

# Improving Health Care Delivery in Rural Communities through the Use of Mobile Phones: A Case Study in Windhoek

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## Abstract

Poor healthcare delivery in rural health centres is a major problem facing the health sector in Namibia. This paper investigated how mobile phones can be used to improve healthcare delivery services in Windhoek rural health centres. Data was collected using structured interviews. A qualitative design was used together with a case study approach. Three health centres, purposefully selected from Windhoek rural communities (Katutura, Khomasdal and Okuryangava) were used as case studies. Activity Theory (AT) and Technology Acceptance Model (TAM) were used to analyse the findings. The findings revealed that mobile phones are widely accepted by doctors, nurses and patients of Windhoek rural health centres; hence can be used to improve slow work processes and healthcare delivery services provided to patients at Out Patient Departments (OPDs) in Windhoek rural health centres. A mobile health service framework (MHSF) was proposed based on the work processes and healthcare delivery needs of patients who visit Windhoek rural health centres. The MHSF was further presented for expert reviews which consisted of a panel of one doctor, one nurse and two IT specialists. The expert review panel approved the MHSF and found it useful in improving healthcare delivery services in Windhoek rural health centres.

**Keywords:** Mobile-health (M-health), mobile phones, healthcare delivery, Information and Communication Technology (ICT), Out-Patient Departments (OPDs), rural health

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centres, activity theory (AT), technology acceptance model (TAM).

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## 1 Introduction

In the last few decades, information technology (IT) has played a significant role in making access to information and communication easier (West 2012). The healthcare sector is no exception to this innovation as Party et al. (2010) emphasise that there have been improvements provided by information and communication technologies (ICTs) in the healthcare sector in the last few years. The expectation of patients is to have healthcare services provided satisfactorily. Therefore, providing healthcare delivery services in an efficient and effective manner is important. Efficient and effective healthcare delivery services will not only improve the confidence of the healthcare sector, but will also improve the healthcare of patients. Majerowicz and Tracy (2010) further explained that the emergence of ICT in healthcare can help improve the way healthcare is administered to patients. Bali and Singh (2007) suggests that the use of mobile phones can help improve healthcare delivery services, especially in rural communities.

Extensive academic research has explored the provision of healthcare delivery services through the use of mobile phones in rural communities (Bali and Singh 2007; Lee et al. 2011; Chib et al. 2012; Thomas 2012; Agrawal 2012; Ni et al. 2014). Based on the literature review conducted, it is evident that there is little research which explores the provision of healthcare delivery services through using mobile phones in the rural context of Namibian hospitals (Southern Africa innovation Support 2013). Therefore, the rationale behind this study is the use of mobile phones to improve healthcare delivery services in Windhoek rural health centres, where healthcare services can be efficiently provided to patients in rural health centres, and work processes of nurses and doctors can be significantly improved. The challenges experienced in Windhoek rural health centres include lack of adequate ICT infrastructures which hampers proper healthcare delivery services in these rural health centres. As a result, doctors and nurses are unable to provide efficient and effective healthcare delivery services to patients who visit these health centres. Doctors and nurses also find it difficult to provide healthcare delivery services within a reasonable timeframe.

The main purpose of this study was to investigate how mobile phones can be used to improve healthcare delivery services in rural health centres. Based on the findings, provide a mobile health service framework (MHSF) to improve healthcare delivery services at OPDs in rural health centres.

This paper is structured as follows: First, it reviews existing literature relevant to the study and presents the theoretical framework guiding the study. Then the research methodology is presented. Next, the findings are presented and discussed. The MHSF is introduced and expert opinions are discussed. The paper concludes with a discussion on the importance of the framework and areas for future research.

## 2 Literature Review

### 2.1 M-Health

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).

In addition, mobile phones are very important tools for communication and have aided development in developing countries where they do not have access to telephone line networks (James and Veerstag 2007). Novak (2012) elaborates on why mobile phones can be used to improve healthcare delivery services in rural communities. Novak (2012) further explains that mobile technology provides 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; hence, mobile phones can be used as tools for patients who visit hospitals located in rural communities to access healthcare facilities.

Weiyi et al. (2014) developed a virtual patient record (VPR) mobile application. The application was used as an educational tool for pharmaceutical students to understand how electronic health records (EHRs) and patient health information (PHI) work in a clinical setting. Although the VPR mobile application immensely contributes to the body of knowledge in which mobile phone applications are used as educational tools, it has a major shortcoming which does not address a wide range of issues which emphasise the need to improve healthcare delivery services in rural hospitals with the use of mobile phones. However, this is addressed in this study as it aims to improve healthcare delivery services with the use of mobile phones.

Another major contribution to m-health is the iMHere application developed by Parmanto et al. (2013). This application is used to monitor patients with Spina Bifida, enabling medical practitioners provide a specific treatment plan for patients through the use of a smartphone application. Although smartphones have become popular, not everyone can afford smartphones especially those from rural communities. However, mobile phones provide basic short message service (SMS) which can be used as a method of providing healthcare

delivery services (Free et al. 2013). This study aims to incorporate the SMS feature as a method of communication between patients and medical practitioners in Windhoek rural health centres.

Recent studies reveal that mobile phones have been widely used to support healthcare delivery (Coleman, 2014; Odigie et al. 2012; Luo et al. 2009). Coleman (2014) proposed the mobile phone adherence monitoring framework (MPAMF), which sends text messages to elderly patients in South African retirement homes to take their medications. Another study conducted in Nigeria suggests that mobile phone intervention improved follow up responses among cancer patients (Odigie et al. 2012). Luo et al. (2009) reported an increase in the use of the SMS feature among Malays and Indian ethnical group; hence, can be used for healthcare service delivery. Although these studies have been conducted in South Africa, Nigeria and Singapore, to the best of the researchers' knowledge, there has been no such study which explores the use of mobile phones to improve healthcare delivery in Namibian hospitals.

## **2.2 M-health in Namibia**

Stiftung (2012) explains that in Namibia, 15% of the public depend on medical aid for medical services, while the remaining 85% of the public depend on the government to provide healthcare delivery services. The high population which relies on the government for medical services creates a bottleneck which compels the government to provide healthcare delivery services in an efficient and effective manner. Southern Africa Innovation Support (2014) reveals that there is currently no mobile application used in the Namibian healthcare sector, although the penetration of mobile phones in Namibia seems to be high. This suggests that there is a gap in the use of mobile phones to improve healthcare delivery services in the Namibian context. This study, therefore serves as one of the few studies which attempts to explore mobile phones as a tool to improve healthcare delivery services in Windhoek rural health centres. There is a need to explore the use of mobile phones as a means of improving healthcare delivery services in Windhoek rural health centres to reduce the impact caused as a result of the high population which depends on the government for healthcare services.

## **2.3 Why mobile phones over internet technologies?**

A study conducted by Majerowicz and Tracy (2010) shows that the emergence of ICT in healthcare can help improve healthcare administered to patients. Hence, the need to access the internet has become increasingly important. However, rural communities still lack the appropriate and adequate infrastructure to provide internet services in healthcare (Haynes

2010). Since mobile phones have a huge potential of providing healthcare delivery services, there is therefore the need to adopt mobile phones in the provision of healthcare services.

According to Royal Tropical Institute (2012), while internet technologies are not fully accessible in rural communities, the mobile phone is the first ICT tool that has been widely adopted in such 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). Therefore, the increase in the number of mobile networks can be used to facilitate new changes to improve healthcare delivery services in rural communities (Royal Tropical Institute 2012).

## 2.4 Theoretical Framework

Hyland (1998) emphasises that Activity Theory (AT) focuses on using human activities in investigating research findings in which these findings are divided into "subjects, tools and objects" where "subjects" refers to the participants involved in the research. "Objects" refer to the activities carried out by the participants and "tools" refer to the mediating device by which the action is executed. Engeström (2001) expanded the original version of AT which includes "rules" which "determine how and why individuals may act and are as a result of conditioning". The revised model of the 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; Verenikina 2001). AT is relevant to this study as it focuses on the interaction among the participants (doctors, nurses and patients), the activities performed by these participants (receiving and delivering healthcare services) and the use of patient health cards as mediating tools between doctors, nurses and patients. Furthermore, Free et al. (2014); Kannisto et al. (2014) propose the use of mobile phones as mediating tools to improve healthcare delivery services.

Technology Acceptance Model (TAM) was proposed by Davis in 1989 (Davis 1989). TAM has become a widely used theory in the information systems (IS) field (Chenet al. 2011). Davis (1989) emphasises that TAM is based on two constructs, perceived ease of use and perceived usefulness. Perceived ease of use refers to the level to which a system user believes in the simplicity of the intended system (Davis 1989). Perceived usefulness on the other hand, refers to the level to which the system user believes that the actual system can be used to improve work productivity (Davis 1989). TAM has been criticised by researchers for its non-conformance to the perceived usefulness of a system determining the ease of that system (Turner et al. 2010). This has been proven otherwise as Chismar and Willy-Patton (2003) explained that users of health information systems (HISs) will learn how to use a system once they believe that it is useful even when it is difficult to use. Cilliers

and Flowerday (2014) indicated that researchers have mostly used TAM to analyse the acceptance of HISs and this is one of the reasons TAM was adopted for this study despite its short comings. TAM is relevant to this study as it investigates the acceptance of mobile phones among doctors, nurses and patients in delivering and receiving healthcare services.

### 3 Research Methodology

This study was conducted in three health centres located in Windhoek rural communities (Katutura, Khomasdal and Okuryangava). These health centres were purposefully selected based on their geographical location which is "rural". The participants consisted of two doctors, two nurses and two patients from each rural health centre. The participants were purposefully selected to include only those who were involved in delivering and receiving healthcare delivery services in Windhoek rural health centres. Another reason for selecting the participants was because they willingly accepted to participate in the study. Bromley (1990: 302) describes a 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". Since the study focuses on investigating healthcare needs of patients who visit rural health centres in Windhoek, the qualitative, case study approach was used. The case study approach was appropriate for this study because the limited number of cases had to be analysed intensively. The case study approach was used to ensure that the objectives of the study were met.

Data was collected using structured interviews. Interviews were conducted at the selected hospitals located in rural communities in Windhoek. The interviews were done separately for each selected rural hospital. Two doctors, two nurses and two patients were present at each rural health centre. Participants were asked to explain in their own words, the processes through which healthcare delivery services are provided to patients in Windhoek rural health centres, the healthcare delivery needs of patients who visit rural health centres and the acceptance of mobile phones among doctors, nurses and patients of Windhoek rural health centres. The interview questions were validated by another researcher before they were used for interviews. The interviews were recorded and transcribed. The data collection process was done between May 2013 and August 2013.

Formal permission was obtained from the management of selected rural health centres before any information was gathered from any of the health centres. Participants were asked to sign an informed consent form before they were interviewed.

Klein and Richey (2007) explained that reviews are used to verify the findings of a proposed solution. For this reason, an expert panel of one doctor, one nurse and two IT specialists were consulted to provide their expert opinions on the proposed MHSF. The experts provided

reviews from both the technical and work processes related to the MHSF.

## 4 Results and Discussion

The findings were analysed using a single case analysis. This study was guided by two theoretical frameworks, namely, AT and TAM, which were used to analyse the findings. The healthcare delivery needs experienced in Windhoek rural hospitals were analysed using constructs from AT: the subjects (doctors, nurses and patients in Windhoek rural health centres), the objects (activities and processes involved in providing and receiving healthcare delivery services), the tools (the use of patient health cards as mediating tools between doctors, nurses and patients), rules (the queueing process, payment process, vital signs checking, diagnosis and drug prescriptions), community (doctors, nurses and patients in Windhoek rural health centres), division of labour (nurses involved in the vital signs checking, doctors involved in diagnosis and drug prescription and patients receive healthcare delivery services). The acceptance of mobile phones in Windhoek rural health centres was analysed using some of the constructs of TAM (perceived usefulness and perceived ease of use). Therefore, the results of the findings are categorised into the following headings:

- Provision of healthcare delivery services to patients in Windhoek rural health centres
- Healthcare delivery needs of patients who visit Windhoek rural health centres.
- Acceptance of mobile technologies in Windhoek rural health centres, which was further categorised into the following sub-sections:
  - Perceived usefulness
  - Perceived ease of use

### 4.1 Provision of healthcare delivery services to patients in Windhoek rural health centres

The findings indicated that an average of fifty to eighty patients visit rural health centres on a daily basis during summer and an average of one hundred to one hundred and fifty patients visit the rural health centres on a daily basis during winter. There is usually one medical doctor assigned to a rural health centre in a day. There is an increase in the number of patients who visit the rural health centre during winter. Services at OPDs usually start with a queue and patients have to wait on the queue before the security guard offers them a

card. Patients' demographic details are registered on the Integrated Health Care Information Management System (IHCIMS) and their health cards are stamped after they pay a sum of four Namibian dollars (N\$4) before being referred to a nurse who does the vital signs checking (blood pressure test, sugar test, cholesterol and urine test) of the patients. Patients' health details are recorded on the patients' health card. After the vital signs checking process has been completed, patients are referred to a doctor with the patients' health card to carry out further investigations. The results of the investigations are recorded on the patients' health card, after which they are referred to the pharmacist who administers drugs to the patients based on the prescription written on the patient's health card. Patients indicated that there was no method through which they were contacted outside the hospital.

One doctor is usually assigned to attend to a high number of patients; this increases during the winter period. One nurse stated: "There is a high amount of workload for medical doctors because only one doctor is usually assigned to this health centre in a day, which amounts to a high number of patients waiting at OPDs". This means there is a huge workload for doctors, which slows down the healthcare delivery process. As a result of the few number of doctors available, patients have to wait on a long queue before they are attended to. This is confirmed in a study conducted by Abdullah (2005) which explains that a low number of medical staff available can increase waiting times at OPDs. The security guard ensures that there is order in the queuing process. Patient demographic details are recorded and stored on the IHCIMS. However, clinical details related to patients' health are recorded manually when nurses perform the vital signs checking (blood pressure test, sugar test, cholesterol and urine test) of the patients. One nurse stated that: "We usually record patient health information such as blood pressure and sugar test on their health card which is also given to the doctor..." Doctors also record patient health details on the patient health card. A doctor also stated that: "After diagnosis, we record the result of our findings on the patient's health card..."

Manually recording PHI on patients' health cards is not an efficient way of storing PHI as it could be very difficult to gain access to this information from another location, which is supported by Bakker's (2007) findings. Another disadvantage of manually recording PHI on patients' health cards is that patients could lose their health cards or vital health information can be viewed by an unauthorised third person. Pharmacists administer drugs to patients based on the doctors' handwritten prescription. Studies have validated the risks involved when patients are given handwritten drug prescriptions which include "handwriting illegibility, missing dose specification and drugs administered to the wrong patient" (Hartel et al. 2011). An m-health application will save time in recording patients' demographic details, thereby reducing time spent in OPDs and reduce errors that could occur when administering handwritten drug prescriptions. Furthermore, there is no formal process in which patients are contacted by the health centre management outside these health centres. This is detrimental to efficiency of healthcare delivery as Hubbard and McNeil (2012) confirms that follow-up can help reduce hospital readmissions. One doctor indicated that if a mobile



application can be installed in these rural health centres, it will not only help improve communication with patients outside the health centre, but it will also improve the provision of healthcare delivery services to patients, and work processes of medical practitioners.

## **4.2 Healthcare delivery needs of patients who visit rural health centres in Windhoek**

Patients revealed that they 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 health centres before being examined by a medical practitioner is rigorous. First, they have to wait on a queue for at least two hours to get their health card stamped for approval in order to begin the healthcare 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 doctor and a pharmacist and these processes could take another three hours to complete.

Patients indicated that too much time is spent at OPDs to have their vital signs (blood pressure, temperature and sugar level) checked and recorded before they are examined by a medical doctor. 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 healthcare services at OPDs. Patients indicated that they only decide to visit the health centre when they are critically sick. Patients are unsatisfied with the current processes of healthcare delivery services in OPDs. Patients want healthcare delivery services at OPDs within a reasonable timeframe. They do not want to wait on queues for too long before they are referred to a medical doctor.

The number of hours spent at rural hospital OPDs is unsatisfactory to patients as it takes an average of seven hours of a day to see a medical practitioner. The time between which patients arrive at the health centres and the time they are attended to by medical practitioners is tedious as they have to wait on long queues. This is attributed to the availability of few doctors in rural health centres. Patients avoid going to the health centre and only do so when they are critically sick. One patient stated: "The long queue is discouraging as I have to stand there for several hours to see a doctor, I'd prefer not to see a doctor simply because of a chest pain but will do so when it is very critical". This is detrimental to the health of patients as ailments do not have to escalate before consulting a doctor. The current healthcare delivery need of patients is to receive healthcare services at OPDs within a reasonable timeframe. This means they do not want to spend much time at OPDs before they are seen by a medical practitioner. Husmark (2015) suggests that mobile phone applications which allow customers make appointments online are effective ways of

improving waiting times.

In the case of Windhoek rural health centres, doctors, nurses and patients are the subjects in the AT as they are involved in carrying out work activities. The objects in the study refer to the activities which are carried out by the subjects (doctors, nurses and patients). Doctors and nurses are directly involved in the provision of healthcare delivery services. Nurses perform the vital signs checking which is recorded on the patients' health card. The nurses also carry out another activity by referring the patient to medical doctors. The doctors perform the activity of diagnosing the ailment and writing drug prescriptions on the patients' health card. Patients are involved in receiving healthcare delivery services as they have to wait on queues, get their health cards stamped, go for vital signs checking, are referred to the doctors and later referred to the pharmacists. The tool used in carrying out these work activities is the patient health card used in recording these activities. The health card which is used to record PHI is the "mediating device" between patients, nurses and doctors; its role is inadequate and so there are queues and unsatisfactory services provided to the patients. The rules guiding these activities include the security guard offering the patients a card to ensure that there is order in the queuing process, registering of patients' details on the IHCIMS and the payment of the sum of 4 Namibian dollars (N\$4). Next, is the checking of vital signs by the nurses before referral to the doctor. Once this is completed, the doctor diagnoses the patient and prescribes drugs. The community which take part in these activities include the doctors, nurses and patients. They form a community in which these activities take place. In a nutshell, within these activities, work is divided among the nurses, doctors and patients. The nurses are responsible for checking vital signs; the doctors are responsible for diagnosing the patients and prescribing drugs, while the patients receive these healthcare delivery services. The use of mobile phones as a mediating device between the patient, nurses and doctors can however produce a totally different outcome.

### **4.3 Acceptance of mobile phones in Windhoek rural health centres**

All the participants who took part in the study indicated that they owned a mobile phone and that they frequently used their mobile phones. All the participants also indicated that they were able to use the SMS feature on their mobile phones. Patients who took part in this study indicated that they would like to receive SMSs regarding health information from their rural health centres. Mobile phone is a device that is widely used by the participants as one of the participants stated: "We all own mobile phones, even if it's the basic one used for communication purposes. It's actually very difficult to find an adult without a mobile phone or find someone who has never used a mobile phone before". This is also validated by the study conducted by Skaria (2013: 26) which explains that mobile phones are "widely used device irrespective of economic or social status of people". The SMS feature is widely used

by the participants, and this is validated in a study conducted by Coleman (2014) which indicates that text messaging is an effective way of communicating with elderly patients in South African retirement homes. As a result of patients' ability to use the SMS feature on their mobile phones; they indicated that they would like to receive SMSs regarding health related issues from their rural health centres.

#### **4.3.1 Perceived usefulness**

Doctors and nurses were asked if it would improve healthcare delivery services if a mobile healthcare delivery system is introduced. Doctors and nurses who participated in the study revealed that a mobile healthcare delivery system will improve healthcare delivery services as they will be able to send health information to patients, keep in touch with them as well as provide healthcare services virtually without the physical presence of the patients.

Nurses and doctors who participated in the study believed that the use of mobile phones will significantly improve their work processes, and as a result improve healthcare delivery services in Windhoek rural health centres. One of the doctors stated that: "...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". Another doctor also indicated that: "Queues are a major problem in our hospitals, when I walk into the hospital, there is a massive number of patients waiting at the OPDs to be attended to. I believe the mobile healthcare delivery system can help improve our work processes, as a result, substantial time wasted at OPDs will be reduced". Furthermore, a doctor also stated that: "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 m-health application that will enable us keep in touch with our patients". This is consistent with Davis' (1989: 320) study which states that "perceived usefulness refers to the degree to which a person believes that using a particular system would enhance his or her job performance". Doctors and nurses believe that using a mobile healthcare delivery system in their rural health centres will improve their work processes. Doctors and nurses also believe that they will be able to communicate better with their patients regarding healthcare related issues, with the use of the SMS feature on their mobile phones.

#### **4.3.2 Perceived ease of use**

Participants were further asked to explain the anticipated difficulties that would arise from the implementation of a mobile healthcare delivery system. Participants indicated that the

use of a mobile healthcare delivery system will not be difficult especially for the patients because the mobile phone is a tool that is widely used. However, participants indicated that training would also improve their quick adoption of the system. All the participants believed that the mobile phone device will be very easy to use as doctors, nurses and patients are already familiar with the device. This is in line with the findings of Chib et al. (2009) which indicates that mobile phones "self-efficacy" and "value perception" encouraged the adoption of mobile phones among healthcare practitioners. Furthermore, participants revealed that although mobile phone is a commonly used device, training will still be necessary which means perceived ease of use has no effect on the acceptance of a technology. This is confirmed by Tulu et al. (2005) and Chismar and Willy-Patton (2003) which indicates that users will adopt a new technology as long it is perceived as useful.

#### **4.4 The need for an m-health framework to improve health care delivery in rural hospitals**

Having analysed the findings, it became evident that the compilation of a Mobile Health Service Framework (MHSF) was necessary. The aim of the MHSF is to provide an m-health solution that will improve healthcare delivery in Windhoek rural health centres. Figure 1 illustrates the MHSF for improving healthcare delivery in rural health centres in Windhoek.

The processes entailed in this framework start with a patient sending his/her demographic details via an SMS to the hospital's short code with the intention to visit the health centre. 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 health centre. On arrival at the health centre, the patient walks straight to the OPD where the nursing sister retrieves 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 long queues to have their demographic details written or their vital signs taken. This will in turn save the patient 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 the 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. The doctor attends to the patient (examines the patient, diagnoses the disease, prescribes treatment and medication) and sends the patient's information to other relevant departments (Pharmacy, Hospital Accounts Department and X-ray Department etc.) in the health centre through the IHCIMS.

Patient receives an SMS from the relevant department where he/she has been referred, for

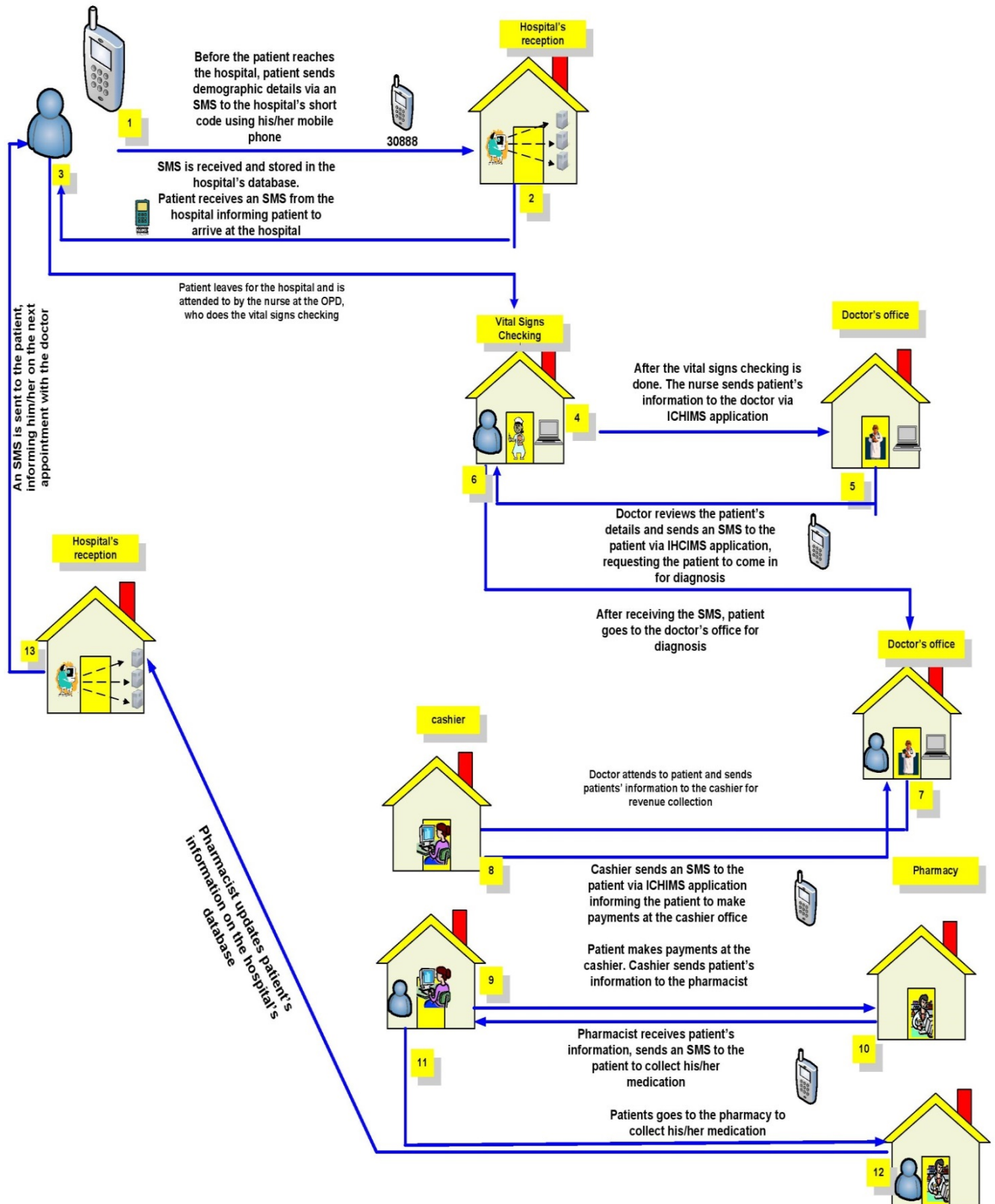


Figure 1: Mobile Health Service Framework (MHSF).

example, the Accounts department to go make 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 on the availability and collection of 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 of the next appointment with the doctor.

## 4.5 Expert Review

The panel of experts (one doctor, one nurse and two IT specialists) who participated in the expert review process approved the MHSF which they found useful in improving healthcare delivery services in Windhoek rural health centres. One IT specialist stated: "The processes in the framework is straight forward and it can be implemented". They also suggested that the MHSF can be expanded to include urban hospitals because high waiting times at OPDs are also experienced in urban hospitals.

## 5 Conclusion

The aim of this study was to develop a MHSF that will improve healthcare delivery services at OPDs in Windhoek rural communities. The MHSF was developed as a result of the interviews conducted in selected Windhoek rural health centres. The result of the group interviews attended by doctors, nurses and patients in selected rural health centres revealed the challenges experienced at OPDs in these health centres. The challenges included substantial amount of time spent in OPDs, slow work processes as a result of lack of proper ICT infrastructure to assist medical personnel in carrying out their functions and shortage of medical doctors in rural health centres, which impacts negatively on their efficiency at providing healthcare services to patients who visit these rural health centres. Developing the 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 health centres. 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 health centre, 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 flow of information between patients and their healthcare providers.

Practically, this study contributes to the use of mobile phones as a means of improving healthcare delivery services in the rural context of Namibian hospitals. Theoretically, this

study contributes to a meagre body of knowledge which studies the use of mobile phone in the provision of healthcare delivery services in a Namibian hospital context.

As a result of financial constraints, the framework could not be implemented; however, expert reviews validated the framework. An area which the researcher did not address is the issue of security. Further research can be done in this area to determine how PHI can be protected. The small sample size may have had an impact on the result. Hence, for future research, it is advisable to include a larger population. Furthermore, the selection of only one city constitutes a major limitation in generalizing the findings. Therefore, for future research, the inclusion of different Namibian cities would be helpful.

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