The proposed theoretical framework for this study will be the AT and TAM theories. The combination of these two models will be used to guide this study.

In a research conducted by Hashim and Jones (2007), they investigated students' response to incorporating information systems in their learning activities using AT, which shows that AT is a relevant theory when dealing with humans and their surroundings.

For this study, the subjects are the patients who visit rural hospitals and are affected by the delays at OPDs, the object is the activity studied which is improving the health care delivery services in rural hospitals and the tool is refers to mobile phones being used to provide improved healthcare delivery services to patients who visit rural hospitals. The community includes patients, nurses and doctors governed by a set of rules (administering health care services / receiving health care services) and division of labour (one administers healthcare services / one receives healthcare services).

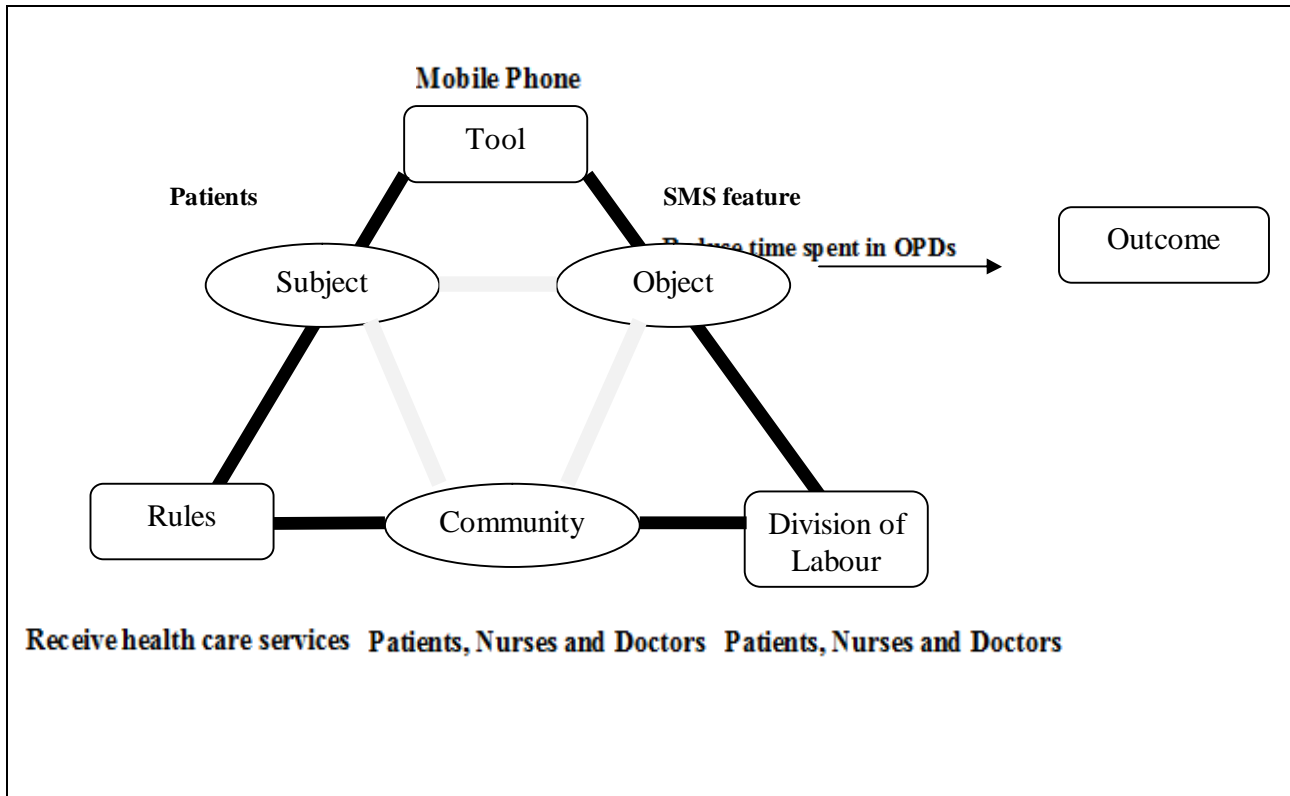


Figure 2.9 The AT model for this study

Lee, Kozar and Larsen (2003) describe Technology Acceptance Model (TAM) as the most influential theory for modelling IS. According to Mazhar (2006) TAM explains the theory about how and when users accept a new technology presented to them, the constructs of this model are the “perceived usefulness and the perceived ease-of-use”. The perceived usefulness as explained by Davis (1989) refers to the “level to which the user believes a system would enhance his or job performance”. For this study, the patients’ perceived use would be their level to which the use of mobile phones would improve the process in delivery healthcare delivery services. The second construct in TAM which is the “perceived ease-of-use” as described by Davis (1989) refers to the level at which the user of the new technology perceives the system to be uncomplicated. In this study, the perceived ease of use would be the level to which patients believe that the method of using of mobile phones in providing healthcare delivery services would be free from effort as mobile phones are easy to use. The TAM model for this study is depicted in Figure 2.10 on the next page.

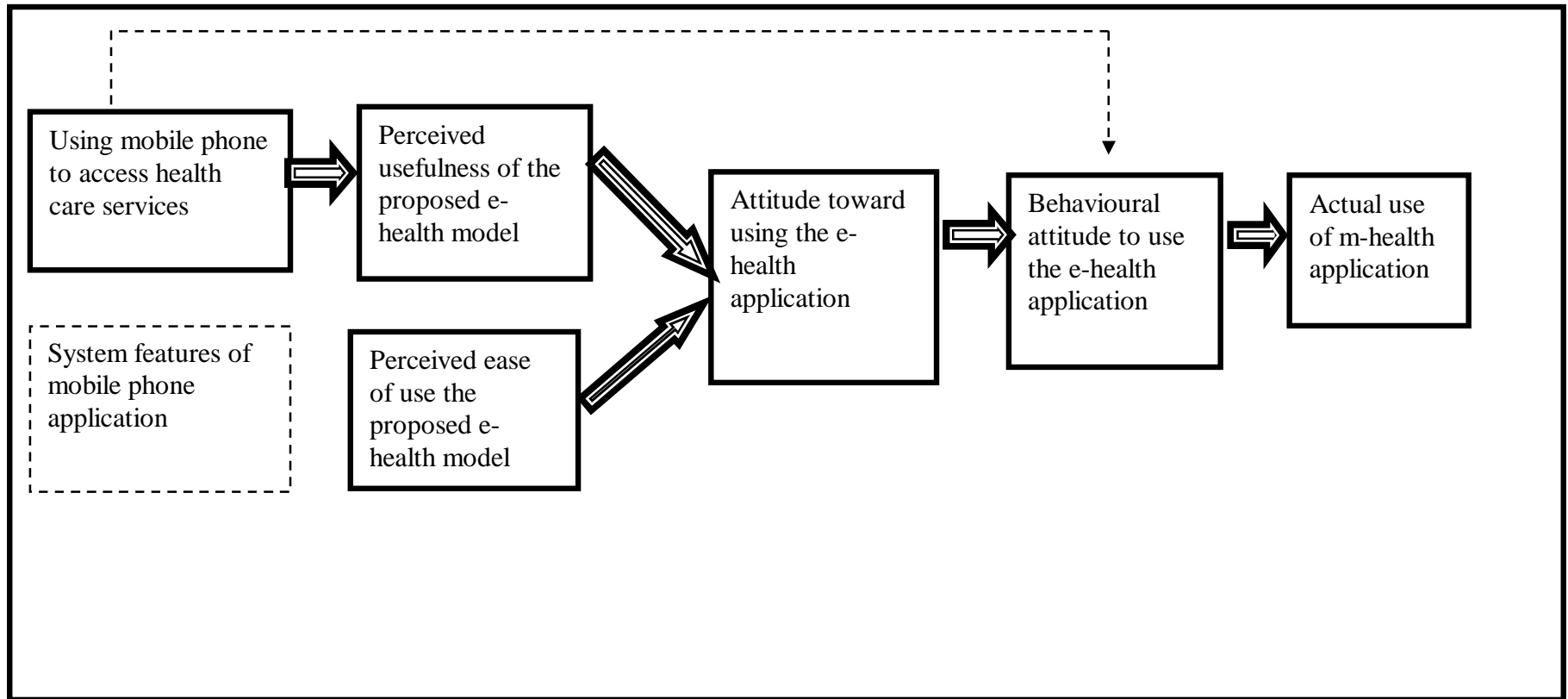


Figure 2.10: TAM for this study

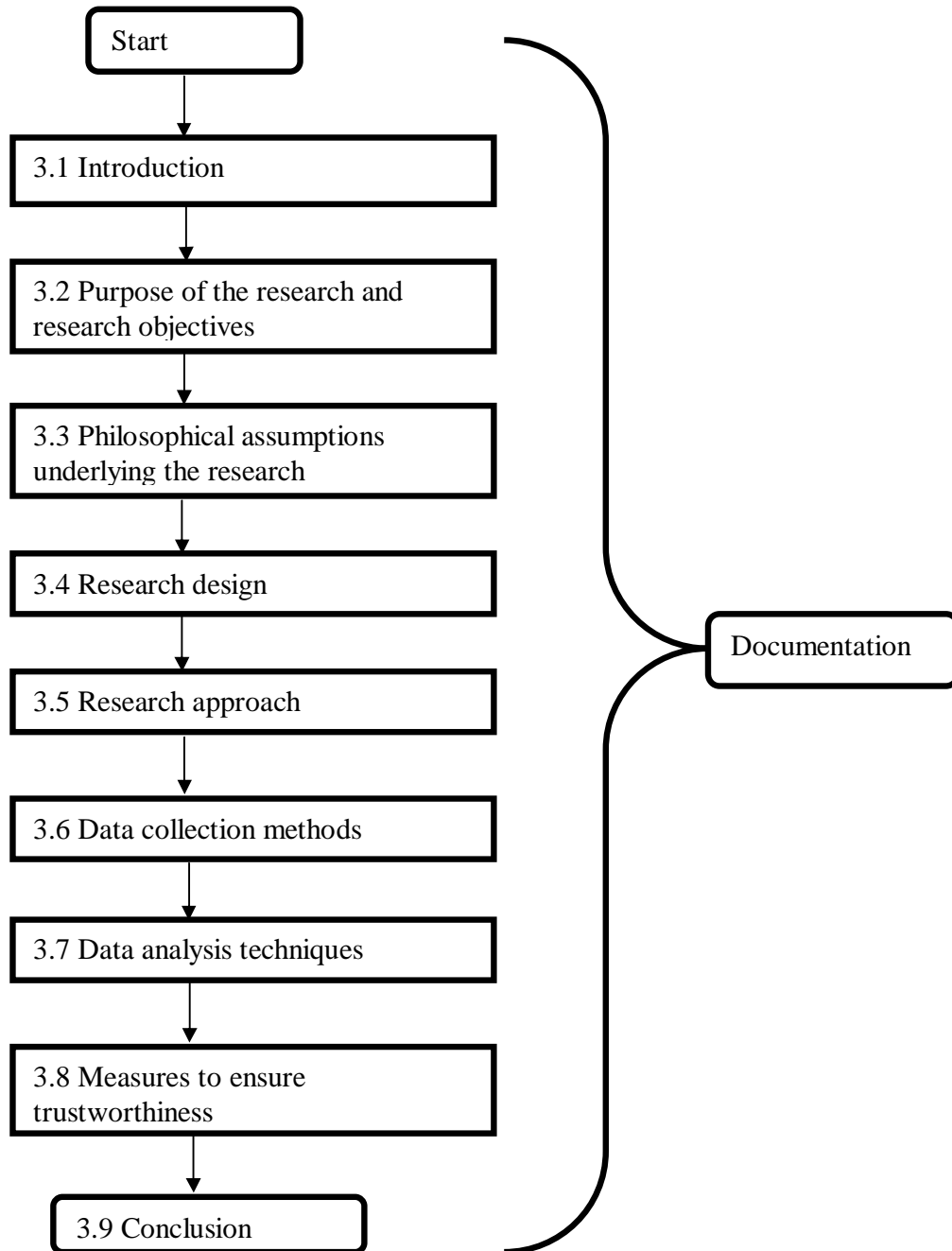
The literature surveyed so far shows that the use of mobile phones in providing health care services will drastically cut down the time spent in OPDs, thereby improving health care delivery services in rural communities in Windhoek.

2.15 Conclusion

This chapter gave a detailed explanation of the literature review, stating the importance of the literature review. Mobile phones were also explained, its importance and why it is relevant to the study. This chapter also explains the role of mobile phones in providing healthcare delivery, the cost of using technology in healthcare, the barriers of using technology in healthcare.

In conclusion, this chapter has explored the existing theoretical frameworks used in the IS field, pointing the gaps and why it is necessary to embark on this research.

CHAPTER 3: RESEARCH METHODOLOGY



CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on the research methodology used for the research study. This chapter also examines the purpose of the research and the research objectives, the philosophical assumptions underlying the research as well as the research design, research methods, data collection methods, data analysis and the measures to ensure trustworthiness.

3.2 Purpose of the research and research objectives

The aim of this study is to investigate how mobile phones can be used to improve healthcare delivery services in rural hospitals, the sub-objectives include:

- To investigate the health care services provided to patients at OPDs in rural hospitals in Windhoek.
- To investigate the penetration level of mobile phone usage in rural communities.
- To provide a mobile health service framework based on the findings to improve health care delivery services at OPDs in rural hospitals.

The research design process used for this study was guided by the research onion model developed by Saunders, Lewis and Thornil (2000) shown in Figure 3.1. The research onion describes the various phases of the research process which includes the research philosophy, research design, research approach, data collection methods and data analysis techniques.

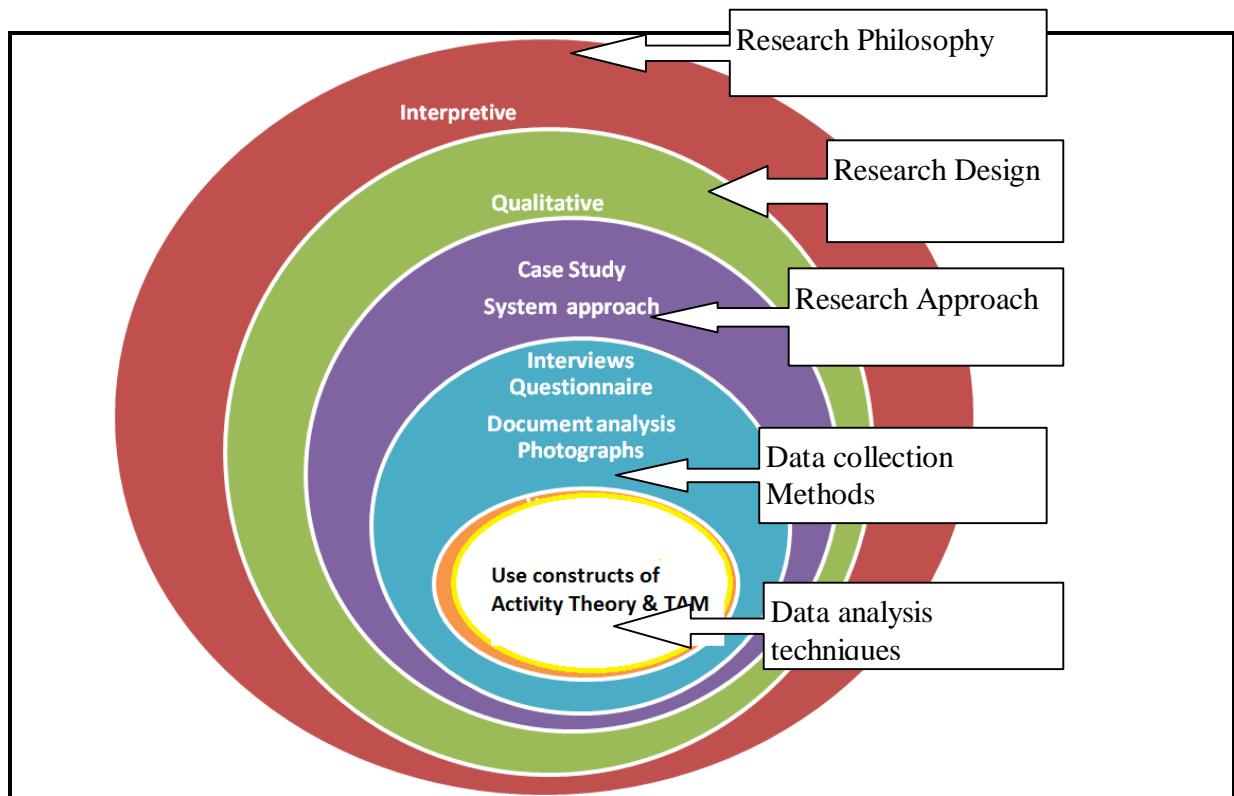


Figure 3.1 The research process onion (Saunders, Lewis and Thornil, 2000).

As explained by Saunders et al (2000), the research onion model is compared to the peeling of the onions until it has reached the lower layer, where the lower layer is the analysis of the upper layers.

3.3 Philosophical assumptions underlying the research

This study was conducted using the interpretive research paradigm. According to (Klotz and Lynch, 2007), the interpretive research paradigm conveys the feelings of the participants. Coleman (2010) explains that there are rules which suggest which methods are pertinent to the research study and which methods are used to corroborate the research findings.

Most qualitative research is guided by three epistemologies which are the interpretive, positivist and critical epistemology (Orlikowski and Baroudi, 1991) as shown in Figure 3.2. These epistemologies are explained in the next sections.

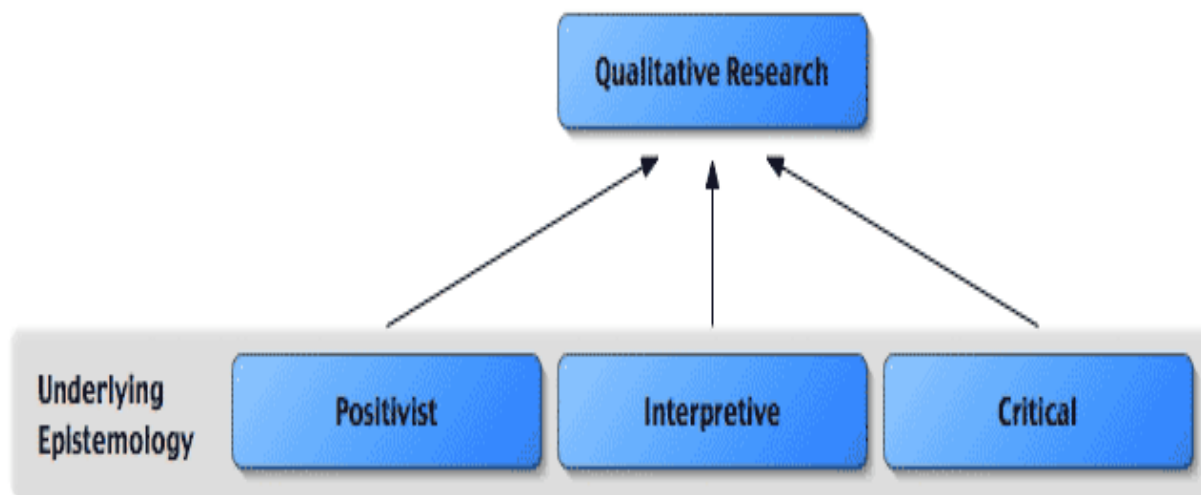


Figure 3.2 Epistemological assumptions for qualitative research (Robinson,2010).

3.3.1 Positivist philosophy

According to (Levin, 1988), the positivist approach focuses on the unbiased findings of the researcher without interrupting with the subject of study. The positivist philosophy is established on the findings which can be verified and mathematically or scientifically proven to be accurate (Williams, 2011). Davison (2008) explains that the positivist philosophy can be used to compare data from different research findings to study how they correlate. However, Davison (1998) argues that the positivist philosophy has not proven to work well with research studies which involves interaction with humans, but has been proven to work well with research studies involving “natural and physical sciences”. Since this research study involves the interaction between humans, it is not a good approach to use the positivist philosophy for this study.

3.3.2 Interpretive philosophy

Davison (1998) describes the interpretive philosophy as the “study of phenomena in their natural environment together with the acknowledgement that scientists cannot avoid affecting those phenomena they study”. The researcher conveys the feelings of the participants based on their personal experiences (Coleman, 2010:123). According to Bevir and Kedar (2008), activities of the participants are taken into considering when analysing the research findings.

Carballo (2003) argues that the interaction between humans cannot be conveyed using philosophical

assumptions designed for natural and physical sciences. The interpretive philosophy is established on the findings which are based on an abstract approach (Carballo, 2003). Interpretive philosophy focuses on social sciences rather than physical and natural sciences.

The interpretive philosophy is suitable for this study because it gives a better understanding of the healthcare services provided to patients in rural communities in Windhoek. Davison (1998) elaborates that “dealing with the interaction of people and technology is considered to be of the social sciences”. Therefore, data collected for this study can only be analysed through the interaction between humans.

3.3.3 Critical philosophy

Salvo (2005) describes critical philosophy as critically analysing and making judgements based on the research findings and as a result uncover the shortcomings identified. McQuillan (2010) emphasizes that the practical understanding of the researcher is purely based on intuition.

After reviewing the philosophical assumptions underlying research, it can be concluded that the most appropriate epistemology for this study is the interpretive philosophy. The next section discusses the research design for this study.

3.4 Research design

The research onion design model from Saunders, Lewis and Thornhill (2000, p. 85) was used for this research study. The research design provides comprehensive information on how the research study will be carried out. Trochim (2006) further describes research design as “the glue that holds all of the elements in a research project together”. Parahoo (1997) suggests that it is important to use the right methodologies when conducting a research study in order to properly illustrate the purpose of the study. This study adopts the qualitative design method and the case study approach.

3.4.1 Qualitative research

Strauss and Corbin (1998) describe qualitative research as a type of research in which the result of the findings are not based on numerical data. The qualitative approach emphasizes that the researcher aims for “a holistic picture from historically unique situations, where idiosyncrasies are important for meaning” (Ospina, 2004). Data analysis for qualitative research is not done from a mathematical or statistical perspective (Sharan, 2002).

Jones (1995) explains that qualitative research is conducted with the aim of analysing the research from the participant's perspective. Sharan (2002) further explains that "qualitative research is a descriptive research method which enables the researcher to use words and pictures to convey what the researcher has learned about the new phenomenon which is in contrast to analysing research from a mathematical perspective". Qualitative research "encompasses a range of philosophies, research designs and specific techniques including in-depth qualitative interviews, participant and non-participant observation, focus groups, document analysis, and a number of other methods of data collection"(Pope and Mays, 2006).

The researcher chose the qualitative research method as the appropriate method for conducting the research because the study revolves around investigating the healthcare delivery needs of patients who visit rural hospitals in Windhoek in order to improve health care delivery services.

Research approach

The research approach used to answer the research question and the sub-research questions is the case study approach. The case study approach is explained in the next section.

3.5.1 Case study approach

Yin (1994, p.13) defines a case study as "an empirical inquiry that investigates contemporary phenomena within its real life context, especially when the boundaries between phenomenon and context are not clearly evident". In other words, the problem to be investigated is done using real life scenarios. Case study research is used to explore issues to be addressed from "specific research questions" in which these cases are analysed using specific scenarios (Gillham, 2007). According to Johansson (2003), case studies explore the intricacies of specific cases which evolved in the field of social sciences. Bromley (1990, p. 302), defines case study as a "systematic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest".

3.5.2 Procedures for conducting case study research

According to (Neale, Thapa and Boyce, 2006), the processes for conducting case study research are explained as follows:

1. Plan

- a. Identify stakeholders who will be involved.
- b. Brainstorm a case study topic, considering types of cases and why they are unique or of interest.
- c. Identify what information is needed and from whom.
- d. Identify any documents needed for review.
- e. List stakeholders to be interviewed or surveyed
- f. Ensure research will follow international and national ethical research standards, including review by ethical research committees.

2. Develop Instruments

- a. Develop interview/survey protocols—the rules that guide the administration and implementation of the interview/survey. Put simply, these are the instructions that are followed to ensure consistency across interviews/surveys, and thus increase the liability of the findings. The following instructions for the study should be included in the protocol:
 - b. What to say to interviewees when setting up the interview/survey;
 - c. What to say to interviewees when beginning the interview/survey, including ensuring informed consent of the respondent
 - d. What to say to respondent in concluding the interview;
 - e. What to do during the interview
 - f. What to do following the interview
 - g. Develop an interview guide/survey that lists the questions or issues to be explored and includes an informed consent form.
 - h. Where necessary, translate guides into local languages and test translation.

3. Train Data Collectors

- a. Identify and train data collectors, where necessary, use interviewers that speak the local language.

4. Collect Data

- a. Gather all relevant documents.
- b. Set up interviews/surveys with stakeholders
- c. Seek informed consent of each respondent (written, documented or oral). Re-explain the purpose of the interview, why the stakeholder has been chosen, expected duration

of the interview, whether and how the information will be kept confidential, and the use of a note taker/tape recorder.

- d. If the respondent has consented, conduct the interview/survey.

5. Analyse Data

- a. Review all relevant documents.
- b. Review all interview/survey data.

6. Disseminate Findings

- a. Write report.
- b. Solicit feedback.
- c. Revise
- d. Disseminate

Figure 3.3 which is shown on the next page presents a diagram which shows the steps involved in conducting a case study research Timane (2011).



Figure 3.3: A case study process (Timane 2011)

3.5.3 Entry into the site of the study

This section describes how the case study, data collection and sampling of participants were carried out. According to Stuart and Barnes (2005, p.4), obtaining permission to conduct research is very important before embarking on the research. Gatekeepers are people who “already have access to individuals or groups of people and who are attempting to safeguard the interests of others” (Stuart and Barnes, 2005, p.4). For this study, permission was granted by the Ministry of Health and Social Services (MoHSS) in order to conduct the research at the respective hospitals (cf Appendix E). In addition, permission was sought from the UNISA Ethics Clearance Committee (cf appendix D) before entry into the sight. Participants were purposively selected from each rural hospital. The healthcare institutions were selected from the rural areas in Windhoek, indicated in Table 3.1

Rural areas in Windhoek		Hospital Name
1	Khomasdal	Khomasdal Hospital
2	Katutura	Katutura Hospital
3	Okuryangava	Okuryangava Hospital

Table 3.1 Health care institutions

This gives a total of 3 healthcare institutions selected for this study.

The map presented below shows the site constituting of the rural communities in Windhoek. There are three rural hospitals taken into consideration.

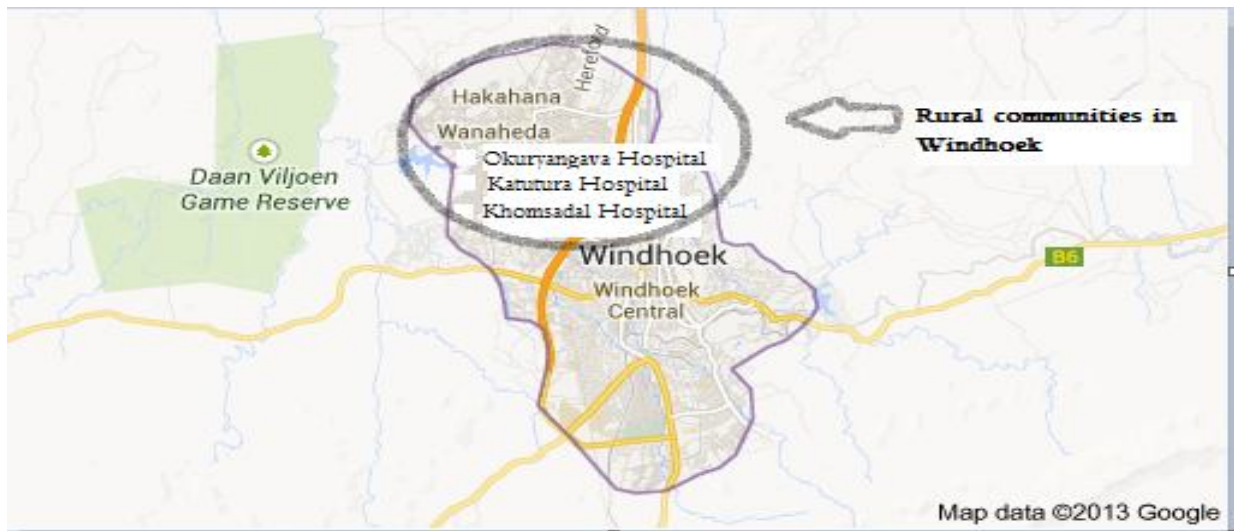


Figure 3.4 Map of Windhoek, Google Maps (2013)

The next section describes the research methods.

3.5.4 Research methods

According to Babbie and Mouton (2002), research methods refer to the process in which the research design is carried out which involves a well-planned and precise procedure. Research methods are often used to portray the findings of a research study from the viewpoint of the participants. Neville (2007).

This research consists of four steps which include:

- Step 1. Literature Study
- Step 2: Data Collection
- Step 3: Data Analysis
- Step 4: Expert Validation
- Step 4: Report Writing

3.6. Data collection methods

Robinson (2010) suggests that the choice of using different sources of data collection is made by the researcher due to factors such as available time needed for the research study, validity of the research study and budget available for the study. Coleman (2011, p.133) further explains that the different data collection methods can be analysed to point the differences and similarities between the findings. The researcher used interviews, questionnaires, observation and document analysis for data collection.

The next section discusses how these methods were administered.

- **Interviews**

Kvale (1996) suggests that the researcher conveys the feelings of the participants in order to interpret their experiences. Interviews were conducted at the selected hospitals located in rural communities in Windhoek. The interview was in form of a group interview in which participants were interviewed at the same time. The interview sessions with the participants were recorded. The interview was done separately for each selected rural hospital. Two doctors and two nurses were present at the hospital in each rural hospital. The interview questions solicited answers for the following:

- Methods of delivering healthcare services to patients at OPDs in rural hospitals at Windhoek.
- The acceptance and use of mobile phones to improve health care delivery in rural hospitals in Windhoek.

Durrance and Fisher (2005) highlights that one of the advantages of conducting group interviews is that interviewing many participants at the same time produces a comprehensive result as compared to individual interviews.

- **Questionnaire**

Questionnaires were used to retrieve information from the participants regarding:

- The penetration of mobile phones in rural communities in Windhoek
- The health care delivery needs of patients who visit hospitals in rural communities in Windhoek.

The table below shows the questionnaire distribution to patients and nurses in selected rural hospitals (cf Appendix A and B).

Participants		Hospital Name
2 Nurses	2 patients	Khomasdal Hospital
2 Nurses	2 patients	Katutura Hospital
2 Nurses	2 patients	Okuryangava Hospital
N=6	N=6	N=3

Table 3.2 Questionnaire distribution table

The main purpose of the questionnaire was to supplement the evidence obtained from the interviewees regarding mobile phones penetration in the rural communities.

- **Document Analysis**

Document analysis was used to gather information about the Namibian government's policies regarding health care and the level of e-health initiatives in Namibia and information about the National Health Policy Framework. This includes:

- providing primary health care for all Namibians
- affordable health care services
- quality health care to be priority when delivering health care services

- **Expert Validation**

The proposed MHSF was validated by a group of experts which includes, one doctor, one nurse and two IT specialists (cf appendix F)

- **Photograph**

Pictures of selected rural hospitals were taken to give a visual description of the hospitals.

3.6.1 Triangulation

Triangulation is defined as the “use of multiple methods mainly qualitative and quantitative methods in studying the same phenomenon for the purpose of increasing study credibility”(Hussein, 2009). The goal of triangulation is to effectively encapsulate the feelings of the participants which will help the researcher increase the probability that their findings are seen as credible and worthy of consideration by others Creswell (2009 cited in, Coleman, 2010, p.153). As explained by Denzin (1970), there are different forms of triangulation which includes:

- **Data triangulation:** This entails gathering data through several sampling strategies, so that slices of data at different times and social situations, as well as on a variety of people, are gathered.
- **Investigator triangulation:** This refers to the use of more than one researcher in the field to

gather and interpret data.

- **Methodological triangulation:** This refers to the use of more than one method for gathering data.

In this study, the methodological triangulation method was used through interviews, questionnaires and document analysis and photographs.

3.6.2 Research population and sampling

Babbie (2006, p.196) describes population as a selection of a component from a collection. The population used for this study consists of three groups, which are the patients, the nurses and the doctors. However, Gay (1987, p. 101) highlights that sampling is the process of choosing a small number of participants from a wide range of participants. Mugo (2002) describes purposeful sampling as the “selection of information rich cases for in-depth study”. For this research, the purposeful sampling method was applied. The purposive sampling was based on the researcher’s opinion on the sample appropriate for the study. A total number of 18 participants were selected, with 6 participants from each hospital; their categories include nurses, patients and doctors as shown in Table 3.3 on the next page. The participants signed the consent form and were informed that they could withdraw from the research study any time, hence the participants volunteered to participate in this research study. The participants were selected from each category.

Wilmot (2005, pp.3) states that qualitative research uses non-probability sampling as it does not produce mathematically generated data. Wilmot (2005) also describes purposive sampling as a method used to randomly choose participants that would participate in a study, in which the selected population represents the whole population. Purposive sampling method was used to identify patients who visit rural hospitals and have access to mobile phones. Doctors and nurses were selected from each rural hospital for the qualitative interviews.

Participants			Hospital Name
2 Nurses	2 patients	2 doctors	Khomasdal hospital
2 Nurses	2 patients	2 doctors	Katutura hospital
2 Nurses	2 patients	2 doctors	Okuryangava hospital
N=6	N=6	N=6	N=3

Table 3.3 Category of participants (n=18)

3.7 Data analysis technique

Data analysis was done using constructs of AT and TAM theories. In order for the researcher to elicit an in-depth understanding of meanings relating to the components of the constructs (*subject, tool, object and rules*) as applied in a natural setting environment, a hermeneutic approach was also used.

3.7.1 Activity Theory (AT)

For this study, the subjects are patients who are affected by the delays at OPDs, the object is the activity to be studied which is improving the health care delivery services in rural hospitals and the tool is the mobile phone being used to provide improved healthcare delivery services to patients who visit rural hospitals. The community includes patients, nurses and doctors governed by a set of rules (administering healthcare services / receiving healthcare services) and division of labour (one administers healthcare services / one receives healthcare services).

3.7.2 Technology Acceptance Model (TAM)

For this study, patients' perceived use would be the level to which the use of mobile phones would improve the process in delivery health care delivery services. The second element in this model which is the perceived ease-of-use as described by Davis (1989) refers to the "level to which the user believes the system would be free from effort". For this study, the perceived ease of use would be the level to which the nurses, doctors and patients believe that the adoption of mobile phones in the delivery of healthcare services would be free from effort.

3.7.3 Hermeneutic approach

Hermeneutics is a method used in interpreting data by understanding its context (Howell, 2013).

Multiple sources of data were collected through interviews, questionnaires, document analysis and photographs in order to ensure the credibility of the study and to ensure that the findings are unbiased. Figure 3.5 on the next page, explains the hermeneutical circle, the understanding of the data sources is very important and this is the first step in the interpretation process. When the result of the data sources have been clearly understood, the next step is to explain the contents of what was understood in the first step, the result of the data sources are explained. The last step in the hermeneutical circle is the appropriation phase where the result of the new data provided new insights on what was understood. The result of data findings are linked to the research study

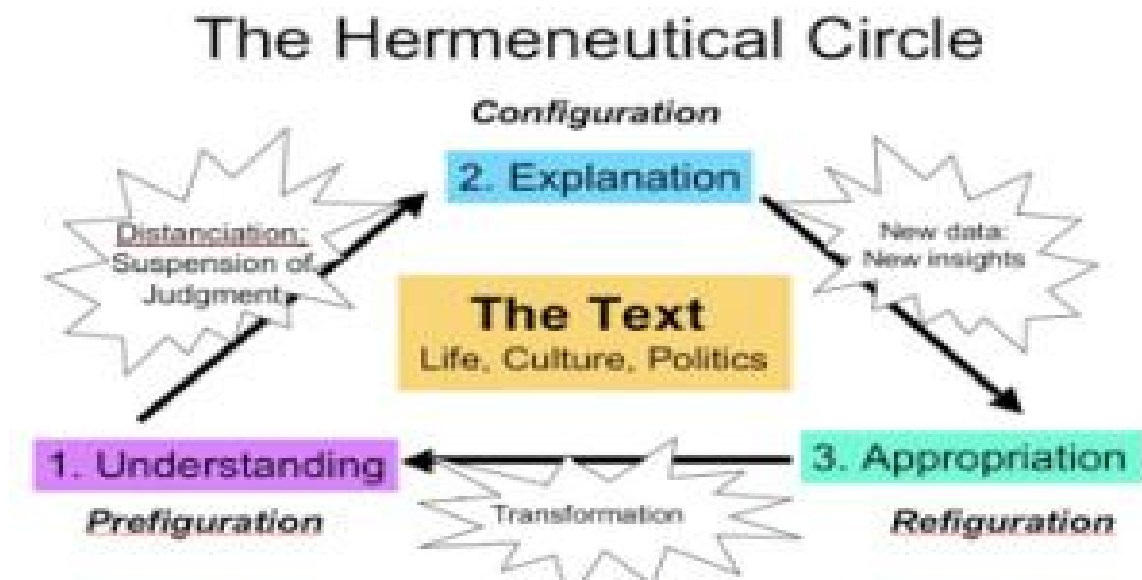


Figure 3.5 The hermeneutic circle (Krumel, 2009)

Klein and Myers (1999) describe the principles for interpretive field research:

1. The Fundamental Principle of the Hermeneutic Circle

This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles. Example: Lee's (1994) study of information richness in e-mail communications. It iterates between the separate message fragments of individual e-mail participants as parts and the global context that

determines the full meanings of the separate messages to interpret the message exchange as a whole.

For this study, the principle of the hermeneutic circle used to analysed the problems encountered by patients who visit rural hospitals in Windhoek using the single-case analysis technique.

2. The Principle of Contextualization

Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.

Example: After discussing the historical forces that led to Fiat establishing a new assembly plant, Ciborra et al. (1996) show how old Fordist production concepts still had a significant influence despite radical changes in work organization and operations.

Chapter 4 gives a detailed explanation of the background of the different case studies which led to the formulation of the research question and sub research questions.

3. The Principle of Interaction Between the Researchers and the Subjects

Requires critical reflection on how the research materials (or “data”) were socially constructed through the interaction between the researchers and participants. Example: Trauth (1997) explains how her understanding improved as she became self-conscious and started to question her own assumptions.

The principle of interaction between the researchers and the subjects was applied to the study as the researcher paid visits to the hospitals, interacted and gained the confidence and trust of the participants before conducting the research.

4. The Principle of Abstraction and Generalization

Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action. Example: Monteiro and Hanseth’s (1996) findings are discussed in relation to Latour’s actor network theory. There was no generalization made the result of the data is specific to the study.

5. The Principle of Dialogical Reasoning

Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (“the story which the data tell”) with subsequent cycles of revision. Example: Lee (1991) describes how Nardulli (1978) came to revise his preconceptions of the role of case load pressure as a central concept in the study of criminal courts several times.

6. The Principle of Multiple Interpretations

Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it. Example: Levine and Rossmore’s (1993) account of the conflicting expectations for the Threshold system in the Bremerton Inc. case.

7. The Principle of Suspicion

Requires sensitivity to possible “biases” and systematic “distortions” in the narratives collected from the participants. Example: Forester (1992) looks at the facetious figures of speech used by city planning staff to negotiate the problem of data acquisition.

3.8 Measures to ensure trustworthiness

According to Labanca (2010), trust worthiness is the ability to present facts on the information gathered during the research which can be verified to be solid. Credibility was gained by the researcher’s unbiased judgement throughout the study and gaining the acceptance of the participants. Participants’ informed consent was received before the researcher embarked on the research. Shenton (2004) explains that trustworthiness can be measured using the following criteria:

- **Credibility**

Shenton (2004) states that internal validity is used to guarantee that the research methods produces the correct findings. Joppa(2000 cited in Golafshani, 2003, p.597) states that validity “determines whether the research truly measures that which it was intended to measure or how truthful the research

results are”. For this study, credibility was achieved when the researcher made preliminary visits to the various hospitals in order to establish good relationship with participants and gain the participants’ trust. The researcher ensured that questions were asked many times in order to test the validity of the participants’ response. The triangulation method was also used in this study as information was gathered from different group of participants which includes the nurses, doctors and patients in order to ensure trustworthiness and verify information consistency and interpretation. Participants were also told they could withdraw at any time to ensure that only honest and bona fide participants participated in the study.

- **Dependability**

Shenton (2004) describes dependability as the “processes within the study which should be reported in detail, thereby enabling a future researcher to repeat the work, if not necessarily to gain the same results”. For this study, detailed description of the interview process was given.

- **Confirmability**

The concept of confirmability is based on the possibility of the researcher’s findings being able to be tested under different circumstances and still produced similar results Shenton (2004). For this study, to ensure that the findings are as a result of the participants ideas and not from the researcher’s point of view, triangulation was used for confirmability.

- **Transferability**

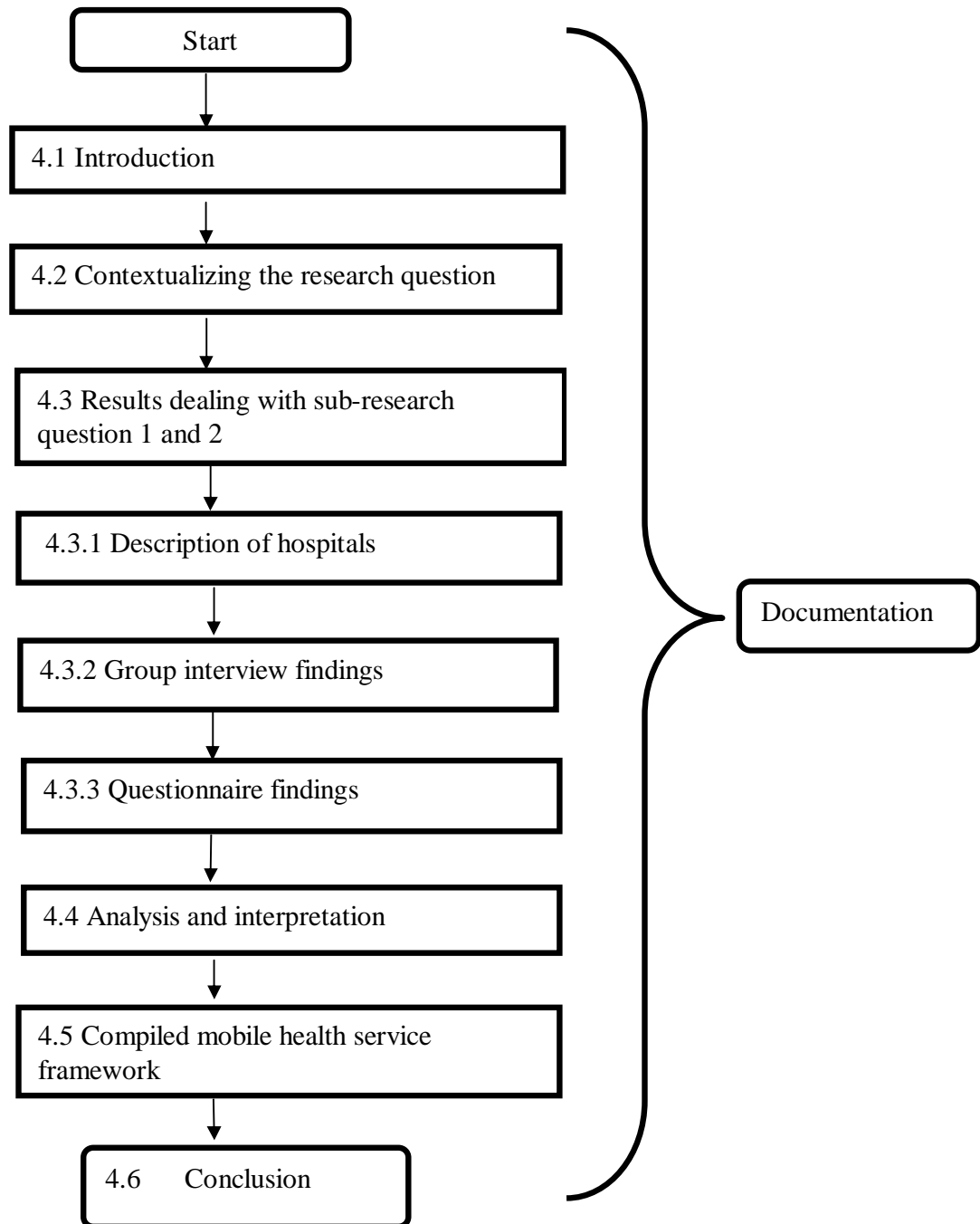
As stated by Merriam (1998 cited in Shenton, 2004, p.69), external validity involves the application of research findings in a specific case to other cases. This implies that the result of the findings from a sample population can be applied to other populations in similar cases, which should also give similar results.

3.9 Conclusion

This chapter examined the three philosophical assumptions underlying research. The interpretive philosophy was chosen for this study because the objective of the research is to investigate the healthcare delivery needs of patients who visit rural hospitals in Windhoek. The qualitative research design using the case study method approach was used to achieve the objectives of the research.

Furthermore, this chapter explains how the participants were selected from each rural hospital in Windhoek. The data collection method used for this study was also explained, which includes interviews, questionnaires, document analysis and photographs. This chapter highlights how the data analysis was carried out and measures to ensure trustworthiness of the research.

CHAPTER 4: RESEARCH FINDINGS AND DATA ANALYSIS



CHAPTER 4

RESEARCH FINDINGS AND DATA ANALYSIS

4.1 Introduction

Chapters 2 and 3 gave a detailed explanation on the literature review and the research methodology used for the study. In this chapter, the researcher discusses the findings, interpretation and analysis of data collected to answer the main research questions and sub-research questions presented in Chapter 1:

How can mobile phones be used to improve health care delivery services at OPDs in rural hospitals in Windhoek?

- What health care services are provided to patients at OPDs in rural hospitals?
- What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?
- How can a compiled mobile health service framework be used to improve health care service delivery to patients at OPDs?

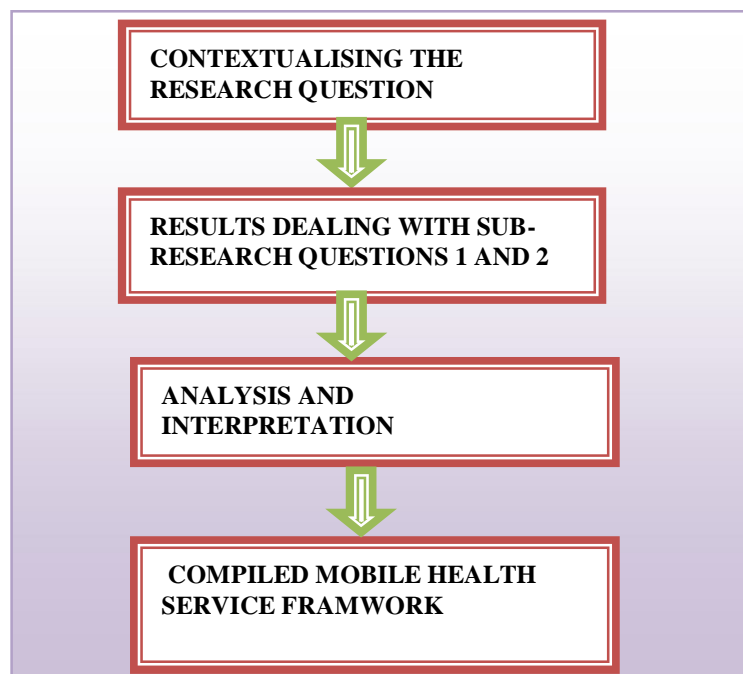


Figure 4.1 Steps for data analysis and interpretation

According to Creswell (2007), the analysis process is done by breaking down information into smaller pieces and putting them together in order to form a large consolidated whole or picture. This approach was used in this study as the main research question was broken in sub-research questions in order to answer the main research question. Figure 4.1 shows the steps used in analysing data collected for this study.

4.2 Contextualizing the research question

As indicated in section 4.1 the main research question to be analysed in this study is:

How can mobile phones be used to improve health care delivery services at OPDs in rural hospitals in Windhoek?

The main research question was further broken into three sub-research questions which are also addressed in this chapter. Measuring instruments such as interviews, questionnaire, document analysis and photographs were used in the data collection process. The use of multiple data collection methods was to provide an in-depth interpretation of data collected. Table 4.1 presents the sub-research question and the data collection method used.

Sub-research questions	Data collection instruments		
	Group Interviews	Questionnaires	Photographs
<ul style="list-style-type: none"> • What health care services are provided to patients at OPDs in rural hospitals? 	√	√	√
<ul style="list-style-type: none"> • What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek? 		√	√
<ul style="list-style-type: none"> • How can a compiled mobile health service framework be used to improve health care service delivery to patients at OPDs? 	√	√	√

Table 4.1 Data collection instruments

4.2.1 The research respondents

As stated in Chapter 3, respondents were purposively selected from rural hospitals located in Windhoek. A total number of 18 participants were selected from each rural hospital. The selected respondents from each rural hospital are in the following categories: 2 nurses, 2 doctors and 2 patients. The respondents were well informed before the interview was conducted. They were informed that participation is voluntary and could withdraw at any time, after which they signed the informed consent form before the interview was conducted and questionnaires distributed to the participants. Table 4.2 presents the name of the rural hospitals and their locations.

Case No	Case Description	Location
1.	Katutura Hospital	Katutura
2.	Okuryangava Hospital	Okuryangava
3.	Khomasdal Hospital	Khomasdal

Table 4.2 Rural hospitals

4.2.2 Issues addressed by the various research instruments

The purpose of this section is to describe the objective of each data collection instrument used for the study.

4.2.2.1 Group interviews

The respondents who participated in the group interview were of different gender and age group. It was also indicated in Chapter 3 that the respondents who participated in the group interviews included 2 doctors and 2 nurses from each rural hospital. The interviews were held at the doctors' office at the selected rural hospitals. The group interview questions were intended to answer sub-research questions 1 and 3:

- What health care services are provided to patients at OPDs in rural hospitals?
- How can a mobile health service framework be compiled to improve health care service delivery to patients at OPDs?

Table 4.3 summarizes the objectives of the group interview questions.

GROUP INTERVIEW	QUESTION NUMBER	QUESTION	OBJECTIVES
Appendix C: Nurses and doctors	1	How many patients visit your hospital per year?	To determine the frequency of patients' visit to the hospital per year.
	2	Do they visit on appointment with the doctors?	To determine the regularity of patients who visit rural hospitals based on doctor's appointment
	3	What processes are involved when patients first arrive at the hospital before they are referred to medical practitioners and how long do these processes take?	To determine the processes involved before patients are examined by the doctor and the time it takes for these processes to be completed.
	4	How does the hospital contact a patient after the patient has visited the hospital for treatment?	To determine if there are methods used for communicating with patients after they have been treated.
	5	What e-health application do you have in your hospital which assists work processes in your hospital?	To determine if there are existing e-health applications used in the hospital

	6	If any m-health application is to be implemented at your hospital, what will be your personal expectations in terms of solving some of the current problems in the hospital	To determine the acceptance and expected benefit if an m-health application was installed in their hospital.
	7	Is there anything else you would like to suggest?	To determine if there are any other issues that might have been missed out during the interview and to get more suggestions from the doctors and nurses.

Table 4.3 Objectives of the interview questions

The next section focuses on the questionnaire data collection instrument.

4.2.2.2 The questionnaire

The questionnaires (cf Appendices A and B) consists of two sets of questions. The first set of questionnaire (cf Appendix A) consists of questions addressed by the patients, while the second set of questionnaire (cf Appendix B) consists of questions addressed by the nurses. The objectives of these two questionnaires are summarized in Table 4.4 and Table 4.5 respectively.

QUESTIONNAIRE	QUESTION NUMBER	QUESTION	OBJECTIVE
Appendix A: Patients	1	How often do you visit the hospital per year?	To determine the frequency of patients' visit to the hospital
	2	How long does it take before you are referred to the doctor?	To determine the amount of time patients' wait in the queue before they are examined by a doctor
	3	Are you satisfied with the time you arrive at the hospital and the time you are examined by a doctor?	To determine the satisfaction of patients with regards to the time spent in the hospital
	4	Do you own a mobile phone?	To determine the penetration rate of mobile phone usage among patients who visit rural hospitals
	5	If the answer to question four is yes, how often do you use	To determine the usage of the

		your mobile phone?	mobile phones among patients in rural communities
	6	How would you rate your competencies on the use of the Short Message Service (SMS) feature on your mobile phone?	To determine the familiarity of the SMS feature of the patients
	7	Would you like to receive SMS's from your local hospital?	To determine if an m-health application can be used as a tool to improve work processes at rural hospitals
	8	If yes, what type of information will you prefer and in which language?	To determine what information they would like to receive from their hospitals on their mobile phone

Table 4.4: Objectives of the questionnaire instruments administered to patients

QUESTIONNAIRE	QUESTION NUMBER	QUESTION	OBJECTIVE
Appendix B: Nurses	1	State the processes involved before a patient is referred to a medical practitioner	To determine the number of activities involved before a patient is referred to a doctor.
	2	State the average time spent on these processes mentioned above	To determine the amount of time patients' wait in the queue at OPDs
	3	Is the average time spent on these processes satisfactory?	To determine the satisfaction of the nurses with regards to the time attending to patients in OPDs
	4	State the average number of patients who visit this hospital every year.	To determine the amount of patients who visit rural hospitals on a yearly basis
	5	What benefits will you expect if a mobile healthcare delivery system was installed in your hospital?	To determine the perceived usefulness of an m-health application
	6	If a mobile healthcare delivery system was installed at your hospital, how would it help in improving the health care delivery services in your	To determine the acceptance of an m-health application
	7	What difficulties do you think would arise from the implementation of a mobile	To determine the perceived ease of use if an m-health application was installed in their hospital

		healthcare delivery system in your hospital?	
	8	What are the current Information and communication technology (ICT) being used at your hospital?	To determine if there are existing IT systems being used in the hospital
	9	Will you like to have access to any e-health application system outside the hospital? And Why?	To determine if the nurses would like to communicate with patients outside the hospital
	10	Any comments or suggestion?	To determine if there are any issues that have been missed out which needs to be addressed

Table 4.5: Objectives of the questionnaire instruments administered to nurses

4.2.2.3 Photographs

Photographs of selected hospitals were taken in order to give a visual description of the hospitals used for the study.

4.3 Results dealing with sub-research question 1 and 2

The sub-research questions stated in section 4.1 are:

1. What health care services are provided to patients at OPDs in rural hospitals?
2. What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?

In order to answer these questions, the three hospitals are first described and the responses to the interview and questionnaires which answer these sub-research questions are stated below in Table 4.6, Table 4.7 and Table 4.8.

4.3.1 Study location and context

This section consists of the description of the three hospitals. The description indicates the following:

- Background / history of the hospital
- ICT access level including ICT availability, accessibility and usability.
- M-health solutions availability

The hospitals are as follows:

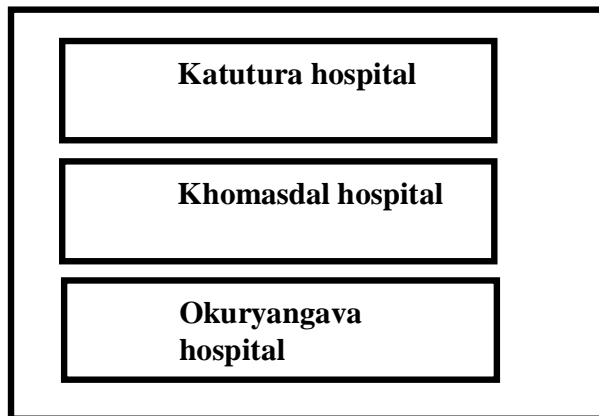


Figure 4.2: Rural hospitals

4.3.1.1 Description of Katutura hospital

This section gives a description of the background/history of Katutura hospital. Document analysis and photographs were used to give a vivid description of the hospital. This section includes:

- Background / history
- ICT access level including ICT availability, accessibility and usability.
- M-health solutions including availability, accessibility and usability.

The description of the hospital infrastructure of Katutura hospital is presented in Figure 4.3 as at the time data collection was done.



Figure 4.3: Katutura hospital

Background/history of the hospital

Katutura hospital is in Katutura, a rural community located in Windhoek, Khomas Region. This hospital serves as a referral hospital for the Katutura community; patients are usually referred to this hospital from the rural clinics. The number of residents the hospital serves is around 6,000. Figure 4.3 and above presents a photograph of Katutura hospital.

ICT access level including availability, accessibility and usability

There was no computer in the consulting room as at the time the research was conducted, the nurses and doctors do not use computers or any other ICT tool for work-related duties. However, the administrative staff use the Integrated Health Care Information Management System (IHCIMS) to capture patients demographic details and for revenue collection. The transmission of patients' data from Katutura hospital to the central hospital is done manually.

M-health solutions including availability, accessibility and usability

There is currently no m-health application installed in the hospital.

4.3.1.2 Description of Khomasdal hospital

This section gives a description of the background/history of Khomasdal hospital. Document analysis and photographs were used to give description of the hospital. This section includes:

- Background / history
- ICT access level including ICT availability, accessibility and usability.
- M-health solutions including availability, accessibility and usability.

The description of the hospital infrastructure of Khomasdal hospital is presented in Figure 4.4 as at the time data collection was done.



Figure 4.4 Khomasdal hospital

Background/history of the hospital

Khomasdal hospital is in Khomasdal, a community located in Windhoek, Khomas Region. This hospital serves as a first point entry hospital before patients are referred to the central hospital. The number of residents this hospital serves is around 3,000. Figure 4.5 presents a photograph of Khomasdal hospital.

ICT access level including availability, accessibility and usability

There was no computer in the consulting room as at the time the research was conducted, the nurses and doctors do not use computers or any other ICT tool for work-related duties. However, the administrative staff use the IHCIMS to capture patients demographic details and for revenue collection. The transmission of patients' data from Khomasdal hospital to the central hospital is done manually.

M-health solutions including availability, accessibility and usability

There is currently no m-health application installed in the hospital.

4.3.1.3 Description of Okuryangava hospital

This section gives a description of the background/history of Okuryangava hospital. Document analysis and photographs were used to give description of the hospital. This section includes:

- Background / history
- ICT access level including ICT availability, accessibility and usability.
- M-health solutions including availability, accessibility and usability.

The description of the hospital infrastructure of Okuryangava hospital is presented in Figure 4.5 as at the time data collection was done.



Figure 4.5 Okuryangava hospital

Background/history of the hospital

Okuryangava hospital is in Okuryangava, a rural community located in Okuryangava, Windhoek, Khomas Region. This hospital serves as a first point entry hospital before patients are referred to the central hospital. The number of residents the hospital serves is around 6,000. Figure 4.5 presents a photograph of Okuryangava hospital.

ICT access level including availability, accessibility and usability

There was no computer in the consulting room as at the time the research was conducted, nurses and doctors do not use computers or any other ICT tool for their work-related duties. However, the administrative staff use the IHCIMS to capture patients demographic details and for revenue collection. The transmission of patients' data from Okuryangava hospital to the central hospital is done manually.

M-health solutions including availability, accessibility and usability

There is currently no m-health application being used in the hospital.

4.3.2 Group interview findings

Group interviews were held in the doctors' office. The nurses and doctors participated in the group interviews. The objective of the group interview is to determine the acceptance level, perceived usefulness and the potential benefit to nurses and doctors in rural hospitals and to determine if an m-health application was already installed at the rural hospitals. The outcome of the interview session gave an in-depth view of the research findings which answered the first sub-research question (cf Table 4.1). In chapter 3, it was stated that the purposive sampling method was used in selecting the participants. The participants were selected from the rural areas in Windhoek. For this study, two nurses and two doctors from each rural hospital were interviewed (cfChapter3). The outcome of the group findings for each rural hospital is summarized on Table 4.6.

Key operational areas and interview questions	Summarized responses with direct quotations from rural hospitals
Q.1 How many people visit your hospital per year?	<p>Respondent 1: <i>“On average 50 to 80 patients visit the hospital on a daily basis.”</i></p> <p>Respondent 2: <i>“It depends on the period, we usually receive large number of patients around February to November, in January and December, most patients travel to their farms and most of the doctors are on leave at that time.”</i></p> <p>Respondent 1: <i>“During the winter season there is a massive amount of patients we receive at the hospital, it could go between 100 and 150 patients a day”</i></p>
Q.2 Do they visit by appointment with the doctors?	<p>Respondent 1: <i>“Some patients visit based on follow-up appointments.”</i></p> <p>Respondent 2: <i>“Some patients visit whenever they fall sick or need medical attention.”</i></p> <p>Respondent 3: <i>“An average of 20 percent of the patients we receive every day visit on appointment, the other 80 percent visit when they are critically sick.”</i></p>
Q.3 What processes are involved when patients first arrive in the hospital before they are referred to medical practitioners and how long do these processes take?	<p>Respondent 1: <i>“The patients have to form a queue outside the hospital, after which the security guard offers them a numbered card. Based on their card numbers the patients are called upon individually to obtain their health card if they do not have one already. They also have to pay a fee of four dollars, get a stamp on their health card and get their details recorded on the IHCIMS application. At this stage, patients could spend between one to two hours in the queue. They have to wait to get their vital signs checked (blood pressure test, sugar test, cholesterol and urine test) which is the recorded on the patient’s health card, the patient is referred to a doctor who does further examinations on the patients, records the findings</i></p>

	<p><i>and writes some prescriptions on the patient's health card. The patient is referred to the pharmacy for the collection of prescribed medications."</i></p> <p>Respondent 2: <i>"Patients have to wait in the queue for hours because there are many patients to be attended to. In a day only one doctor is assigned to our hospital."</i></p> <p>Respondent 1: <i>"Patients could spend at least 3 to 4 hours in the queue depending on the number of patients visiting the hospital especially during the winter season."</i></p> <p>Respondent 1: <i>"Patients on appointments are usually referred to the doctor first, after the vital signs checking is done."</i></p>
<p>Q.4 How does the hospital contact a patient who has visited the hospital for treatment?</p>	<p>Respondent 1: <i>"We do not have any method or procedures for contacting patients after treatment."</i></p>
<p>Q.5 What e-health application do you have in your hospital which assists work processes in your hospital</p>	<p>Respondent 1: <i>"We do have the IHCIMS application which is used by the administrative staff of the hospital, but we do not use it for our duties"</i></p> <p>Respondent 2: <i>"The application is used for recording patient's demographic details on the system and recording revenue collection"</i></p>
<p>Q.6 If an m-health application is to be implemented at your hospital, what will be your personal expectations in terms of solving some of the current problems in the hospital</p>	<p>Respondent 1: <i>"That will be very exciting for me as a doctor because tracing patients' details is quite a problem for me since we do not have the patient's health records available to us. Time will be saved as well because I will be able to respond to patients faster than before"</i></p> <p>Respondent 2: <i>"There are patients who lose their health cards and a result it is difficult to really determine their medical history, so I believe an e-health application will be able to save patients' medical record we can use for future analysis"</i></p>

	<p>Respondent 3: <i>“Queues are a major problem in our hospital, when I walk into the hospital, there is a massive number of patients waiting at the OPDs to be attended to. If the e-health application can help in reducing the processes involved, then substantial amount wasted in OPDs will be reduced.”</i></p> <p>Respondent 4: <i>“Sometimes we are not able to get in touch with our patients, we are not able to keep track of patients, we give them appointments, some of them do not turn up, it will really be a good idea if we can have an e-health application that will enable us keep in touch with our patients.”</i></p> <p>Respondent 3: <i>“There are times when only one doctor is assigned to our hospital and sometimes when the nurses are the only medical resources available especially during the festive periods, it will be a good idea if we can communicate with our patients remotely with mobile technologies.”</i></p>
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Table 4.6 Summarized responses to interview questions

4.3.3 Summary of the group interview response

In answering the sub-question 1:

What healthcare services are provided to patients at OPDs in rural hospitals?

The group interviews provided answers to the sub-question stated above. The summary of the responses are indicated below:

- An average of 50 to 80 patients visits the hospital on a daily basis during summer.
- An average of 100 to 150 patients visits the hospital on a daily basis during winter.
- There is an increase in the number of patients who visit the hospital during winter.

- Services at OPDs start with a queue. Patients have to wait in the queue before the security guard offers them a card
- Patients' demographic details are registered on the IHCIMS and their health cards are stamped after they pay a sum of four Namibian dollars (N\$4).
- Patients are referred to a nurse who does the vital signs checking (blood pressure test, sugar test, cholesterol and urine test) of the patients.
- Details are recorded on the patients' health card.
- Patients are referred to a doctor with the patients' health card to carry out further investigations on the patient after which patients are referred to the pharmacy

The group interviews further revealed that:

- An m-health application will save time in recording patients demographic details as a result decrease time spent in OPDs
- With an m-health application installed in the rural hospitals, patients can be easily traced and follow-up will be much faster.
- Patients' health information can be easily retrieved by the nurses and doctors.
- Rural hospitals do not have any method for contacting patients after treatment.
- There is a shortage of medical practitioners in the rural hospitals
- Rural hospitals lack ICT tools when carrying out work duties
- There are too many processes carried out at the OPDs

The group interviews also revealed that there is an IHCIMS implemented in the rural hospitals. It also revealed that the IHCIMS application is used to record patients' health information and to keep patients' demographic information, but it is not used for recording patients' medical information, communication or delivering of healthcare information to patients. In addition, the respondents suggested that if an m-health application was implemented in their hospitals, it will improve their work performance and assist them to deliver better healthcare services to their patients. The next section focuses on the questionnaire findings.

4.3.4 Questionnaire findings

To answer the second sub-research question:

“What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?”

The results of the questionnaire instrument which was administered to nurses and patients assisted in answering the question, the answers are summarized in Table 4.7 and Table 4.8 respectively. Participants stated the following:

Key operational areas and questions asked	Summarized responses from respondents of rural hospitals
How often do you visit the hospital per year?	4 out of 6 respondents indicated that they often visit the hospital whenever they fall sick
How long does it take before you are referred to a doctor?	6 out of 6 respondents indicated that it takes many hours before they are referred the doctor
Are you satisfied with the time you arrive at the hospital and the time you are examined by a doctor?	6 out of 6 respondents indicated that they are not satisfied
Do you own a mobile phone?	6 out of 6 respondents indicated that they have a mobile phone
If the answer to question four is yes, how often do you use your mobile phone?	3 out of 6 respondents indicated that they use their mobile phones always
How would you rate your competencies on the use of Short Message Service (SMS) feature on your mobile phone?	5 out of 6 respondents indicated that they were very competent in the use of the SMS feature on their mobile phones.
Will you like to receive SMS's from your local hospital?	6 out of 6 respondents indicated that they would like to receive SMS's from their local hospitals
If yes, what type of information will you prefer and in which language?	6 out of 6 respondents indicate that they would like to receive SMS's from their local hospitals regarding health information in English language

Table 4.7 Summary of questionnaire findings for patients

Key operational areas and questions asked	Summarized responses from nurses of rural hospitals
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<p>State the processes involved before a patient is referred to a medical practitioner</p>	<p>5 out of 6 respondents indicated that patients have to record their demographic information, stamp their health card and pay the required fee at the cashier.</p> <p>Patients have to join the queue to be tested for their vital signs.</p> <p>After the vital signs checking is completed, patients are referred to a doctor, who does further examination the patient.</p> <p>The doctor refers the patient to the pharmacy</p>
<p>State the average time spent on these processes mentioned above</p>	<p>5 out of 6 respondents indicated that an average of one hour is spent on each process</p>
<p>Is the average time spent on these processes satisfactory?</p>	<p>6 out of 6 respondents indicated that the average time spent on these processes is not satisfactory</p>
<p>State the average number of patients who visit this hospital every day.</p>	<p>6 out of 6 respondents indicated that an average of 100 patients visit the hospital everyday</p>
<p>What benefits will you expect if a mobile health care delivery system was installed in your hospital?</p>	<p>5 out of 6 responses indicates that the respondents feel it would help them in terms of their work processes</p>
<p>If a mobile health care delivery system was installed at your hospital, how would it help in improving the health care delivery services in your hospital?</p>	<p>5 out of 6 respondents believe that they would be able to send health information to patients, keep in touch with patients as well as provide health care services virtually without the physical presence of the patient.</p>

What difficulties do you think would arise from the implementation of a mobile health care delivery system in your hospital?	6 out of 6 respondents believe training should be provided
What are the current Information and Communication Technology (ICT) being used at your hospital?	Responses from respondents indicate that there is an IHCIMS application installed in their hospitals used by the administrative staff but not by the medical staff.
Will you like to have access to an m-health application system outside the hospital? And Why?	6 out of 6 responses from the respondents indicate that they would like to have access to an m-health application because it would improve their work processes and help them keep in touch with patients
Any comments or suggestion?	There was no further comment posed by the nurses

Table 4.8 Summary of questionnaire findings for nurses

4.3.5 Summary of questionnaire findings

This section presents a summary of the questionnaire findings administered to nurses and the patients

- Patients spend a long time on queues. Sometimes, many before they are referred to a medical practitioner; this means that there is a substantial amount of time spent in OPDs.
- All the participants who took part in the research revealed that they possessed a mobile phone; which means that there is a high level of mobile phone penetration among patients who visit rural communities.
- There is high usage of the SMS feature on their mobile phones
- There is no m-health application currently used in the rural hospitals.
- 5 out of 6 participants have the competency of using the SMS feature on their phones.
- 4 out of 6 respondents often visit the hospital whenever they fall sick
- They would like to receive SMS's from their local hospitals in English language.

4.4 Analysis and Interpretation

This section interprets and analyses the findings using some of the constructs from AT and TAM theories.

These constructs, subjects, objects, tools and perceived satisfaction (cf Chapter2) aided the researcher to categorize the findings into themes for analysis. Therefore, the themes for analysis in this section include:

- Services provided to patients at hospital OPDs
- Level of mobile phone penetration and usage by patients
- Health professionals and patients satisfaction

4.4.1 Services provided to patients at hospital OPDs

The result of the interview conducted at the hospitals and the questionnaires administered to the participants reveal the services provided to patients' at OPDs in rural hospitals are primary healthcare which includes:

1. Registering of patient demographic information
2. Revenue collection
3. Stamping of patient health card
4. Checking of vital signs(Body Temperature, Pulse Rate, Respiration Rate, Blood Pressure)
5. Patient diagnosis
6. Providing treatment
7. Providing medication

Figure 4.6 below depicts the services provided to patients at OPDs

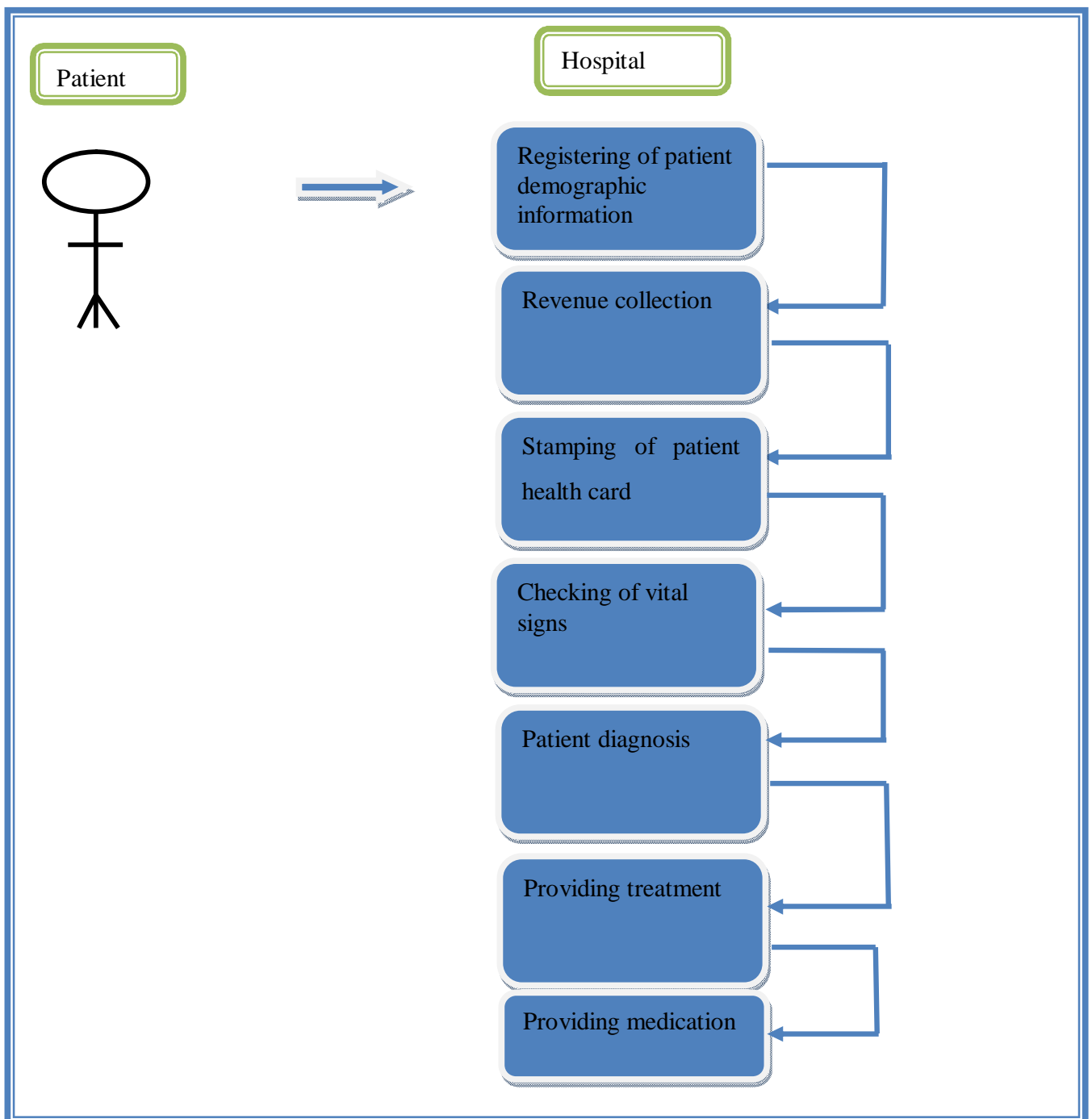


Figure 4.6 Services provided to patients at OPDs

4.4.2 Level of mobile phone penetration and usage by patients

This section presents a single-case analysis for all the cases by considering the summarized responses for the interviews and questionnaires. The questionnaires administered to patients emphasized on

determining the level of mobile phone usage of patients who visit rural hospitals in Windhoek. When asked if they owned mobile phones, for each rural hospital, all respondents indicated that they were in possession of a mobile phone. The mobile phone usage is fairly high as shown in Figure 4.7. To answer the second research question:

“What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?”

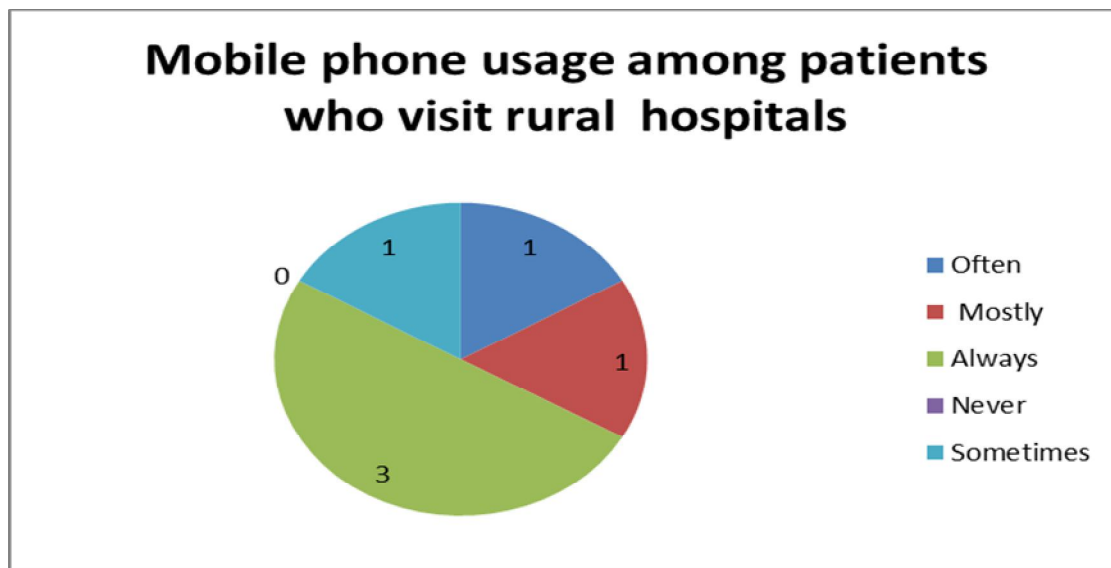


Figure 4.7: Mobile phone usage among patients who visit rural hospitals

3 out of 6 patients who visit rural hospitals use mobile phones for communication always (N=3)

1 out of 6 patients who visit rural hospitals use mobile phones for communication most of the time (N= 1)

1 out of 6 patients who visit rural hospitals used often use mobile phones for communication (N= 1)

1 out of 6 patients who visit rural hospitals use mobile phones for communication most of the time (N= 1)

None of the 6 patients who visit rural hospitals have never use mobile phones for communication

(N= 0)

4.4.2.1 Perceived ease of use (PEOU)

PEOU deals with “user motivation that is based on the assessment of the intrinsic aspect of using the information technology (IT), such as its interface and the process involved in using it” Gefen and Straub (2008). Respondents were asked to rate their competences when using SMS. Figure 4.8 presents a summary of the findings

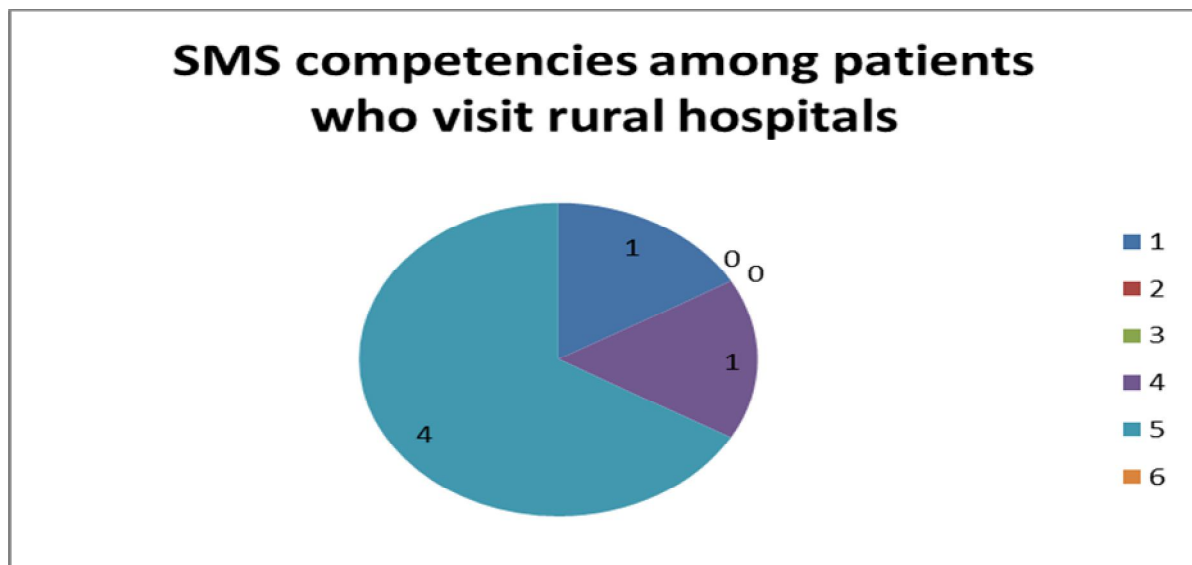


Figure 4.8: SMS competencies among patients who visit rural hospitals

Figure 4.8 shows that most of the respondents could use the SMS feature on their mobile phones. When asked if they would like to receive SMS’s from their local hospital, 5 out of the 6 participants responded positively. This shows that respondents believe that communication with them through the use of the SMS feature on their mobile phones would be relatively easy to adopt.

4.4.3 Health professionals and patients satisfaction

Mazhar (2006) explains that TAM is an information systems theory that models how users come to accept and use a technology. The two constructs used in this model which are the perceived usefulness and the perceived ease-of-use were used to interpret the research findings. During the group interview session, majority of the interviewees explained that it will improve their work processes if an m-health application was installed at their hospital. In otherwords, nurses and doctors

believe that if an m-health application was installed at their hospital there would be improved health care delivery services in the execution of their daily activities.

4.4.3.1 Perceived usefulness (PU)

Davis (1989) explains that the perceived usefulness refers to the degree to which a person believes that using the particular system will enhance his job performance, while perceived-ease-of-use refers to the degree to which a person believes that using a particular system would free him or her from effort. Gefen and Straub (2008) emphasized that the reason PU is critical in the adoption of a new technology is that IT systems are mostly developed to achieve non IT related goals and objectives. Perceived usefulness is very important in determining the perception of the system to be developed. Mobile phone usage is high among participants who live in the rural communities as shown in Figure 4.7. When analysing the perceived usefulness of the proposed m-health model, respondents were asked what they feel would be their benefit if an m-health application was installed in their hospital, in a summarised response, participants felt it will improve their work processes, which includes being able to communicate with patients and reduce the amount of time spent in OPDs. Patients believe it will improve the way information and health care delivery services are delivered to them and reduce the amount of time spent in OPDs. Based on the findings it is recommended that the SMS feature should be included in the communication process since both patients and the medical practitioners are familiar with this feature on their mobile phones.

The findings of the group interview and the questionnaires revealed that there are many processes carried out at OPDs before patients are referred to medical practitioners and there is no method for communicating with patients before and after treatment.

Moreover, findings reveal that high number of patients use the SMS feature their mobile phones. This finding means that it will be easy for patients and medical practitioners to adapt because of their familiarity with mobile technologies. It was also revealed that the health care practitioners were enthusiastic about the installation of mobile phone application in their hospitals. The health care practitioners believe that it would help them in their daily activities, communicate with patients as well as improve their work processes.

However, the findings revealed that the challenges experienced by patients in rural hospitals such as the long waiting times at OPDs and the inability to communicate with patients after treatment could

also be improved if the mobile health care service framework was implemented in these hospitals.

4.5 Compiled mobile health service framework (MHSF)

Having analysed the findings it became evident that the compilation of the MHSF was necessary to answer sub-research question 3:

“How can a compile mobile health service framework be used to improve health care service delivery to patients at OPDs?”

Therefore, the development of a mobile health service framework (MHSF) became of paramount importance. The mobile health service framework (MHSF) for the selected rural hospitals in Windhoek includes the:

- aims and objectives of the MHSF
- processes for the proposed m-health solution
- guidelines for implementing the MHSF

4.5.1 Aims and objectives of the MHSF

The aim of the MHSF is to provide an m-health solution that will improve health care delivery in rural hospitals in Windhoek. This led to specific objectives to:

- Create an integrated MHSF at rural hospitals in Windhoek.
- Directly connect patients with health care givers with the use of mobile phones.
- Incorporate the existing IHCIMS to the MHSF

In order to achieve the aims and objectives listed above, the development of the MHSF must be guided by the following principles:

- Interoperability of the patient mobile phones with the hospital’s IHCIMS
- Interoperability with the existing IHCIMS system

4.5.2 Processes for the proposed MHSF

The processes for the proposed MHSF is presented in Figure 4.9 below, which indicates how patients at home can send SMSs to the hospital notifying the hospital of their intention to visit the hospital as well as providing the hospital with their demographic information . The proposed MHSF is presented

in Figure 4.9 on the next page.

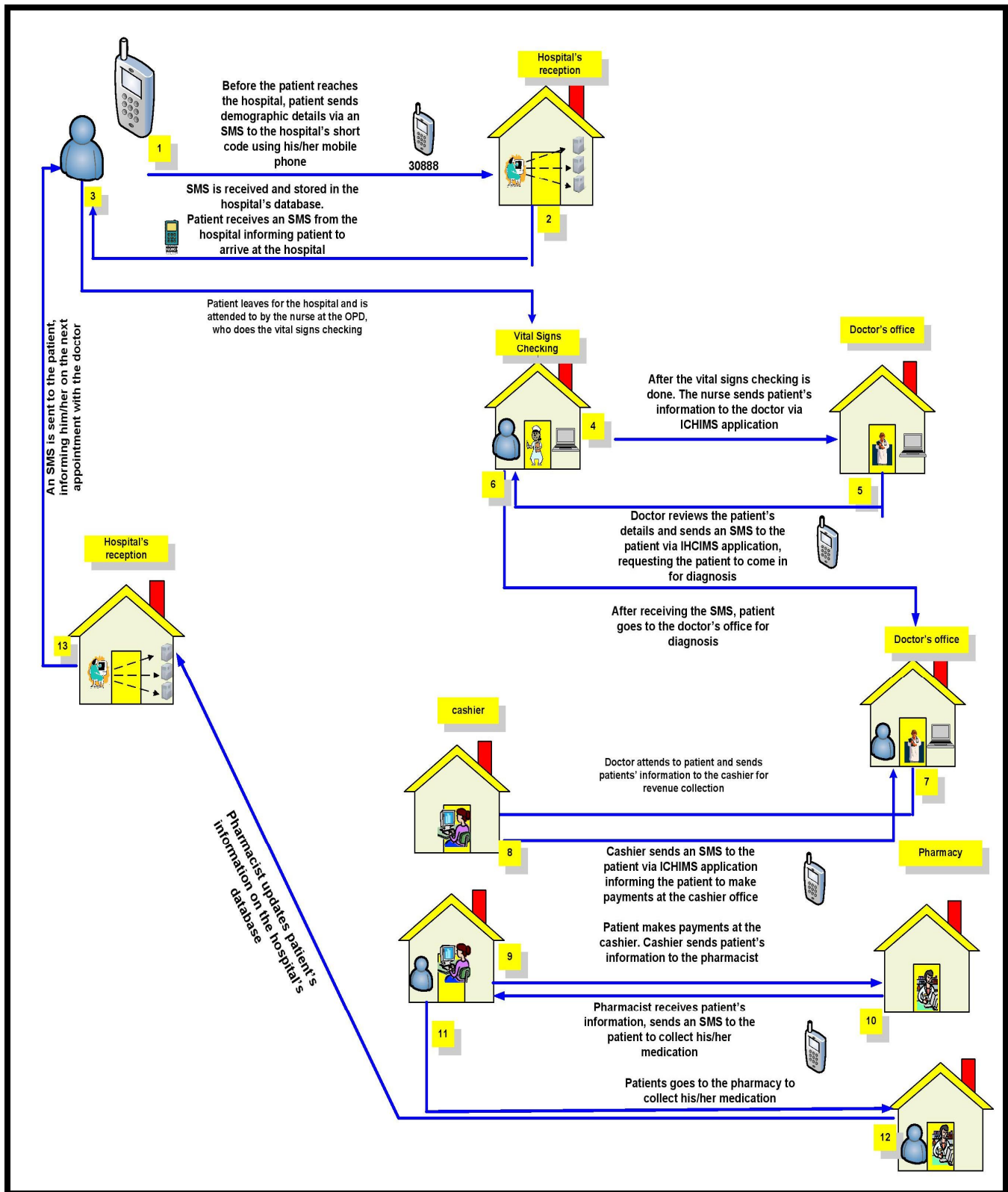


Figure 4.9 Mobile health service framework for improving health care delivery in rural communities in Windhoek

The processes entailed in this framework starts with a patient sending demographic details via an SMS to the hospital's short code with the intention to visit the hospital. The patient's details are stored on the hospital's database via the IHCIMS. An SMS is sent to the patient's mobile phone, informing the patient of receipt and expectation of his or her arrival at the hospital. On arrival at the hospital, the patient walks straight to the OPD where the nursing sister will retrieve his or her personal information and moves on to check the patient's vital signs (blood pressure, temperature, weight and initial diagnoses). Patients do not have to wait on the queue to have their demographic details written or their vital signs taken. This will in turn save the patients and hospital time.

After the vital signs checking is completed, the patient's health information is sent to the doctor in his consulting room via the IHCIMS. The doctor reviews patient's information and sends an SMS to the patient's mobile phone, informing him or her to come into the consulting room for diagnosis. The SMS is sent through the IHCIMS. The nurse is also informed about the patient's consultation with the doctor.

Doctor attends to the patient (examines the patient, diagnoses the disease, prescribes treatment and medication) and sends the patient's information to other departments (Pharmacy, Hospital Accounts Department and X ray Department) in the hospital through the IHCIMS.

Patient receives an SMS from the relevant department where he has been referred e.g. the Account Department to go for payment. On the other hand, if the patient's information is sent to the Pharmacy, the Pharmacist receives the patient's information and sends an SMS to the patient via the IHCIMS application to collect his/her medication. The patient receives the SMS and goes to the Pharmacist to collect his/her medication. The Pharmacist updates the patient's information on the hospital database. An SMS is automatically sent to the patient's mobile phone to inform the patient on the next appointment with the doctor.

4.5.3 Guidelines for implementing the MHSF

The framework can be used to improve processes at OPDs in hospitals to reduce the waiting times spent at OPDs. However, the shortage of medical practitioners and the level of computer literacy of medical practitioners are of major concern, which led to the development of an implementation guide.

The procedures for developing the implementation guide were governed by the principles from Microsoft (2011) and Coleman (2010).

Guideline 1: Organising requirements

Before implementation is carried out, health care institutions must define requirements which constitute a list of needs which include:

- User interface, user process and business component requirements
- Communication related requirements which includes the communication mechanism
- Capabilities such as availability and reliability

In order to achieve the requirements stated above the following steps must be followed:

- Clarifying and gathering needs of patients and medical practitioners from a business perspective
- Understand the required features and processes that need to be put in place
- Understand the architectural requirements based on the needs of the patients and compare with the solutions presented with the MHSF
- Document the business and technical requirements

Guideline 2: Defining the operational environment

This is to evaluate the software and hardware needed to implement the MHSF in the context of the expected business environment which includes:

- Integrating the existing systems with the MHSF to create an information sharing environment
- A stable infrastructure to ensure a manageable m-health environment

In order to achieve the requirements stated above the following steps must be addressed:

- Understand the requirements by collecting and organising national, regional and local requirements of health institutions.
- Define the initial technical architecture by determining the technical capabilities, defining the

initial architecture scope and boundaries.

- Configure the technical environment.
- Configure the technical solution by evaluating and testing the technical environment, make necessary adjustments to the technical architecture solution until satisfactory results are obtained.

Guideline 3: Align the existing healthcare applications with the new m-health application

This involves aligning the existing healthcare applications with the new m-health framework. Already existing applications were originally developed to work independently. The existing systems should allow interoperability which will enable the alignment of the new m-health application in order to share information

In order to achieve the requirements stated above the following steps must be addressed:

- Understand current and target capabilities of the application which involves assessing the existing applications to reveal what it does, how it works, future needs and the current coverage and what the missing components are.
- Understand the interoperability capabilities by assessing its capabilities of aligning with other systems
- Defining a preferred application solution by mapping it onto the new application solution and define the revised application architecture.
- Define a preferred application solution by reviewing how the application might fit into a portfolio of complementary applications. Make adjustments and reconcile the new application with the others.

Guideline 4: Developing Solution

When a request for proposal (RFP) is received, it is analysed to clarify and categorize the requirements posed by the organization. This is compared with the MHSF, aligned with the application software and the preferred operational environment to identify gaps and overlaps which can provide a vehicle for the structured response to the RFP.

In order to achieve the requirements stated above the following steps must be addressed:

- Understand the scope and boundaries in which to develop the content of requirements

- Understand key architectural features by analysing requirements and comparing them with the MHSF to arrive at architectural specifications
- Define the business and technical architectures by reconciling required business features with the MHSF and reconciling required features with the MHSF architecture
- Develop a solution by selecting the preferred applications and operational environment and prepare a response to the RFP

The value of the MHSF to the Windhoek region

The MHSF integrates mobile services with the existing e-health application whilst keeping the current ICT infrastructure. This will lead to more efficiency in the way health care service is delivered to patients as medical practitioners will be able to keep a close relationship with their patients. It has become evident that there have been long waiting queues at OPDs and as a result patients are not satisfied with the way health care services are delivered to them. The use of mobile phones as a method of sending patients' demographic information to the hospital's database will help in reducing long waiting times at OPDs in rural communities as patients will be examined by a medical practitioner without waiting to get their demographic details recorded in the hospital, hence reducing the amount of waiting times at OPDs.

4.5.4 Expert validation

In addition to proposing the MHSF, the opinion of experts in the field was taken into consideration. A panel of one doctor, one nurse and two IT specialists were assigned to review the framework to give their opinion on the proposed framework. The researcher presented the proposed MHSF to the panel at the Okuryangava hospital. The expert review team approved the MHSF and found it useful in improving healthcare delivery services in rural hospitals in Windhoek and they suggested the framework can also be incorporated in the urban hospitals as urban hospitals are also affected with delays in OPDs. This was seen as an expansion of the research study. The experts have already concluded that it will be taken into consideration to be added into the next financial year's budget to start the implementation of the framework.

The researcher suggests that the inclusion of urban hospitals in the framework can be done as an

expansion of the research study.

Below are some of the comments of the experts:

Respondent 1:

“This is very interesting because everyone has access to mobile phones these days”

Respondent 2:

“The processes in the framework is straight forward and it can be implemented”

Respondent 3:

“We will present this framework to our management to consider it for next year’s budget”

Respondent 4:

“The framework will decrease the time spent at OPDs and this will make our work faster”

Respondent 2:

“We need to implement this framework as soon as possible”

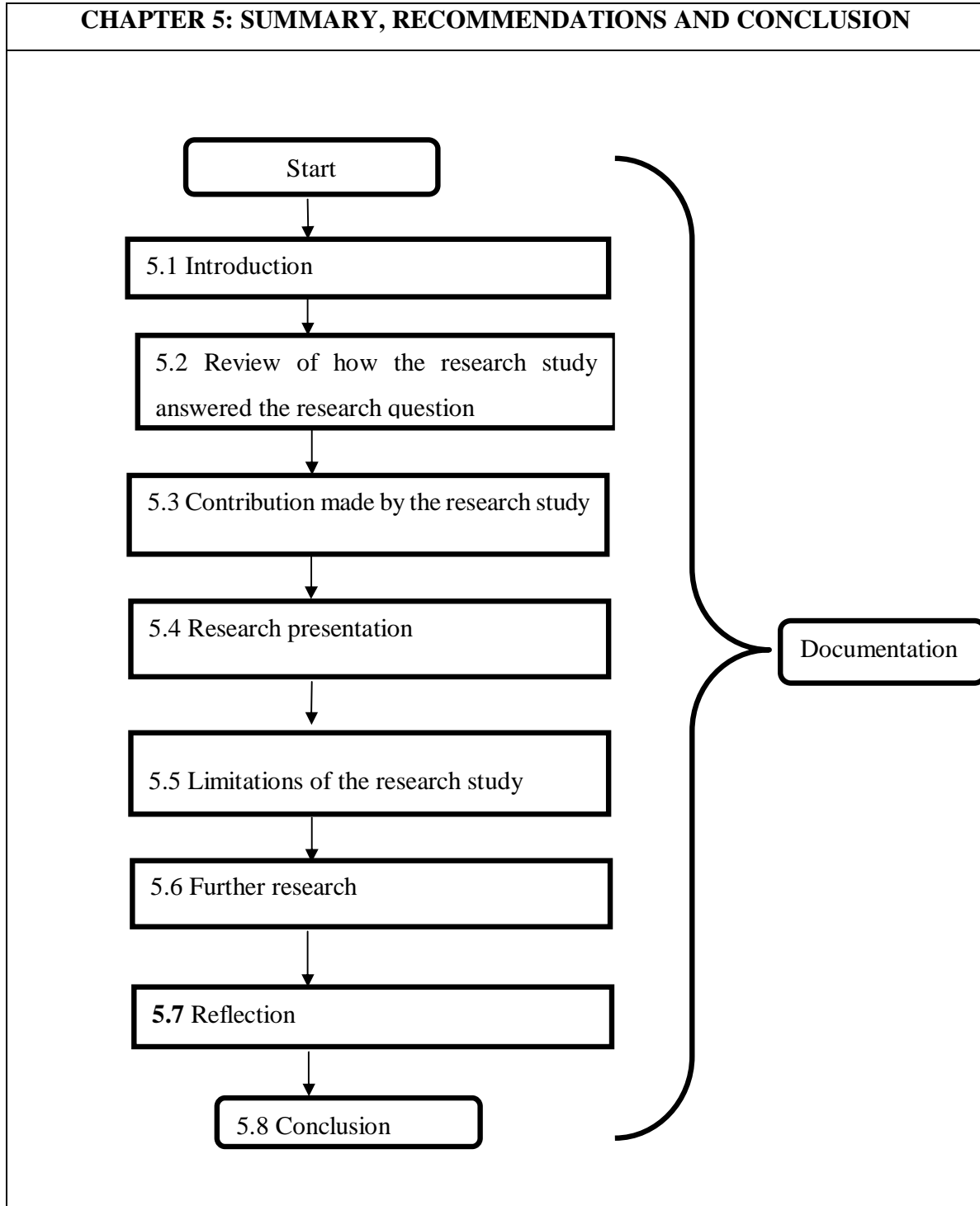
The acceptance letter from Ministry of Health and Social Services is attached as appendix F

4.6 Conclusion

This chapter answers all the research questions and sub-research questions. This chapter starts with an overview of the aims and objectives, analysing the findings for the rural hospitals revealed by the questionnaire and interview questions. This chapter also focuses on the development of the MHSF which provides a framework which can be used by health care institutions in Namibia to improve health care delivery services in rural hospitals and the guidelines for implementing the MHSF.

CHAPTER 5

CHAPTER 5: SUMMARY, RECOMMENDATIONS AND CONCLUSION



CHAPTER 5

SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The information provided in previous chapters show that the main research question and the sub-research questions have been successfully addressed (cf Chapter 1, section 1.3). This chapter reflects on the significance, contribution and summary of this research study. Table 5.1 presents the chapter(s) and sections in which the main research question and the sub-research questions were answered.

Question Number	Research Question	Addressed in:	Output in section:
Main research question	The main research question is: How can mobile phones be used to improve health care delivery services at OPDs in rural hospitals in Windhoek?	Chapter 4	4.5
Sub-research question 1	What health care services are provided to patients at OPDs in rural hospitals?	Chapter 4	4.4.1
Sub-research question 2	What is the level of mobile phone penetration and usage of patients who visit rural hospitals within the communities of Windhoek?	Chapter 4	4.4.2
Sub-research question 3	How can a compiled mobile health service framework be used to improve health care service delivery to patients at OPDs?	Chapter 4	4.5

Table 5.1 Chapters in which the research and sub-research questions were addressed

The research objectives (cf Chapter 1, section 1.3.1) were successfully answered by addressing the three sub-research questions. The first sub-research question focused on determining the health care services provided to patients at OPDs in rural hospitals. The questionnaire and group interviews revealed the health care services provided to patients at OPDs in rural hospitals. It showed that the following health care services are provided to patients at OPDs (cf Chapter 4, section 4.4.1)

1. Registering of patient demographic information
2. Revenue collection
3. Stamping of patient health card
4. Checking of vital signs (Body Temperature, Pulse Rate, Respiration Rate, Blood Pressure)
5. Patient diagnosis
6. Providing treatment
7. Providing medication

The second sub-research question made emphasis on the level of mobile phone usage among patients who visit rural hospitals in Windhoek. The outcome of the questionnaires administered to patients to determine the level of mobile phone usage of patients who visit rural hospitals in Windhoek revealed there is a high number of mobile phone usage among patients and there is also a high usage of the SMS feature on their mobile phones (cf Chapter 4, section 4.4.2).

The third sub-research question focuses on determining how a mobile health service framework can be compiled to improve health care service delivery to patients at OPDs. The third sub-research question was answered in the questionnaire administered to patients and nurses and group interview with the nurses and doctors. The outcome of the questionnaires administered to patients and nurses revealed that there is a high level of mobile phone usage and a high level of the SMS feature usage on patients' mobile phones (cf Chapter 4, section 4.4.2). As a result, a mobile health service framework was developed to provide ways of using mobile technologies to improve health care delivery services provided to patients at OPDs.

5.2 Review of how the research study answered the research question

This study was pioneered by the use of mobile phones to improve health care delivery in rural communities. This study employed the qualitative research method together with the interpretive philosophical paradigm to determine various ways in which the use of mobile phones can improve health care delivery to patients at OPDs. The researcher poses the following questions:

- **Based on the methods used for this study, were the research and sub-research questions appropriately answered?**

When trying to investigate how mobile phones can be used to improve health care delivery at OPDs in rural communities, understanding the social and human problems underlying the circumstance was also put into consideration as Davison (1998) elaborates that dealing with the interaction of people and technology is considered to be of the social sciences. The use of the interpretive philosophical paradigm as well as the qualitative method provided descriptive methods to explain how mobile phones can be used to improve health care delivery services at OPDs in rural communities as well as the social impact of the usage of m-health applications in rural hospitals.

- **Why was a case study approach appropriate for this study?**

M-health is a relatively new field and its application is fairly adaptive since it is the most available tool utilized in rural communities. As Yin (2003) clearly defines case study research method as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used”. For this reason a case study method was used in order to investigate the phenomenon of this research study within a real-life context using multiple sources as evidence.

- **Does the research data capture important findings relevant to the research study?**

The major data collection instruments were the questionnaires, group interviews, documents analysis and photographs. The purpose was to reveal the similarities as well the differences in the research findings for each data collection instrument. The data collection instruments used in this research study helped to successfully answer the sub-research questions. Sub-research question 1 was answered by the questionnaire administered to patients; it revealed vital information with regards to the level of mobile phone penetration and usage of patients who visit rural hospitals. Sub-research 2 was answered by the group interview conducted and the questionnaires answered by the nurses, it helped to reveal the health care services provided to patients at OPDs. Sub-research question 3 was answered by the group interviews conducted and the questionnaires answered by the nurses, which was used to compile a MHSF to improve health care delivery at OPDs (cf Table 4.1).

- **Does the research address problems that are of concern to patients and health care givers in Windhoek?**

The research study revealed the problems encountered by patients who visit rural hospitals in Windhoek, which includes the long waiting times at OPDs, experienced by patients who visit rural hospitals. It also shows that patients are not satisfied with way health care services are provided to them (cf chapter 1 section 1.3), which led to the development of this research study. The findings made at the end of the study helped to determine ways of improving health care delivery services to patients at OPDs and also reduce the long waiting times spent at OPDs which led to the development of the MHSF. The MHSF provided will improve the health care delivery to patients as well as the health care delivery process from the health care givers. Although, the MHSF has not been implemented, the research provides guidelines for its implementation.

5.3 Contribution made by the research study

This study has made both theoretical and practical contributions which will be explained in the next sections.

5.3.1 Theoretical contribution

On a theoretical level, during the investigation process, measuring instruments such as questionnaires and interview questions were developed. These measuring instruments can be reused when embarking on a similar research at other rural hospitals in Windhoek.

5.3.2 Practical contribution

On a practical level, the findings have made contributions to the Ministry of Health and Social Services in Namibia which oversees all public health sectors in Namibia. Based on the MHSF, an m-health application can also be developed, not only for rural hospitals, but the urban hospitals as well using the same research design and research methods. The MHSF is flexible as its design is not mapped to a specific hospital. The MHSF aids the adoption of mobile phones in m-patient record systems and ways to reduce waiting time at OPDs.

Furthermore, the MHSF was developed based on the problems encountered by patients at OPDs in rural hospitals. The MHSF caters for the interoperability with the existing ICHIMS which can be of

great benefit.

5.4 Research presentation

This chapter aims to help the reader reiterate the importance of each chapter as presented in the thesis. Chapter 1 introduces the background of the research explaining the challenges facing the health care sector in rural communities in Windhoek. The researcher further argues on the importance and relevance of the research study, hence the formulation of the research question. The relevance of the research study was based on the expectation that a mobile health service framework will be developed to improve health care delivery processes in rural communities located in Windhoek.

The essence of Chapter 2 was to present the theoretical framework applicable to the research study. Chapter 2 vividly explained the already existing theoretical frameworks used in the IS field and how these already existing theoretical frameworks can be used to the benefits of rural hospitals in Windhoek.

Chapter 3 addresses the various methodological approaches used in carrying out the research as well the philosophical assumptions underlying the research, the research design, research approach, data collection methods, data analysis and measures to ensure trustworthiness.

Chapter 4 presents the findings and interpretation of the research study. The findings and interpretations were summarised for each selected rural hospital. The outcome and findings in chapter 4 and the literature review done in Chapter 2 helped in the development of the mobile health service framework to improve health care delivery processes in rural communities in Windhoek.

Chapter 5 summarises the research study.

5.5 Limitations of the research study

There were only three rural communities in Windhoek chosen for this research. This researcher originally sought to obtain the detailed health care services delivered to patients who visit rural hospitals in Windhoek, but only three hospitals were selected. It would have been time consuming to have used all rural hospitals in Windhoek. The MHSF for this research was developed as a result of the findings made from the selected rural hospitals. However, despite the use of only three rural hospitals as a sample population, the result obtained from this research can be replicated and applied

to other rural communities in Windhoek and in Namibia as well.

Another limitation of the study is that the developed MHSF has not been tested in an operational environment to ensure its functionality and needed improvements. This is as a result of the financial constraints involved with the implementation of the MHSF. However the AT and TAM constructs were adopted in the design of the MHSF in order to ensure its validity.

5.6 Further research

The MHSF was developed as a result of the findings from the patients, nurses and doctors who participated in the data collection process. It could be that the researcher may have missed other elements that could have been used to provide more efficient ways of improving health care delivery services to patients at OPDs who visit rural communities, therefore the researcher recommends further research to be done in this area.

Furthermore, the issue of security and privacy was not discussed because it was out of scope for this study. However further research can be done in this aspect to tackle the issue of security and privacy which can be used to ensure that patients medical records remain secured.

5.7 Reflection

(Reid, 1993, p. 100) defines reflection as “the process of reviewing an experience of practice in order to describe, analyse, evaluate and to inform learning about practice”. Boyd and Fales (1983 p.100) further describes reflection as “the core difference between whether a person repeats the same experience several times becoming highly proficient at one behaviour, or learns from experience in such a way that he or she is cognitively or affectively changed”. In this section, the researcher reflects on the findings made from the research study.

In retrospect, the researcher believes that a research study can be successfully completed if the following are put in place:

- setting realistic goals and objectives
- clearly formulate research and sub-research questions.
- constant interaction with supervisor
- motivation and determination of the researcher

- applying the ethics of research to the research study

At the end of the research study, the researcher feels contented, highly motivated and filled with determination to embark on further research studies in the m-health field.

5.8 Conclusion

This chapter provided the summary and reflection of the research study by taking into consideration the issues addressed in each chapter and how it led to answering the research and sub-research questions. This chapter also focused on the contributions made by the study, research presentation, limitations of the study, revealing aspects of the research study that need further research and the reflection of the research study.

The researcher embarked on this research study to develop a MHSF that will improve health care delivery at OPDs in rural communities. The MHSF was developed as a result of the group interviews conducted and the questionnaires administered to the patients and nurses in the selected rural hospitals in Windhoek. The literature review also helped in the development of the MHSF. The result of the group interviews attended by the nurses and doctors and questionnaires filled out by the patients and nurses in the selected rural hospitals revealed the challenges experienced at OPDs in rural hospitals in Windhoek. The challenges included substantial amount of time spent in OPDs, lack of proper ICT infrastructure to assist medical personnel in carrying out their functions and shortage of medical practitioners in rural hospitals, which impacts negatively on their efficiency at providing health care services to patients who visit rural hospitals. Developing the mobile health (MHSF) based on the result of the findings was very crucial as the framework took into consideration the challenges experienced at OPDs in the selected rural hospitals. In other words, patients' physical presence at hospitals is limited to when it is absolutely necessary. Even when they have to be at the rural hospital, they do not have to spend or waste time on long queues because their vital information is easily fed into the system. Through their mobile phones, they are easily reached and there is free and flow of information between them and their health care providers.

The developed MHSF which is a major step toward providing m-health solutions in rural hospitals was developed using the constructs of AT and TAM theories. The MHSF does not need to be confined to rural hospitals in Windhoek, but its implementation can also be extended to urban

hospitals in Windhoek as well as the other hospitals in Namibia as it was stated during the expert validation phase that urban hospitals are also encountered with the problem of delays at OPDs.

In conclusion, this research study has been a new learning experience for the researcher as m-health is a relatively new field in the field of e-health. However, the research study helped to reveal new dimensions of solving challenges experienced at OPDs in rural hospitals. The whole process involved in completing this research has contributed immensely to my knowledge of m-health.

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APPENDIX A

HEALTH CARE DELIVERY NEEDS EVALUATION QUESTIONNAIRE FOR PATIENTS

CONSENT FORM

Good day, my name is Gloria E. Iyawa. I am a masters' student at the University of South Africa (UNISA). This study is about the penetration of mobile phones in rural hospitals and the health care needs of patients who visit rural hospitals in Windhoek. I was given the approval by XXX to conduct the research in XXX clinic. As a patient/employee in this clinic, would you be prepared to answer some questions about the penetration of mobile phones and the health care delivery needs of rural hospital patients in Windhoek.

- Please understand that your participation is voluntary
- Your interview questionnaire will take 5-10 minutes
- Your response remains confidential

Yes	No	Consent
-----	----	---------

1. How often do you visit this hospital per year? Please mark with X

On doctor's appointment	Whenever I fall sick	Occasionally for medical check up
-------------------------	----------------------	-----------------------------------

2. How long does it take before you see the doctor?

5 to 10 minutes	30 minutes to 1 hour	It takes many hours to see a doctor

3. Are you satisfied with the time you arrive at the hospital and the time you are examined by a doctor?

Yes	No
-----	----

4. Do you own a mobile phone?

Yes	No
-----	----

5. If the answer to question 4 is yes, how often do you use you a mobile phone? Mark X

Never	Sometimes	Often	Mostly	Always
-------	-----------	-------	--------	--------

6. How would you rate your competencies on the use of Short Message Service (SMS) feature on your mobile phone?

(On a scale of 1-5, where 1- poor and 5 – excellent) Mark X

1	2	3	4	5
---	---	---	---	---

7. Will you like to receive SMS's from your local hospital?

<i>Yes</i>	<i>No</i>
------------	-----------

8. If yes, what type of information will you prefer and in which language?

--

The End

Thank you for your time and participation

APPENDIX B
HEALTH CARE DELIVERY NEEDS EVALUATION QUESTIONNAIRE
FOR NURSES

CONSENT FORM

Good day, my name is Gloria E. Iyawa. I am a masters' student at the University of South Africa (UNISA). This study is about the penetration of mobile phones in rural hospitals and the health care needs of patients who visit rural hospitals in Windhoek. I was given the approval by XXX to conduct the research in XXX clinic. As a nurse in this clinic, would you be prepared to answer some questions about the penetration of mobile phones and the health care delivery needs of rural hospital patients in Windhoek?

- *You participation in this research project is voluntary and you may withdraw at any time if so desired*
- *Your interview will take 5-10 minutes*
- *Your response remains confidential*

1. Consent Yes No

2. State the processes involved before a patient is referred to a medical practitioner?

3. State the average time spent on these processes mentioned above?

4. Is the average time spent on these processes satisfactory? Please mark with X

Yes No

5. State the average number of patients who visit this hospital everyday

6. What benefits will you expect if a mobile health care delivery system was installed in your hospital?

7. If a mobile health care delivery system was installed at your hospital, how would it help in improving the health care delivery services in your hospital?

8. What difficulties do you think would arise from the implementation of a mobile health care delivery system in your hospital?

9. What are the current Information and communication technology(ICT) applications being used at your hospital?

10. Will you like to have access to any e- health application system outside the hospital? And Why?

11. Any comments or suggestions?

THE END

Thank you for your time and participation

APPENDIX C

INTERVIEW QUESTIONS FOR NURSES AND DOCTORS

The aim of this interview is to determine how healthcare workers deliver healthcare services in Windhoek hospitals and how the usage of mobile phones can improve healthcare delivery.

- *You participation in this research project is voluntary and you may withdraw at any time if so desired*
 - *Your interview will take 5-10 minutes*
 - *Your response remains confidential*
1. How many patients visit your hospital per year?
 2. Do they visit by appointment with the doctors?
 3. What processes are involved when patients first arrive in the hospital before they are referred to medical practitioners and how long do these processes take?
 4. How does the hospital contact a patient after the patient has visited the hospital for treatment?
 5. What e-health application do you have in your hospital which assists work processes in your hospital?
 6. If any other e-health application is to be implemented at your hospital, what will be your personal expectations in terms of solving some of the current problems in the hospital?
 7. Is there anything else you would like to suggest?

THE END

Thank you for your time and participation

APPENDIX D

UNISA ETHICAL CLEARANCE LETTER



Gloria E. Iyawa (50862979)
School of Computing
UNISA
Pretoria

2013-10-01

Permission to conduct research project

Ref: 077/GEI/2013

The request for ethical approval for your MSc in Computing research project entitled "Improving health care delivery in rural communities through the use of mobile phones: Casestudy in Windhoek" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:

http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

A handwritten signature in black ink, appearing to be "Gloria E. Iyawa".

Chair: School of Computing Ethics Sub-Committee



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APPENDIX E

APPROVAL LETTER FROM THE MINISTRY OF HEALTH AND SOCIAL SERVICES (MOHSS)

P.O BOX 26213,

Windhoek,

Namibia.

07 October, 2013.

Director: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

SUBJECT: PERMISSION TO VISIT KHOMASDAL HOSPITAL, OKURYANGAVA HOSPITAL AND KATUTURA HOSPITAL TO GATHER INFORMATION ABOUT HEALTH CARE SERVICES PROVIDED TO PATIENTS AT OPDs IN THESE HOSPITALS AS PART OF A MASTERS RESEARCH PROGRAMME.

Dear Dr. [REDACTED]

I am a student at the University of South Africa (UNISA), enrolled for a Masters Research Programme. The title of the research programme which has been approved by UNISA is:

"Improving healthcare delivery in rural communities through the use of mobile phones: Case study in Windhoek"

The reason for this letter is to request your permission to visit Khomasdal hospital, Okuryangava hospital and Katutura hospital to gather information about the health care services provided to patients at OPDs in these hospitals.

The research proposal has been evaluated by the UNISA Ethical Clearance Committee and received ethical clearance. The data will be used for research purposes only.

I attached a copy of the questionnaire, interview questions and the approved research proposal for your perusal.

I include my supervisor's and my own contact details in the event of any requests for further information.

Looking forward to hearing from you.

Yours sincerely,

Ms G.E Iyawa
Cell: 0814545413
Email: 50862979@mylife.unisa.ac.za

Student number: 50862979
Supervisor: Dr. Alfred Coleman
Tel: +27 12 429 6395

Email: colema@unisa.ac.za

Note: Name of the director who issued the approval letter was obscured in accordance to confidentiality agreement

**APPROVAL LETTER FROM THE MINISTRY OF HEALTH AND SOCIAL SERVICES
(MoHSS)**

PERMISSION TO VISIT HOSPITALS IN WINDHOEK TO GATHER TO GATHER INFORMATION ABOUT HEALTH CARE DELIVERY SERVICES PROVIDED TO PATIENTS AT OPDs FOR MASTERS RESEARCH PROGRAMME

← REPLY ←← REPLY ALL → FORWARD ...



[Redacted Name]

mark as read

To: IYAWA G E;

10th October, 2013,

Ms.G.E Iyawa,
P. O Box 26213,
Windhoek,
Namibia.

Ms. Iyawa

Your request for permission to visit Katutura hospital, Khomasdal hospital and Okuryangava hospital for your masters research has been approved.

You may proceed with the interview and questionnaire distribution.

Regards,

Dr. [Redacted Signature]

Note: Name of the director who issued the approval letter was obscured in accordance to confidentiality agreement

APPENDIX F
EXPERT VALIDATION APPROVAL LETTER FROM THE MINISTRY OF HEALTH
AND SOCIAL SERVICES
(MOHSS)

← REPLY ← REPLY ALL → FORWARD ...



[REDACTED]
Fri 23/05/2014 02:46

mark as unread

To: IYAWA G E;

22nd May, 2014

Ms. G.E Iyawa,
P.O Box, 26213,
Windhoek,
Namibia.

Ms. Iyawa,

The proposed Mobile Health Service Framework (MHSF) is appropriate for reducing waiting times at OPDs in rural hospitals in Windhoek. The use of mobile phones to send demographic details to the hospital's database via SMS is very relevant to these hospitals.

If the framework is implemented, it will also improve the work processes for both administrative and medical staff stationed in these rural hospitals.

It was also suggested that the MHSF will also be appropriate for urban hospitals.

Thanks and Regards,

Mr. [REDACTED]

Director: [REDACTED] Ministry of Health

Note: Name of the director who issued the expert validation letter was obscured in accordance to confidentiality agreement