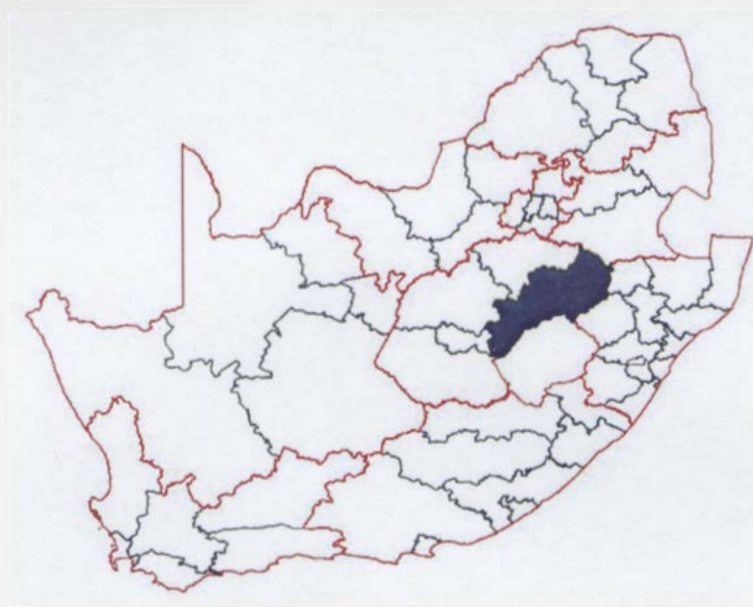


**Lessons for policy and regulation from mobile applications in public health: The Case of  
Community Health Work in Daspoort, South Africa**



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**Abstract:**

The extraordinary growth in mobile telecommunications and advances in innovative application development has evolved into a new field of e-health, which includes mobile health (m-health) among others. m-Health is a new technology that is deployed in the Tshwane City health clinic named Daspoort as one of the national health insurance pilots. m-Health has revolutionised the way primary health care is administered in Daspoort in particular and in Tshwane City in general.

The purpose of this case study is to establish lessons learned in the implementation of m-health as an alternative to bridging the health access gap. The study is meant to provide a library of lessons learnt and good practices in providing primary health services through the use of mobile technology, in this case m-health. The findings from this research suggest that m-health promotes efficiency and improves access. The results revealed that m-health poses challenges for practitioners in the absence of an e-health policy to fully cater for m-health. The implementation of m-health without a supportive legal framework is a risky exercise for both health professionals and community health-workers. Lack of clear guidelines from the National Department of Health in the implementation of m-health brings along a sense of vulnerability among health practitioners should things go unexpectedly wrong.

In summary these are some of the key lessons learned: (i) Operating outside a m-health policy and legal framework is very risky. (ii) Poor co-ordination of initiatives as a result of the lack of a collaborative policy and regulation results in silo efforts which lead to weak results. (iii) Community health workers, although they are part of the m-health project are not covered by any legal framework; something that can expose them to criminal risk. (iv) m-health policy and legal vacuum result in a poor buy in of m-health projects as managers are not accountable to take the project forward (v) Poor end of project planning as funded by donors leads to the death of m-health.

## DECLARATION

I, Khopotso Holeni (0618288H), hereby declare that this research report is my own unassisted work except as indicated in the references and acknowledgements. It is submitted in partial fulfillment of the requirements for the Degree Master of Management in ICT Policy and Regulation (MM ICT PR) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other university.



**KHOPOTSO CECILIA HOLENI**

Signed at Wits University

on this 27 day of SEPTEMBER 2013

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**Dedication:**

I wish to dedicate this research output to my parents, my husband and my two sons, for their unwavering encouragement and support, during a crucial time where I did not have the luxury of time given the triple constraints of work obligations, family life and educational commitments. I am indeed grateful to all of you.

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Special thanks goes to my husband Miyelani and our children; Vuxeni and Hlanganani, who have not enjoyed much time with me during the compilation of this thesis. I look forward to days of quality time with them. I would also like to thank my family ntate Pitso and mme MaKhopotso Molekane, Papa Nelson and Mama Florence Holeni, Hopolang Mabaso, Thato Molekane and Beauty for giving me all the support I needed at home.

I sincerely hope this work contributes and provides salient lessons for policy and regulation in deploying an efficient m-health system in South Africa.

**Acronyms:**

|          |                                                        |
|----------|--------------------------------------------------------|
| AIDS     | Acquired Immune Deficiency Syndrome                    |
| CHW      | Community Health Worker                                |
| COPC     | Community Oriented Primary Care                        |
| DHIS     | District Health Information System                     |
| DOH      | Department of Health                                   |
| DST      | Department of Science & Technology                     |
| e-health | Electronic Health                                      |
| ES       | Electronic Solution                                    |
| EHR      | Electronic Health Record                               |
| GDP      | Gross Domestic Product                                 |
| HCBC     | Home and Community-Based Care                          |
| ICT      | Information Communication Technology                   |
| LL       | Living Labs                                            |
| LBS      | Location Based System                                  |
| M&E      | Monitoring & Evaluation                                |
| m-health | Mobile Health                                          |
| MGDs     | Millennium Goals Developments                          |
| NDOH     | National Department of Health                          |
| NHI      | National Health Insurance                              |
| NPO      | Non-profit Organisation                                |
| OECD     | Organisation for Economic Co-operation and Development |
| PHC      | Primary Health Care                                    |
| SMS      | Short Messaging Service                                |
| TelL     | Tshwane e-health Living Lab                            |
| TB       | Tuberculosis                                           |
| WHO      | World Health Organisation                              |

## Glossary of terms:

| Term                         | Description                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Digital Divide</b>        | Broadly referred to as the gap between those who have access to Information Communication Technology and are using it effectively, and those who do not.                                                                                                                                                                                                                     |
| <b>Activator platform</b>    | A mechanism to promote collaboration of industry, government, universities, and research organisations to foster the culture of generating home-grown innovations.                                                                                                                                                                                                           |
| <b>e-health</b>              | <p>Use of Information and Communication Technologies (ICT) for health; to treat patients, pursue research, educate, track diseases and monitor public health.</p> <p>Information and communication technology that facilitates health and health care.</p>                                                                                                                   |
| <b>GeoMed/ Mezzanineware</b> | <p>Software Company that develops and supplies patient-centred Information Communication and Technology (ICT) medical device solution.</p> <p>Mezzanine provides Mobile Health Solutions to service providers and technology partners through the reach, scale and security of the Vodafone network.<br/>www.mezzanineware.com</p>                                           |
| <b>Health Access Gap</b>     | A vacuum that exists to attaining primary health care services.                                                                                                                                                                                                                                                                                                              |
| <b>m-health</b>              | Public health practice supported by mobile devices, such as patient monitoring devices, personal digital assistants (PDAs), and other wireless devices.                                                                                                                                                                                                                      |
| <b>Mobile Applications</b>   | Utilities and modules used to provide m-health solutions.                                                                                                                                                                                                                                                                                                                    |
| <b>Living Labs</b>           | These are neither a traditional research lab or "test-bed", They provide an "innovation platform" that brings together all stakeholders such as end-users, researchers, industrialists, policy makers, and so on, at the earlier stage of the innovation process in order to experiment breakthrough concepts and potential value for both the society (citizens) and users. |

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## **CHAPTER 1: PRIMARY HEALTH CARE TRAJECTORY IN SOUTH AFRICA**

This chapter provides an introduction and background to the South African landscape followed by Chapter 2 which is a review of the pertinent literature. The third chapter is a discussion of the research question and the methodology adopted. The fourth chapter is a presentation of the research results. This is followed by an analysis of the said results in Chapter 5. Finally, Chapter 6 presents the conclusions and puts forward some recommendations.

### **1.1 Overview of the Health Landscape in South Africa**

South Africa has 4 200 public health facilities with varying capacity, skills and resources to deal with the health burden. The number of people per clinic is estimated at thirteen thousand seven hundred and eighteen (13 718), exceeding World Health Organisation (WHO) guidelines of ten thousand (10 000) per clinic. Health care in South Africa varies from the most basic primary health care; offered free by the state, to highly specialised, hi-tech health services available in both the public and private sectors (Khumalo, n.d.)

Despite the availability of these facilities, according to (Ramokgopa, 2012), the country is besieged with a quadruple burden of disease consisting of HIV & AIDS, TB, High maternal mortality and child mortality. Non-communicable diseases, violence and injuries are also compounding this situation.

Furthermore, the Department of Labour (DoL) conducted a study to ascertain the scarcity of critical skills in the health sector. This excursion focused on determining the shortage of doctors, nurses and paramedics. The study identified that there is not only a shortage of medical doctors in the public sector but other medical practitioners as well (Mignonne, 2008).

According to the Constitution Act 108 of 1996 (schedule 4), health services in South Africa are delivered across three levels of government: national, provincial and local. Both national and provincial governments have concurrent jurisdiction over health as a service delivery area, meaning they both make decisions and have a duty to deliver services. This is supported by Chapter 10 of the Constitution under public administration. In practice, “the role of the National Department of Health (NDoH) focuses on legislation, policy, norms and standards, and ensuring

equity, while the role of the provincial departments of health is focused on the planning, budgeting and delivery of health services at the higher level. Local government is responsible for the delivery of municipal health services as stipulated in the National Health Act No. 61 of 2003 (Department of Health, 2012).

It is generally accepted that the public health sector in South Africa is under pressure to deliver services to the growing population. (Ataguba & Akazili, 2010) state “public health expenditure in South Africa accounts to at least 40% of the total budget spent” and this budget allocation has to cover almost 40 million people. The private sector, on the other hand, is run largely on commercial lines and caters for middle and high-income earners who tend to be members of medical aid (insurance) schemes. It also attracts most of the country's health professionals.

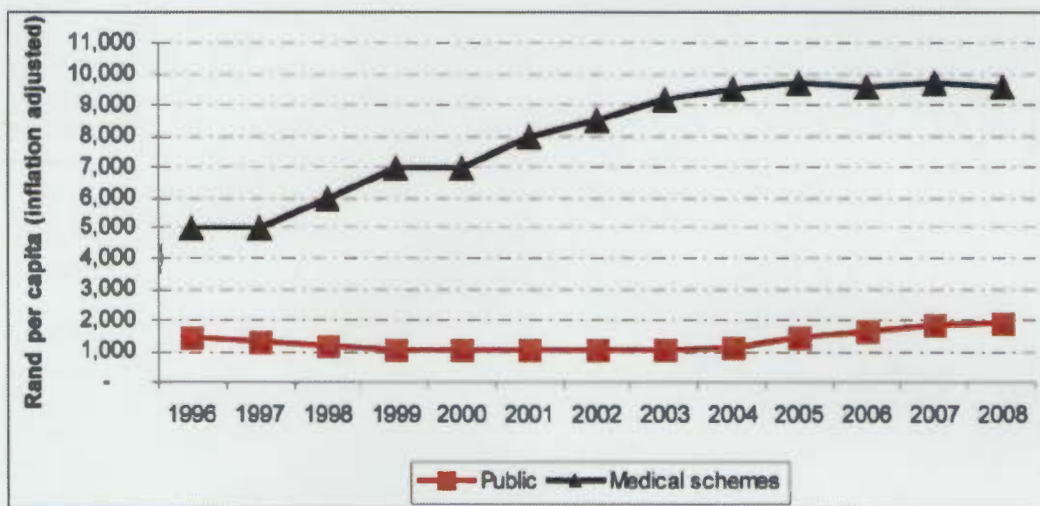


Fig. 1. Trends in real per capita spending by medical schemes and the public health sector. Source: Council for Medical Schemes Annual Reports (for medical schemes); National Treasury annual Budget Reviews (for public spending); Statistics South Africa (for CPI and population).

### Figure 1: Trends in real per capita spending by medical schemes and the public health sector

Source: Ataguba & Akazili, 2010: 14

## 1.2 National Health Insurance

The National Department of Health has introduced the National Health Insurance to address the dichotomy of problems faced by the health system. The National Health Insurance (NHI) is a financing system that is aimed at ensuring that all citizens of South Africa (and legal long-term residents) are provided with essential health care, regardless of their employment status and ability to make a direct monetary contribution to the NHI Fund (Health, 2012). The NHI acknowledges that the present health care system places a lot of focus on the curing of diseases and performance of procedures when people have developed complications. Its primary focus is on the prevention of disease and promotion of health.

Piloting of the NHI commenced in the following ten selected districts in 2012:

*KwaZulu Natal – Amajuba, Western Cape – Eden, Gauteng – Tshwane, Mpumalanga – Gert Sibande, Free State – Thabo Mofutsanyana, Limpopo – Vembe, Northern Cape – Pixley ka Seme, North West – Kenneth Kaunda, KwaZulu Natal – Umgungundlovu, Eastern Cape – Oliver Tambo.*

According to the National Health Insurance, the primary objective of these pilots is to:

- Test innovations necessary for implementing National Health Insurance.
- Establish district health authorities that will be the contracting agencies for the delivery and provision of health services within a strengthened district health system.
- Undertake health system strengthening initiatives in selected pilot districts.
- Support Tshwane pilot districts in implementing identified service delivery interventions.

(Hugo, 2013) argues that health care must be re-engineered and moved from the concept of service delivery to the concept of social innovation. It must move from institutions to the communities. The current state of the health service delivery in the country has made it necessary to dissect the needs of the community and pre-empt the possible cause and effects that arise in our communities. It has become imperative to understand the socio economic imperatives that have an impact in the health situation and it calls for a collaborative effort at

community level to ensure that the source of problems is rooted for an improved and healthy community.

The overall mission and vision shared by the City of Tshwane seem to be in congruence with the above-mentioned objectives of the NHI within its mission, the City of Tshwane (CoT) cites that its focus is to “sustainably enhance the quality of life of all people in Tshwane through a developmental system of local government and by rendering efficient, effective and affordable services. It is the vision of the city to model itself against the ethos of smart cities, where innovation is encouraged to meet societal needs” (Tshwane, 2012). To live up to the promise of a smart city Tshwane City partnered with the Smart Innovation Office at the Innovation Hub as outlined below.

### **1.3 The Living Lab**

In 2009, the Smart Innovation Office at the Innovation Hub launched the Tshwane ICT Cluster Network consisting of the Innovation Hub resident companies including some members of the INNOV8 community. “The intention was to use the ACTIVATOR platform - a mechanism to promote collaboration of industry, government, universities, and research organisations to foster the culture of generating home-grown innovations” (TshwaneSmartCity, 2009). This fostered the creation and use of the Living Labs. This in turn led to provision of ICT support for the Primary Health Care clinics in Tshwane City in particular.

What began as an internal idea at the Innovation Hub in South Africa is now broadly embraced by the University of Pretoria and the National Department of Health. The Innovation Hub in partnership with the Finland consortium introduced the concept of Smart Cities and Living Labs. The concept of Living Labs has become the ethos for the City of Tshwane and has differentiated CoT and the way the health service is delivered. The Daspoort clinic is one of the clinics where m-health is implemented and is run by the University of Pretoria (school of Family Medicine) and the City of Tshwane. Therefore this study has used the Daspoort clinic as a case study for this research. It is also one of the NHI pilots. The service providers which include Mezzanine/ Geo-med, Synaxon, non-governmental organisations (NGOs), Community Health Workers and schools joined together to implement m-health at Daspoort Clinic to bring primary health services to the communities. The Daspoort clinic embraces e-health through the use of an

electronic records system which is supported by Synaxon. (Meyer, 2013) states, access to up-to-date patient information grants one the opportunity to participate and offer better primary health care in the communities, hence electronic records are regarded as essential. The Daspoort clinic uses Community Health Workers (CHWs) who are equipped with a hand held device to capture and retrieve information during home visits. The CHW requires the consent of the patient to retrieve and to record the patient's health information. The lessons learnt on the use of mobile applications in bringing public health services on community level are discussed later on in this research report.

#### **1.4 Profile of the City Of Tshwane and Medical Facilities**

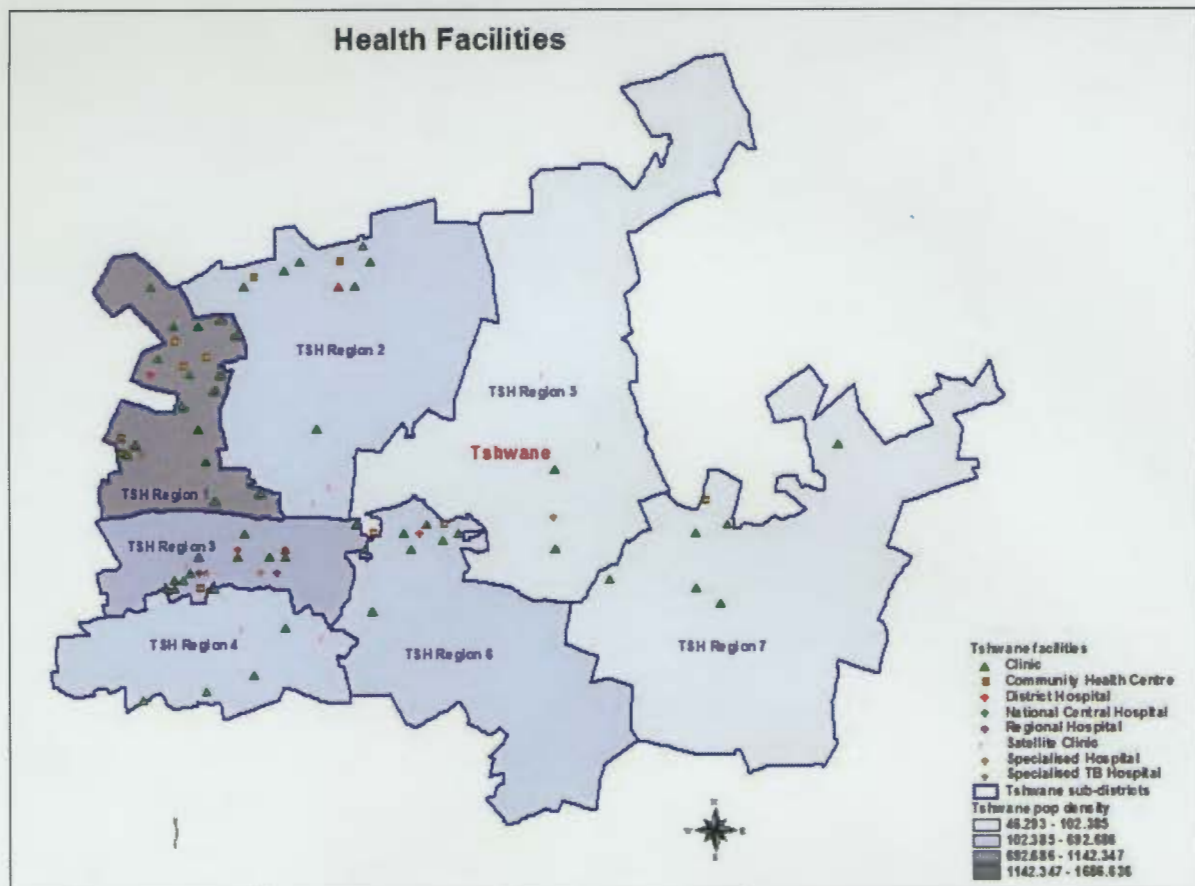
The Tshwane Health district is situated in the northern part of the Gauteng province. The District is demarcated into seven Health Sub- Districts which are aligned to the administrative demarcation of the City Of Tshwane Metro. The District has a total population of 2,708,702 people as per the 2011 mid-year census. In Tshwane, health service is delivered through 1 Regional Hospital, 5 District Hospitals, 8 Community Health Centres, 68 Clinics and 3 satellite service units<sup>1</sup>(Asia & Wolmarans, 2012).

| Sub Districts      | Service Provide | Clinic    | CHC      | District Hospital | National Central Hospital | Regional Hospital | Satellite Clinic | Specialised Hospital | Specialised Psychiatric Hospital | Grand Total |
|--------------------|-----------------|-----------|----------|-------------------|---------------------------|-------------------|------------------|----------------------|----------------------------------|-------------|
| Tshwane 1 SD       | Province        | 15        | 3        | 1                 | 1                         |                   |                  |                      |                                  | 20          |
|                    | Municipality    | 2         |          |                   |                           |                   |                  |                      |                                  | 2           |
|                    | Province Aided  | 2         |          |                   |                           |                   |                  |                      |                                  | 2           |
| Tshwane 2 SD       | Province        | 12        | 1        | 1                 |                           |                   |                  |                      |                                  | 14          |
|                    | Municipality    |           |          |                   |                           |                   | 1                |                      |                                  | 1           |
| Tshwane 3 SD       | Province        | 4         | 1        | 2                 | 1                         | 1                 |                  | 1                    | 1                                | 11          |
|                    | Municipality    | 9         |          |                   |                           |                   |                  |                      |                                  | 9           |
|                    | Province Aided  | 1         |          |                   |                           |                   |                  |                      |                                  | 1           |
| Tshwane 4 SD       | Municipality    | 4         |          |                   |                           |                   | 2                |                      |                                  | 6           |
| Tshwane 5 SD       | Province        | 3         |          |                   |                           |                   |                  | 1                    |                                  | 4           |
|                    | Municipality    | 3         |          |                   |                           |                   |                  |                      |                                  | 3           |
| Tshwane 6 SD       | Province        | 2         | 2        | 1                 |                           |                   |                  |                      |                                  | 5           |
|                    | Municipality    | 5         |          |                   |                           |                   |                  |                      |                                  | 5           |
| Tshwane 7 SD       | Province        | 3         | 1        |                   |                           |                   |                  |                      |                                  | 4           |
|                    | Municipality    | 3         |          |                   |                           |                   |                  |                      |                                  | 3           |
| <b>Grand Total</b> |                 | <b>68</b> | <b>8</b> | <b>5</b>          | <b>2</b>                  | <b>1</b>          | <b>3</b>         | <b>2</b>             | <b>1</b>                         | <b>90</b>   |

**Figure 2: Tshwane Service Delivery Platform**

Source: Asia & Wolmarans, 2012

Tshwane Health District has a mixture of public health facilities and private health service providers rendering services to health service users. The public health facilities comprise primary health care (PHC) facilities owned and managed by the Provincial Government, as well as those owned by the Tshwane Metropolitan Municipality (City of Tshwane).



**Figure 3: Tshwane Health Facility distribution.**

Source: Asia & Wolmarans, 2012

The approach adopted by government through the National Health Insurance and other initiatives, clearly suggests the country has a two-tiered health system. One health system is on par with the health systems of developed countries; whilst, the other part of the health system is characterised by mostly basic infrastructure. Within the two tiers, the public health system is further fragmented by the fact that there are two "service" providers of health care, the provincial and municipal government. The health facilities are run in isolation from each other and the patient records are managed differently by each health "service" provider.

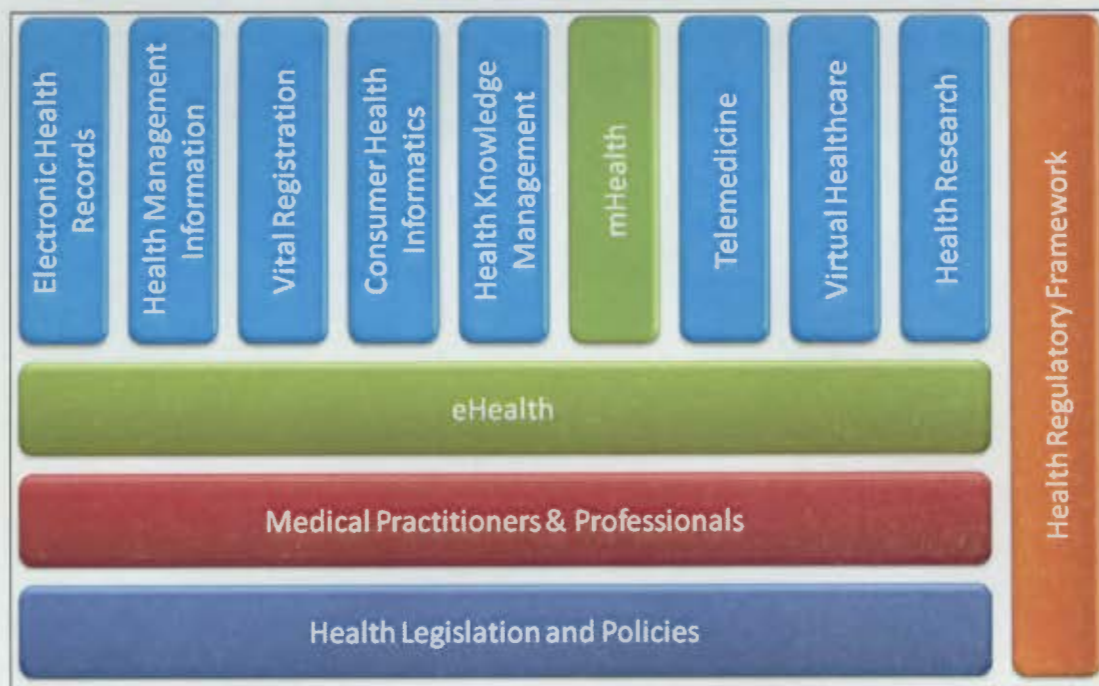
The Minister of Health, (Motsoaledi, 2012) states there is a challenge of a proper health information management system in South Africa which is characterised by fragmentation and

lack of co-ordination, prevalence of manual systems and lack of automation. Where automation existed, there was a lack of interoperability between the different systems. This challenge and others stated above have resulted in the promulgation of the South African e-health Strategy in September 2012.

## **1.5 e-health Strategy of 2012**

The e-health Strategy was influenced by the 58<sup>th</sup> World Health Assembly (WHA) of 2008 which encouraged countries to ensure that they possess and implement viable information systems that are able to inform their decision making on health (Department of Health, 2012). While access has improved, the quality of health care has deteriorated. The shortage of health care professionals and other challenges based on the lack of system interoperability assume a new-found reality, which is, electronic health.

The concept of e-health embodies a significant spectrum of technologies including "health care informatics, mobile health (m-health), e-prescriptions, electronic medical records (EMR), telemedicine, and other similar technologies often cited with an electronic or 'e' prefix" (Weeks, 2012).



**Figure 4: e-health architectural model.**

Source: Holen<sup>1</sup>, 2012 (Adapted from eHealth Strategy SA)

The above architectural model embodies crucial elements of the e-health eco system. While each one of these elements is crucial in the end to fulfill an electronic health system, their effectiveness is only realised when they are deployed together, and in adherence to the health legislation, policies and a clear regulatory framework.

Taking this forward, the National Health Insurance pilot has adopted a bottom up approach to health care services; with greater investments made at primary health care level. This study focuses on examining the e-health paradigm with special emphasis on m-health and Daspoort is the unit of analysis. mHealth is investigated in the context of assessing its capability to provide effective public health services at community level and identifying the lessons learned in the process of implementing m-health. Assessing m-health implementation can be fully understood within a context of a Socio-Health environment and related Demographics and these are explained below.

## 1.6 Socio–Health and Demographics

The South African health system experienced a number of shortcomings and accomplishments since 1994. However, this journey has not been one without any challenges. The district health system was recognised as one of the mechanisms for the implementation of primary health care with the responsibility for the day to day management of primary health facilities and community outreach (Harrison, 2009). It is argued this initiative has not been totally successful. Harrison (2009) highlights some of the shortcomings and accomplishments as presented in the table below:

| Accomplishments                         |                                                       | Shortcomings                                                                            |                                                        |
|-----------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------|
| <b>Legislation and gazetted policy</b>  |                                                       | <b>Insufficient prevention and control of epidemics</b>                                 |                                                        |
| 1                                       | Free primary health care                              | 1                                                                                       | Limited effort to curtail HIV/AIDS                     |
| 2                                       | Essential drugs programme                             | 2                                                                                       | Emergence of MDR-TB and XDR-TB                         |
| 3                                       | Choice on termination of pregnancy                    | 3                                                                                       | Lack of attention to the epidemic of alcohol abuse     |
| 4                                       | Anti-tobacco legislation                              | <b>Persistently skewed allocation of resources between public &amp; private sectors</b> |                                                        |
| 5                                       | Community service for graduating health professionals | 4                                                                                       | Inequitable spending patterns compared to health needs |
|                                         |                                                       | 5                                                                                       | Insufficient health professionals in public sector     |
| <b>Better health systems management</b> |                                                       | <b>Weaknesses in health systems management</b>                                          |                                                        |
| 6                                       | Greater parity in district expenditure                | 6                                                                                       | Poor quality of care in key programmes                 |
| 7                                       | Clinic expansion and improvement                      | 7                                                                                       | Operational inefficiencies                             |
| 8                                       | Hospital revitalisation programme                     | 8                                                                                       | Insufficient delegation of authority                   |
| 9                                       | Improved immunisation programme                       | 9                                                                                       | Persistently low health worker morale                  |
| 10                                      | Improved malaria control                              | 10                                                                                      | Insufficient leadership and innovation                 |

**Figure 5: Health System accomplishments and shortcomings.**

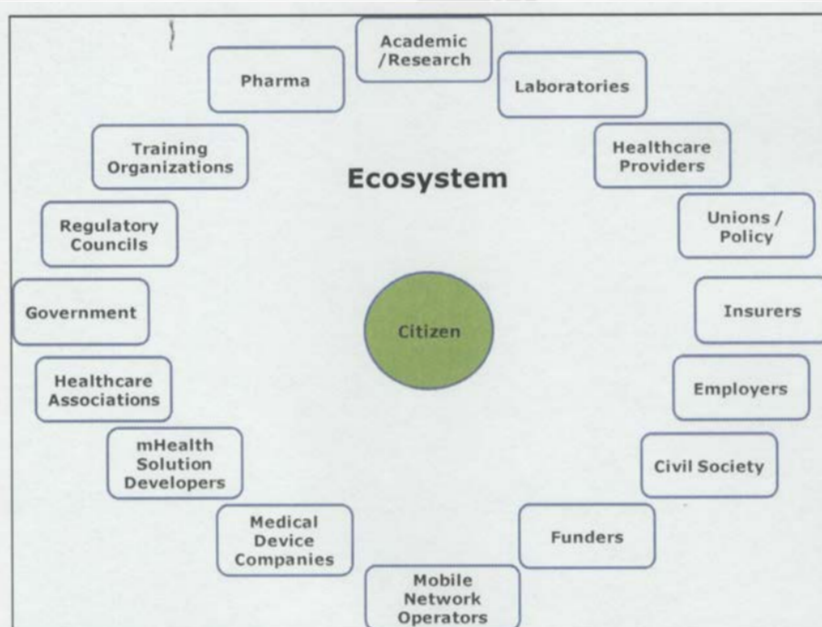
Source: Harrison, 2009

Futurists argue that the success of a strong health system in any country is dependent on a collaborative effort from different stakeholders involved in the health ecosystem. (De Vos, 2012) argues that a balanced health system requires a functional real time national health information system. This is also alluded to by the Deputy Minister of Health in her statement on the need for real time records and systems interoperability (Ramokgopa, 2012). GSMA, (2012) states the importance of working with policy makers to develop a regulatory framework that promotes mHealth adoption. There is

realisation that the widespread use of mobile connectivity in health care is proving to be an alternative method that could cut costs, increase the reach and accessibility of health care services and reduce the impact of illness on people's lives. Therefore, collaboration by all stakeholders in the ecosystem is necessary for the successful deployment of primary health care which is preventative in nature.

## 1.7 mHealth Ecosystem

Padarath & English, (2011) reinforces the need for the different stakeholders in the value chain to collaborate for the effective adoption of mHealth. They allude that the general challenge where policy decisions are systematically decentralised and operational decisions systematically centralised could be overcome if all the stakeholders in the ecosystem collaborate and address public health need at grass roots.



**Figure 6: m-health Ecosystem**

Source: Holeni, 2012 (Adapted from De Vos, 2012)

Earlier in the paper it was stated that m-health is part of e-health and in the following paragraphs e-health is being defined in order to clarify the link between m-health and e-health.

## **1.8 The WHO definition of e-health**

The World Health Organisation (WHO) defines e-health as the “use of Information and Communication Technologies (ICT) for health to treat patients, pursue research, educate, track diseases and monitor public health” (WorldHealthOrganisation, n.d.). Various initiatives and partnerships have been adopted by government, non-governmental organisations both in the private and public sectors to utilise ICTs to bring health services closer to the people. These initiatives have encountered challenges through their deployment and significant lessons arose for policy and regulators.

Lewis (2012) concurs with the e-health definition by WHO and offered further insight to include the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals. Examples cited include health information networks, electronic health records, tele-medicine services, wearable and portable systems which communicate, health portals, and many other ICT-based tools assisting disease prevention, diagnosis, treatment, health monitoring and lifestyle management. e-health is centred around ICT applications, hence more information about applications is provided below.

### ***1.8.1 e-health Application Initiatives in South Africa***

There are a number of initiatives and companies involved in developing integrated health applications in South Africa including the rest of the Africa and the world. To name a few, they include: “Rockefeller Foundation, Norad, United Nations Foundation, Vodafone foundation, Cell-life, Alere connected health limited, hi4life – HIVSA, Mobenzi, Mobile Alliance for Marternal Action, MTN foundation, Specsystems (GSMA, 2012).

The role of ICT and mobile technology has shown promise as enablers for bridging the digital divide and asserting services in areas where it could otherwise be deemed impossible as indicated earlier. The mobile applications developed by the various m-health vendors are

proving to be effective tools for supporting the health system function. Some of the applications focus on data collection, surveillance, management and evaluation. They are used as job aids for improving clinical services to diagnose, treat and follow-up on patient care, and as tools for health promotion interventions and for health worker education (Bam, 2012).

As alluded to earlier in this document, the Innovation Hub introduced the Living Labs concept where third parties or mobile application providers created a platform to come up and introduce preventative solutions that would aid in the promotion of e-health through the use mobile technology. Effective solutions are then adopted and introduced in communities to improve the socio economic living standards such as those within the Tshwane City. In the City of Tshwane health services and solution providers through the TeLL initiative can engage directly with primary health care clinics, health providers and related stakeholders. The Living Labs concept has provided an effective integrated e-health system, which helps reduce operational inefficiencies, deliver cost savings and enable health and social care providers to enhance the ways in which they deliver care (Weidermann, 2012).

As previously indicated, the focus of this paper is to identify the lessons learned in introducing mobile applications into health systems. This involves investigating the interaction between m-health application and members of the community. The aim is to bring forward a better understanding on how communities respond to m-health at the point of care. GSMA, (2012) indicates that large numbers of studies have been performed over the past two decades to assess whether mobile phones pose a potential health risk to community health or not. To date, no adverse health effects have been established as being caused by mobile phone use. Instead, mobile technology continues to gain popularity as an effective and efficient way of promoting and bringing health services to communities. The high level mobile penetration in South Africa as well as the agile nature of the applications used in disseminating information further affirms the popularity and convenience of mobile into health. Leon & Scheider, (2012) state that there is growing interest and enthusiasm for modern ICTs in both high and low income countries, as tools that can contribute to rapid improvements in the way services are delivered to citizens. Therefore, the City of Tshwane is among those institutions that have used mobile technology to render services. Because this is a novelty in the country it becomes important to identify lessons learned and to infuse these in the plans aimed at rolling out m-health in other parts of the country. The study is meant to provide such lessons.

## **1.9 Problem Statement**

Researchers have argued that developing countries tend to struggle more than the developed countries in regard to providing affordable health care of an acceptable quality; based on norms and standards defined by the World Health Organisation (WHO); and one that avoids mortality based on specified disease groupings as per the Organisation for Economic Co-operation and Development (OECD). Furthermore, poor management, underfunding and deteriorating infrastructure force governments to develop and adopt a new model of bringing health services to the communities. It is also not known to what extent this new model is working and how easily it can be replicated across South Africa with a high degree of success.

In dealing with the entire health care value chain, legislation and policies that are currently in place must be reviewed to ensure that they promote access, affordability and quality of health care related to m-health, in particular to the public health care sector. The lack of access to affordable quality health care for reasons mentioned above and others which the author has not cited shall hereafter be referred to as the health care access gap.

The emergence of new initiatives in any sector requires a flexible legislative and policy frameworks especially where there is a merging or overlap of different sectors. It is against this view that this study assesses the lessons learnt and their relevance in the process of developing legislation and new policies that effectively support an enabling environment and implementation of e-health living labs and the use of mobile applications to bring public health services to the communities.

## **1.10 Purpose Statement**

The purpose of this study is to provide a library of lessons learnt and good practices in providing health services through the use of mobile technology. The study sought to provide information and knowledge that can be used in informing e-health policy, regulations and implementation with respect to mobile applications. The specific reason and purpose is to ascertain if the laws and regulation affect the use of mobile technology in bridging the health access gap. It is to establish the affordability of the use of mobile applications as well as their intuitive and ease of use for those who employ mobile applications to conduct service delivery. It is to determine

whether the living labs concept and theory is effectively exploited to support the health policy objectives.

This chapter provided discussions pertaining to the background of the study that included a wide range of mobile connectivity in health care that could significantly reduce costs increase the reach and accessibility of health care services and reduce the impact of illness on people's lives. The m-health initiative in the City of Tshwane is a good example illustrating new ways of solving issues of access to affordable health care. While there are various e-health initiatives around the world pioneering new ways of addressing access to health services, challenges are also highlighted within the same context relating to policy and regulation. It is apparent that ICTs in health are important and play a crucial role in the future use of Mobile technology which underpins the success of the e-health strategy of the Department of Health. Of concern is the lack of understanding of the lessons learnt regarding the use and implementation of m-health within the country and what policy and regulations are available to inform this new kind of service in health. This study as indicated earlier sought to find solutions for these concerns and pertinent questions surrounding m-health.

## **1.11 Main Research question**

How do lessons learnt from the Tshwane e-Living Labs inform the policy and regulation frameworks?

### ***1.11.1 Research Sub Questions***

As indicated above, the main research question has numerous sub-questions and these are listed in the table below. The sub-questions are structured into four themes. These themes were the basis for instrumental development and data analysis.

- How does the TeLL enable innovation of m-health applications?
- What can we learn about the accessibility to technology platforms (m-health applications, devices etc.) by m-health users- community health workers?

- How do we understand the ability of m-health users to use the m-health applications based on their general literacy?
- How do laws and regulations affect the use of mobile technology in bridging access to public health?

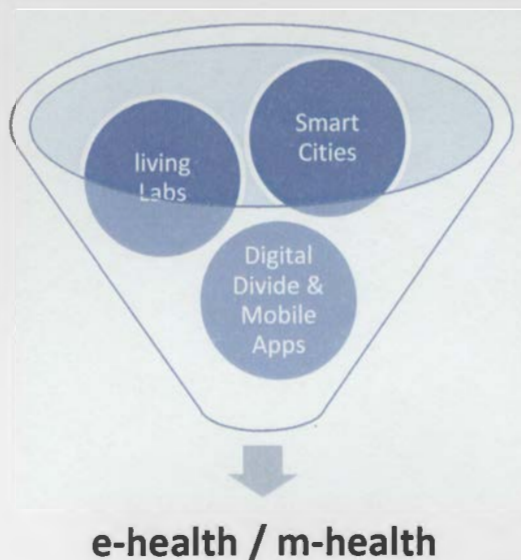
The following chapter is a review of the pertinent literature and conceptual theoretical frameworks that underpin the use of ICTs in health and m-health in this instance and with specific reference to mobile health in Tshwane City.

## **CHAPTER 2 REVIEW OF LITERATURE ON THE ROLE OF MOBILE APPLICATIONS IN BRIDGING THE HEALTH ACCESS GAP**

### **2.1 Review of literature layout**

A number of authors have contributed valuable knowledge and lessons that they have learnt regarding the health and mobile technology. The knowledge gathered forms the basis of the citations and references captured in this chapter. The role of mobile applications in health and its ability to bridge the digital divide is not vastly documented therefore, and in particular there is paucity in the literature regarding m-health services.

This chapter goes further than the traditional literature review where some key highlights from some interviews with key authors are reflected upon. It presents a review of key literature relating to the research question. Firstly, it looks at the role of ICT in shaping the development of smart cities and the new ways of delivering services to the citizens, electronically. It specifically considers the influence of the model of the smart cities in delivering public health services. The City of Tshwane has adopted this concept as one of the new ways of delivering health services to its residents with an express aim of improving the health of its residents as mentioned earlier. Secondly, it analyses the role of the living labs and how they are effectively adopted and used to promote and support the national health policy. Thirdly, it discusses the role of mobile technology and applications in bridging the access gap to public health services. Fourthly, it looks at the analytical framework to be employed in evaluating the effectiveness of mobile applications in bringing public health services. Lastly, it reviews the current health policy to establish the limitations that would hinder the mainstreaming of m-health and how the health policy should be improved to cater for the electronic delivery of health services in South Africa. This sequence is depicted in figure 7 below:



**Figure 7: Systematic Flow adopted**

Source: Holeni, 2012

## 2.2 The role of ICT in shaping the development of smart cities

The diffusion of Information Communication and Technologies (ICT) is changing the way service delivery is rendered. Previously ICTs existed in silos but lately they have grown into a single powerful technology for development. The impact of ICT is evident across socio and economic engagements of most developing states. ICT has become a development indicator used in the modern world.

The concept of smart cities is becoming more prevalent resulting in cities beginning to model themselves around this concept. The premise of this concept is on how ICTs are used for development and delivery of services. The City of Tshwane and the City of Oulu in Finland entered into a twinning agreement to help Tshwane become a Smart City. Funding was sought from the Municipal Association of Finland through its North-South Local Government Co-operation Programme to support the partnership (Morwane, 2007). The Innovation Hub was appointed by the City of Tshwane (as mentioned earlier) as the implementing agency of the project. A project office was established within The Innovation Hub precinct. Through the

partnership the City of Oulu transferred skills to the City of Tshwane to more effectively implement its Smart City Project and enhance its operational efficiency.

Maleho, (2012) defines smart cities as a knowledge workforce, broadband connectivity, innovation marketing and lobbying force.

To affirm the above, it is argued Tshwane has a knowledge base, in the form of four universities; the University of Pretoria, the Tshwane University of Technology, UNISA (University of South Africa) and the University of Limpopo Medical School (old Medunsa). The city hosts seven of the eight national science councils, such as the Agricultural Research Commission (ARC), Council for Scientific and Industrial Research (CSIR), Council for Geosciences, Human Sciences Research Council (HSRC), Medical Research Council (MRC), South African Nuclear Energy Corporation (NECSA) and the South African Bureau of Standards (SABS). There is significant medical competence in the city, a strong defence cluster and two of the key Blue IQ projects housed in the City of Tshwane at the Innovation Hub and the Automotive Supplier Park in Rosslyn (TshwaneSmartCity, 2009).

The vision of the Tshwane Smart City project as stated is to continue sustained economic growth and a high quality of life for citizens by aligning, integrating and developing a common vision between industry, research institutes, universities and local government. Also, through innovation projects, the city wants to create an environment that grows high technology cluster based businesses, attracts creative people and deploys significant broadband connectivity to schools, residents, business and government facilities. Maleho, (2012) further states, the smart city objective was to establish alignment and integration of the various research, educational institutions, industry, government and the city to achieve economic benefits for the city and its residents. It aimed to exploit the knowledge base in these institutions to create key economic clusters (i.e. ICT, Biotechnology and aerospace). It was to further the enhancement of the city's operations through the use of smart technologies to provide efficient service to the residents, increase knowledge and capacity through the relationship that exists with the City of Oulu in Finland. It would also strengthen the collaboration between BEE companies in Tshwane & the Finnish counterpart through job creation and the alleviation of poverty through SMME development initiatives (TshwaneSmartCity, 2009).

Morwane, (2013), cited that the smart city project was a collective mandate from the Office of the Mayor. The key elements of the project included that it would be supported by the Innovation Hub project office. Furthermore to complete a City of Tshwane Baseline Study and define industry clusters and investigate the status of university research and the level of applied research, as well as develop a skills profile for the City and investigate the feasibility of broadband roll-out to citizens, business and government facilities. In this process, leverage support for local industries from key players in the region to achieve economic growth.

Labuschagne, (2007) in view of the same initiative cites some salient challenges that must be taken into account in the roll out of projects of a similar nature. Firstly, criticism is cited in terms of the capacity within the city to position itself to take advantage of technology. Moreover, the funding, lack of requisite skills, lack of innovation and research and lack of sharing due to a strong "silo" based approach strategic initiatives were cited as some of the challenges. Furthermore, disjointed approaches to projects and to infrastructure development formed the basis of some criticism among different players in the project as outlined in private conversations.

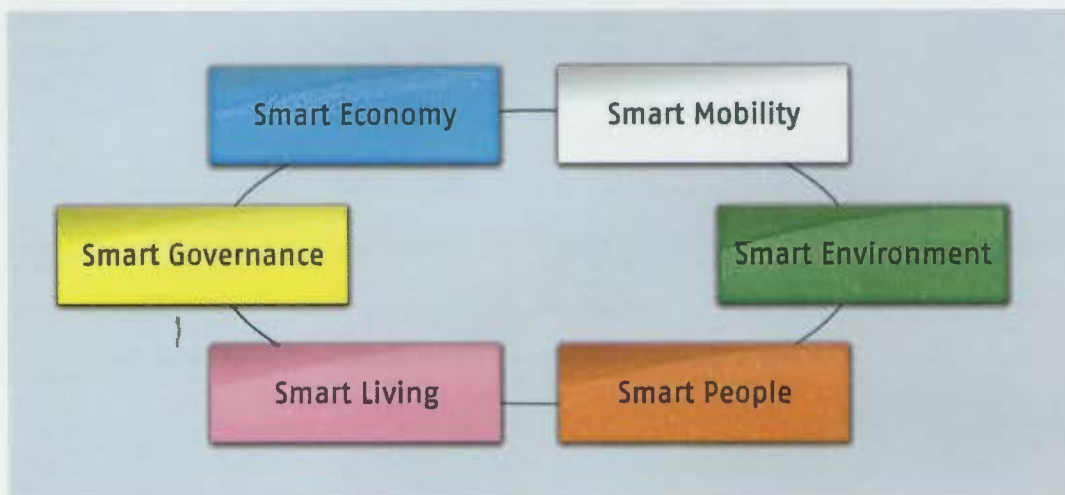
A Smart City is mostly referred to as a city performing well in six characteristics, built on the 'smart' combination of endowments and activities of self-decision, independence and awareness of the needs of its citizens (Wood, n.d.).

The six characteristics include:

- Smart Governance which entails participating in decision-making, public and social services and transparent governance.
- Smart Mobility: local and international accessibility, sustainable; innovative and safe transport system, availability of ICT infrastructure.
- Smart Environment: sustainable resource management, pollution, environmental protection, attractiveness of natural conditions.
- Smart People: level of qualification, affinity to lifelong learning, cosmopolitanism, social and ethnic plurality, participation in public life, flexibility and creativity.

- Smart Living: Health conditions, cultural facilities, individual safety, housing quality, education facilities, social cohesion.
- Smart Economy: Innovative spirit, internationally embedded, entrepreneurship, flexibility of labour market, productivity, economic image and trademarks.

It is argued that ICT alone cannot be used as a pillar to realise development. A holistic approach must be adopted and all indicators must effectively be fuelled to work together for a city to develop and benefit all those who live in it equally. The diagram below presents the requirements needed to develop a conducive environment for a Smart City.



**Figure 8: Smart City Requirements**

Source: Wood, n.d.

### **2.1.1 Smart Mobility as Perceived Luxury Services**

There are cases where full utilisation of mobile communications is still lagging behind when it comes to access to advanced services such as the mobile internet. Goldstuck, (2012) states that South African internet user base has grown from 6.8 million in 2010 to 8.5 million at the end of 2011. "Penetration is now approaching 20% and for the first time we can see the mass market embracing digital tools on their phones" (Goldstuck, 2012). Some level of education and awareness is still necessary to continue pulling this trend forward. In South Africa, research

shows that mobile phones are widely being used for social networking. However, there is another area that is transcending where mobile communication is being used for development such as bringing health services to the doorstep of communities. Mobile phones and applications are becoming essential tools and they are being used more explicitly for development or as empowerment tools.

### **2.1.2 The advent of Smart Cities and influence on e-health**

It is the desire of each living economy to transcend and make life better for those who live in it. Maleho, (2012) during an interview at the Innovation Hub explained; one of the reasons for setting up the Tshwane e- Living Lab was to “participate in the health policy directives but most importantly to put Tshwane on the map as the model in South Africa through which the definition of a Smart City will be realized”.

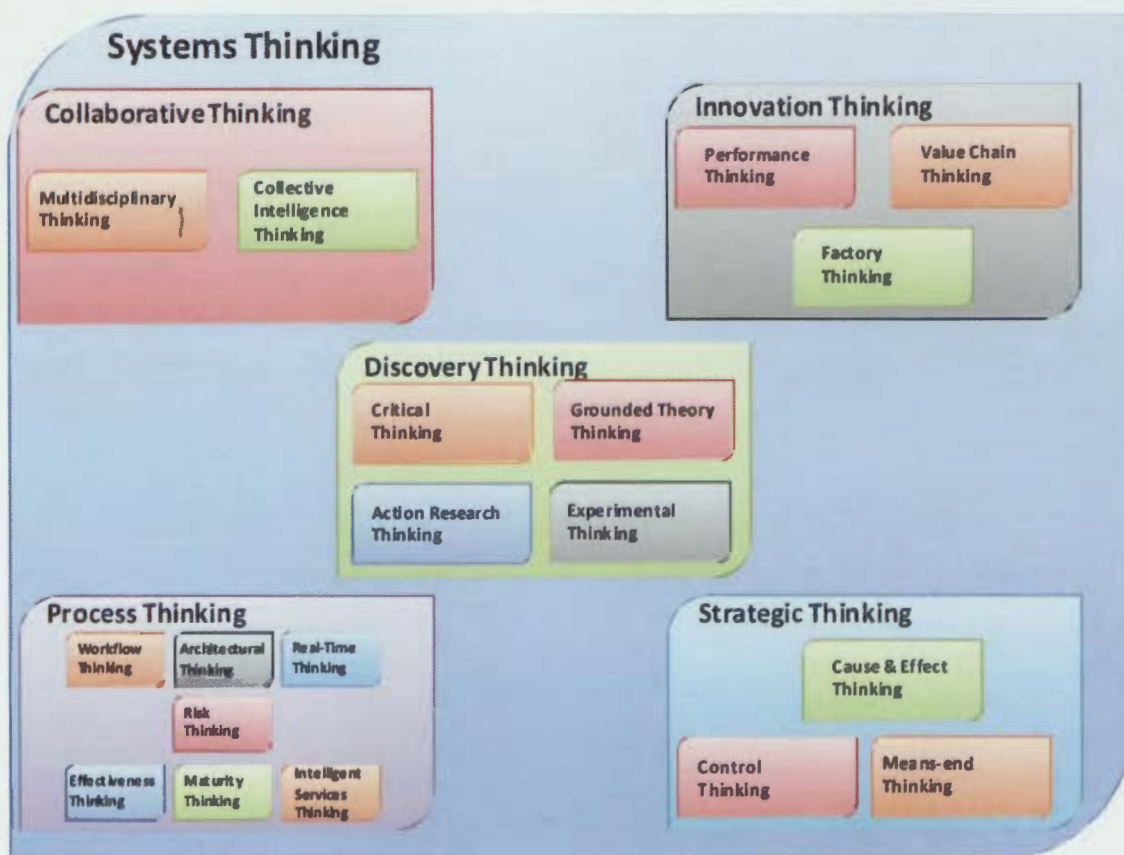
Tshwane takes the Smart City model further and realises that through partnerships between citizens, businesses and public authorities, the Living Labs model allows people and industries to test tomorrow's best innovations in Information and Communications Technologies (ICT). In essence, a Living Lab is a new way to deal with community-driven innovation in real-life contexts. The Living Lab concept is fuelled by knowledge sharing, collaboration and experimenting in open real environments.

Living Labs are systems consisting of tools, processes and methodologies for the creation of innovation environments focusing on real life user communities. Van der Walt & Buitendag, (2009) states “The Living Lab approach is a natural tool for learning, experimentation and research for the implementation of large scale collaborative product/service performance improvement opportunities for organisations”.

An observation dictates that the success on any initiative is dependent on the involvement and support by those who use the service. Van der Walt & Buitendag, (2009) further argues, “critical success factors for prosperous communities are stated in research papers, but the ones mentioned most of the time are connected to trust, involvement of members in the innovation

process, access to adequate knowledge regarding the problem environment, state-of-the-art ICT tools and methodologies, and good governance”.

(Maleho, 2012) highlighted that the objective of the Living Labs collaboration was to “transform the economy of the City by using knowledge-intensive industries; to create citizen wellness; to achieve City government operational efficiency; and to enhance ICT connectivity to the community and businesses in the city”. In essence this is based on knowing how and why things work. “Living Labs are systems consisting of tools, processes and methodologies for the creation of innovation environments focusing on real life user communities”. These environments allow for innovative ideas that are designed with a bottom up approach. Solutions are relevant to the end users who utilise the service. Van der Walt & Buitendag, (2009) argue, pertinent thinking process is relevant in the Living Labs deployment and it is outlined below:



**Figure 9: Living Lab Thinking Framework**

Source: Van der Walt & Buitendag, 2009

Under the Tshwane Living Lab initiative, third party aggregators and developers, innovatively followed a thinking process and came up with mobile applications that are relevant in improving the primary and public health access problem. While primary health workers, previously used paper based system, m-health brings a seamless integration to the system. Information is captured with ease and diagnosis is done timeously leading to an effective preventative action by the health workers.

The Daspoort Clinic which was used in this case study, partnered with Mezzanineware; Community Health Workers utilise the mobile applications technology to bring health services to the people of Tshwane- Daspoort clinic ward. "Mobile phones are widely diffused and they allow quick interpersonal communication. This facilitates the provision of health services which can take several forms! In its most advanced form, the mobile phone can serve as a tool with which to analyse and transmit the results of tests from remote locations" (De Vos, 2012). "The pressures to improve efficiency and service exist in all sectors but perhaps nowhere more than in health care. Health care costs are on a rising trend, increasing at a much faster rate than inflation in the economy as a whole. In addition, people have rising expectations for high-quality care and customer service" (Pritchard, 2006).

More common uses of enhanced m-health service are in the area of health education (information on HIV, pregnancy, etc.) and for eliciting second opinions such as when a midwife encounters a situation where the advice of a doctor is important. The use of mobiles for health provision also facilitates the collection of health care information. Mobiles can also be used to develop better control of pharmaceutical inventory. They allow suppliers to have better control over the inventory of drugs in rural locations. This helps when there is a need to move drugs to locations with the greatest need as with the outbreak of diseases. The mobile phone provides much needed services to people at the bottom of the economic pyramid.

### **2.1.3 Living Labs Theory – an enabler tool to the Health Access Gap!**

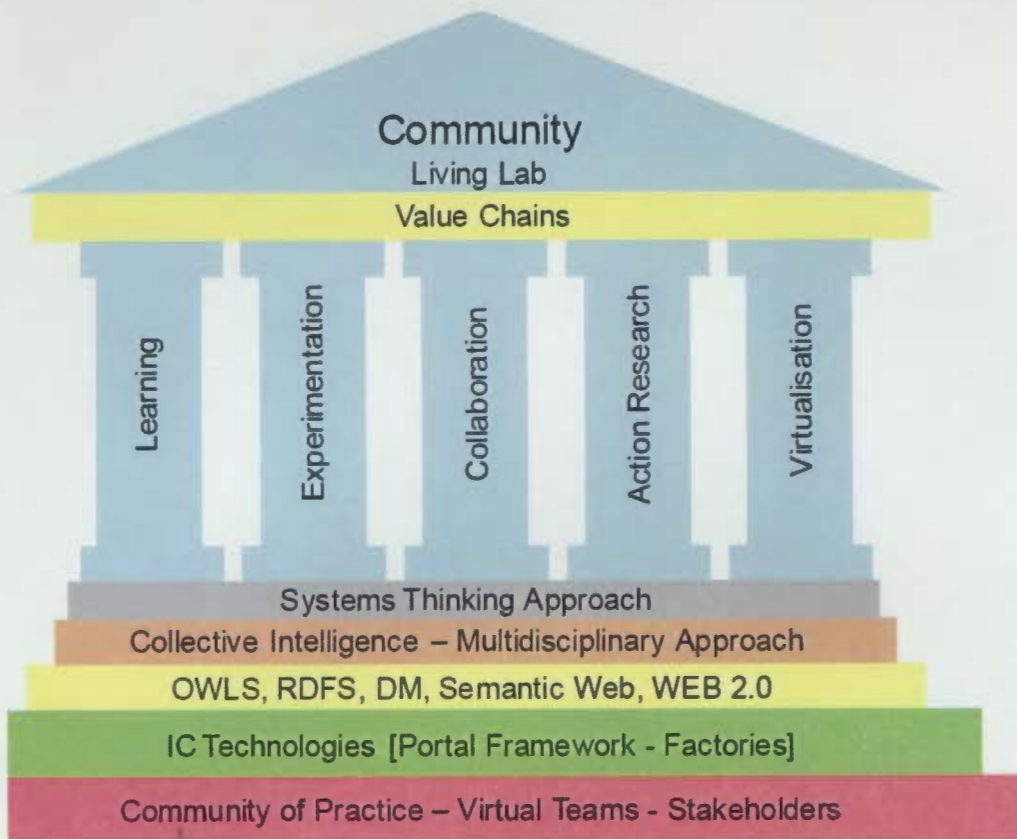
Due to some stated health challenges, inequality to health access and shortage of health professionals, alternatives to redress the socio economic challenges proved necessary. Mobile communication is highlighted as one of the astounding areas of growth of the decade. For a service that was originally viewed as a luxury service for the affluent individuals, it has been

adopted by a wide range of people in South Africa and around the world. To date, mobile phones are widely used and they allow quick interpersonal communication. Ling, (2011) states, "the mobile phone can serve as a tool with which to analyse and transmit the results of tests from remote locations. For example, a specially made microscope can be mounted on camera enabled mobile phones that allows for the identification of tuberculosis in blood samples. This can be used in remote locations far away from a traditional lab". It becomes compulsory for new innovations to transcend in this space, those innovations are likely to transcend through the Living Labs concept which provides a safe environment for developers and innovators to come up with practical societal solutions to problems.

For the purposes of this study, Tshwane e-health Living Lab (TeLL) is used to highlight or establish the relevance of Living Labs on m-health deployment. The relevance of mHealth is becoming excessively prevalent to the socio and economic eco system.

Given the transformation and convergence brought by the Information, Communication and Technology, The Tshwane Municipality became cognisant of the growing need to venture into electronic health. They took an action to transform the whole city and model it against similar cities that have gone through a similar path of development in the world. They explored an alternative health service by establishing the Tshwane e-health Living Lab. The aim of the Tshwane e-health Living Lab (TeLL) initiative was to create an environment where the health and social care ecosystem maximises the use of mobile applications to "increase accessibility, increase quality and ultimately improve the cost efficiency of health and social care" (Geomed, 2010). To achieve this mandate, the City partnered with Vodafone/ Vodacom and GeoMed medical information technology and delivered the m-health solution through the nompilo community health support system/ platform.

Wubeeling, (2010) refers to Living Labs as the methodology for user driven innovation and the organisations that primarily use them. It is all about experimentation and co-creation with real users in real life environments, where users together with researchers, firms and public institutions together search for new solutions, new products, new services and new business models. Van der Walt & Buitendag, (2009) applies the following community Living Labs framework:



**Figure 10: Living Labs Conceptual framework**

Source: Van der Walt & Buitendag, 2009

Living Labs are test bed platforms for real life situations. The aim is to contribute to new innovation developments where users and citizens become active users. Living Labs are about societal involvement and promoting innovation at a societal level, involving academia, SMMEs, public institutions and large companies in an open innovation process that happens in real environments and has an immediate impact. In this context, the Innovation Hub through the Finland government sponsorship is a partnership that initiated a project to focus on the development of mobile applications to address the health challenges facing it under the auspices of the Tshwane–Health Living Lab (TeLL). This initiative was further carried out by the University of Pretoria.

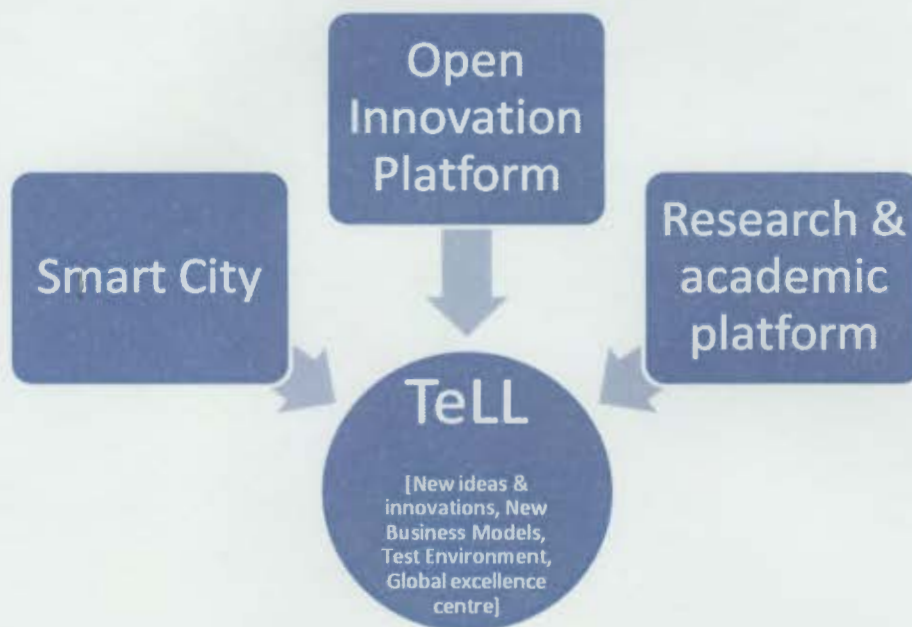
In this context, the focus is on the primary patient information system provided by GeoMed/ Mezzneware, a South African biomedicine and engineering company with clinical experience

and approval type. e-Living Lab acts as a collaborative innovation platform in the City of Tshwane whereby Rural and Peri- urban clinics for public health are supported through innovation so as to enhance delivery and bring much needed access to the latest products and services impacting on health care to the people of South Africa. Role players are brought together to develop, trial and implement innovations (processes, technologies, systems, training and people management).

The focus is to:

- Develop solutions to improve the efficacy of service delivery at current points of care.
- Identify opportunities and required solutions to improve service delivery through moving from point of care to a home based care approach (De Vos, 2012).

This collaboration is depicted in figure 11 below:



**Figure 11: Tshwane e Living Lab**

Source: Holeni, 2012 (Adapted from De Vos, 2012)

There are approximately 2 200 000 (2004) people living within the borders of Tshwane; 72.65% black, 23.84% white, 1.99% coloured and 1.52% Indian and Asians. Tshwane holds a "1079 population density per sq metre, poverty rate of 35.5%, 11 public hospitals, 55 clinics and 7 community health clinics" (Geomed, 2010).

With this addressable population and the number of community health clinics, it becomes more essential to consider alternatives to bring services closer to the people. In the discussion with the Innovation Hub officials and one of the key service providers (De Vos, 2012), it became eminent that medical skill in underserved areas remains an ongoing challenge. Through the Living Lab initiative, mobile technology is utilised to allow lower skilled health workers to perform part of the workload currently assigned to higher skilled workers. The idea behind TeLL is to use an auditing system to formalise the Community Health Worker (CHW) programme and NQF accreditation as well as minimum remuneration to qualifying CHWs. Community care services include: home nurses, TB DOTS supervisors, family planning, HIV and AIDS communicators, home-based care givers, generic community health workers and health educators. m-Health at community level activities is run on the nompilo system which is a mobile based monitoring and evaluation integrated solution with which home and community based care services can be recorded, analysed, improved and reported to the relevant stakeholders (Ogunmefun, et al., 2010).

## **2.2 Role of Technology in bridging the Health access gap**

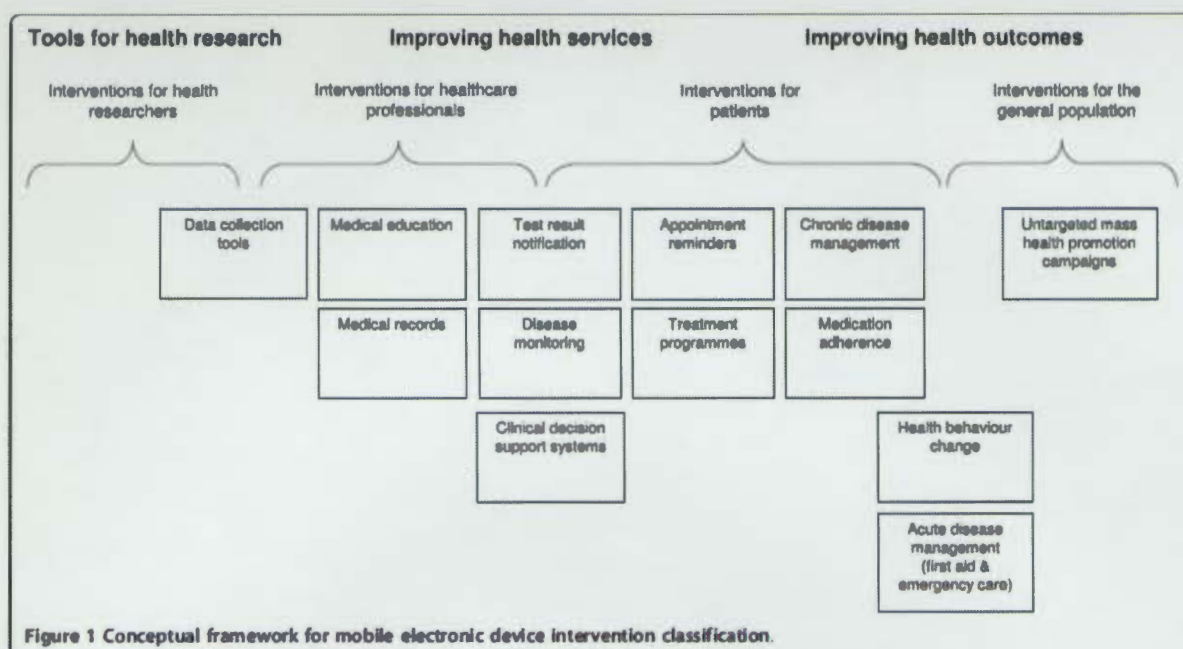
### **2.2.1 *Mobile technology in bridging the Health access gap***

Technological change in health care goes beyond medical equipment and medicines. Information, Communication and Technology (ICT) has had a major impact on the changing health systems. Mobile is fast becoming an interface between service providers and the public.

According to (Atun & Sittampalam, 2006) it is more eminent that mobile applications offer potential value to health care providers, patients and funders through:

- Tackling inefficiencies in service provision by improving communication between service providers and users.
- Improving the effectiveness of health care through improved self management and monitoring of patients with chronic conditions e.g. diabetes, and improved adherence to treatment programs e.g. tuberculosis. Chronic conditions such as diabetes place significant and increasing demands on health care services.
- It further increases the ability of some hard-to-reach to access health care services by reducing the barriers of inconvenience, confidentiality or privacy.

The potential of the mobile is to help provide more accessible and better health care more efficiently. Mobile phones provide another avenue to access to health care and health information. Economically, the increase in demand for convenient cost-effective health care may lead to reductions in future health care costs by improving health outcomes. In essence, then, the cost impact may be modest relative to the health benefits obtained.



**Figure 12: Conceptual framework for mobile electronic device intervention classification - m-health outcomes**

Source: Free et al., 2010

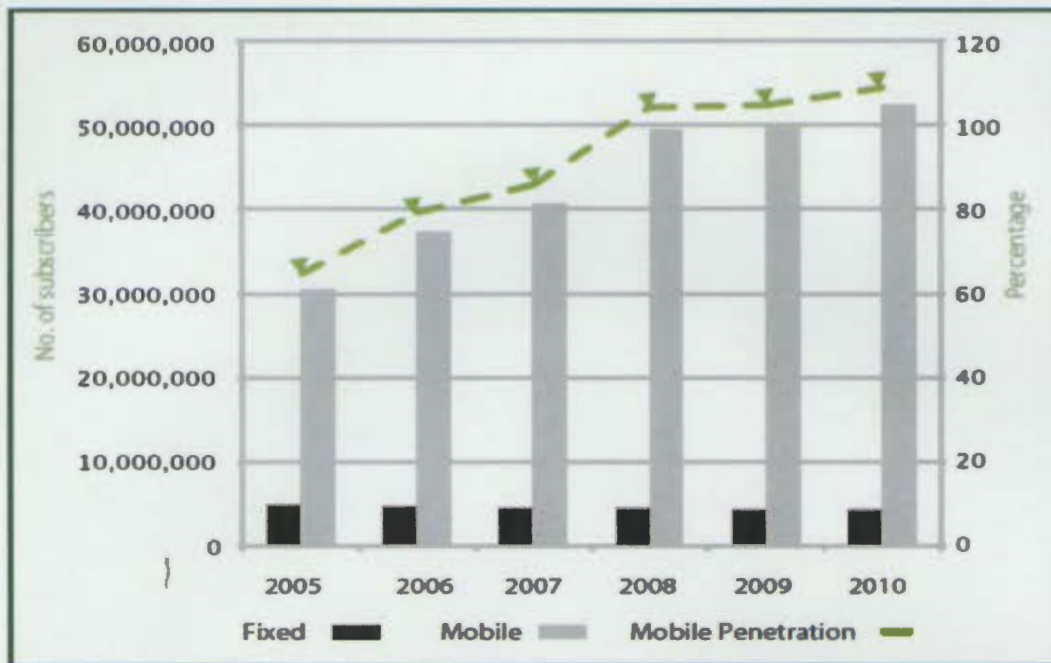
The role of mobile applications in health has gained prominence, the author realises that mobile phones are becoming a business and individual necessity. The mobile evolution, context of digital divide and integration of e-health policy framework is visited.

Digital divide is broadly referred to as the gap between those who have access to Information Communication Technology and are using it effectively, and those who do not (Bridges, 2001). However, different authors to a great extent argue that digital divide is not just about e-technology availability but also other dimensions such as accessibility, affordability, reliability, speed and utilisation (Loo & Nyan, 2012).

Most countries are struggling with the digital divide where some parts of the country are highly developed and have access to advanced telephony whilst other parts of the country have no access to these services. South Africa is no exception; the country consists of large rural areas with low population density and limited access to resources, and economically active urban

conglomerations where a limited range of competing services is available. The access to a telephone has improved with the introduction and growth of the mobile telephony.

According to (BMI-T, 2011) mobile communication penetration has had a giant leap frog on Fixed line services:



Source: BMI-T, 2011

**Figure 13: Mobile Penetration in SA 2011**

Source: BMI-T, 2011

For a number of years South Africa could not roll out fixed landlines and public phones quickly enough to cover the furthest areas (rural) of the country and ironically even in some of the urban centres. Mobile phone penetration has overtaken the rollout of fixed landlines as most teenagers and adults in South Africa own at least one phone device. This state of ICT penetration in local municipalities (Tshwane) is also reflected below cited from the ICASA Underserviced Areas definition regulations: (ICASA, 2012).

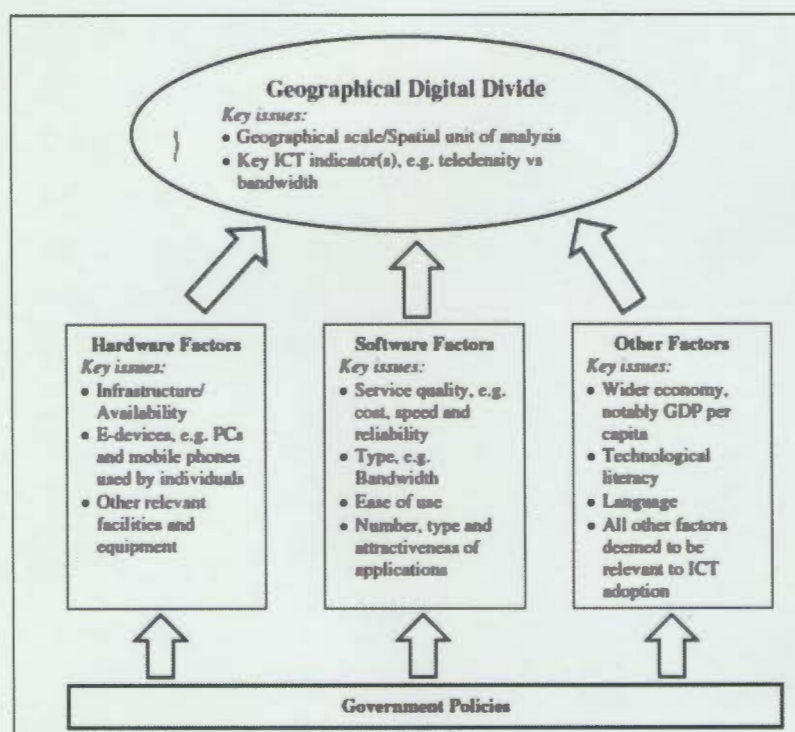
| Local Municipality                                    | Internet | Computer | Telephone | Cellphone | average of 4 |
|-------------------------------------------------------|----------|----------|-----------|-----------|--------------|
| City of Tshwane<br>Local Metropolitan<br>Municipality | 12.8%    | 28.6%    | 24.8%     | 83.3%     | 37.4%        |

**Figure 14: Technology Penetration in the City Of Tshwane**

Source: ICASA, 2012

### 2.2.2 Digital Divide

The Digital Divide concept is not only taken in the context of usage but geographic divide. (Loo & Nyan, 2012) expresses this in an analytical framework that borders on the policy reflected below.



**Figure 15: Digital Divide**

Source: (Loo & Nyan, 2012)

Government policy must be used as a driving force behind innovative means of bridging the divide and bringing services closer to the people.

(Mariscal, 2005) argues that there has been increasing attention on digital divide issues in the public arena, in the academic literature, yet there is no consensus regarding the appropriate policy to implement. It seems the subject of digital divide is recognised, however, the complexity of it is imposing a challenge to the policy makers. The debate on the digital divide in the telecommunications policy literature has taken place along a spectrum that argues, on the one hand, that the market alone will take care of any perceived disparities. On the other hand, government should implement policies that subsidise access in some fashion. Given the transition that South Africa has gone through with ICT, it is important to note that in dealing with the issue of the digital divide, a market efficiency gap shall deliberately be omitted. Market efficiency gap normally refers to the difference between the levels of service penetration that can be reached under current plans and conditions, and the level one would expect under optimal market conditions. The digital divide debate shall be based on the access gap.

(Mariscal, 2005) argues that different debates are happening on the digital divide and whether one wants to adopt a theoretical perspective, each one of them has a direct implication on policy.

| Theoretical perspectives                                                                         | Policy implications                                                  |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| <i>Market economy</i><br>Market as the engine of growth and thus expansion of telecommunications | Policies that promote competition                                    |
| <i>IT-for-development</i><br>IT as the engine of growth                                          | Pro-active support to the consumption of telecommunications services |
| <i>Social capital</i><br>Community-based economic growth                                         | Integral policies that promote access                                |

**Figure 16: Digital Divide: Theoretical perspective vs. Policy implementations.**

Source: Mariscal, 2005

Based on the above, it is imperative to dissect and understand the implications of mobile applications in bridging the digital divide. By default, the author shall adopt the social capital theoretical perspective to demonstrate the use of this theory to promote the health access gap. It is the author's view that this positive uptake of mobile penetration must not be celebrated in isolation to the digital divide. There is an evident increase in broadband penetration, yet one cannot quantify significant penetration on broadband services. One could allude the lack of adoption of services to the lack of access, perceived relevance of the service offered, digital literacy and ultimate costs involved.

(Guomundsdottir, 2005) maintains, although there could be an increase in the basic material access; digital skill, user mentality and cultural appropriateness remain hindrances to service adoption. The following table presents different approaches to digital divide.

| Different Approaches to the Digital Divide Concept                                                                                           |                                                                                                                                                                                                                                                                                                                            |                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Van Dijk and Hacker (2003)                                                                                                                   | www. bridges.org                                                                                                                                                                                                                                                                                                           | Warschauer (2004)                                       |
| <b>Mental Access</b><br>Lack of elementary digital experience, lack of interest, computer anxiety and unattractiveness of the new technology | <b>Socio-cultural factors</b><br>Are people limited in their use of technology based on gender, race, or other socio-cultural factors?                                                                                                                                                                                     | <b>Social resources</b><br>Communities and Institutions |
| <b>Material Access</b><br>No possession of computers and Network connections                                                                 | <b>Physical access</b><br>Is technology available and physically accessible?<br><b>Appropriate technology</b><br>What is the appropriate technology according to local conditions, and how do people need and want to put technology to use?<br><b>Affordability</b><br>Is technology access affordable for people to use? | <b>Physical resources</b><br>Computers and Connectivity |
| <b>Skills Access</b><br>Lack of digital skills caused by insufficient user friendliness and inadequate                                       | <b>Capacity</b><br>Do people understand how to use technology and its potential uses?                                                                                                                                                                                                                                      | <b>Digital resources</b><br>Content and Language        |

|                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| education or social support.                                            | <p><b>Relevant content</b><br/>Is there locally relevant content, especially in terms of language?</p> <p><b>Integration</b><br/>Does the technology further burden people's lives or does it integrate into daily routines?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |
| <p><b>Usage Access</b><br/>Lack of significant Usage opportunities.</p> | <p><b>Trust</b><br/>Do people have confidence in and understand the implications of the technology they use, for instance, in terms of privacy, security, or cyber crime?</p> <p><b>Legal and regulatory framework</b><br/>How do laws and regulations affect technology use and what changes are needed to create an environment that fosters its use?</p> <p><b>Local economic environment</b><br/>Is there a local economy that can and will sustain technology use?</p> <p><b>Macro-economic environment</b><br/>Is national economic policy conducive to widespread technology use, for example, in terms of transparency, deregulation, investment, and labour issues?</p> <p><b>Political will</b><br/>Is there a political will in government to do what is needed to enable the integration of technology throughout society?</p> | <p><b>Human resources</b><br/>Literacy and Education</p> |

## Figure 17: Approaches to the Digital Divide Concept

Source: Guomundsdottir, 2005

Using the bridges approach above, the illustration of the relevance of the digital divide and use of ICT applications on mobile health is provided to the thematic framework of the study which is discussed below.

According to Information Society & Development, (2012) the policy on e-health is aimed at addressing the following:

- To strengthen the development of a comprehensive and integrated health information systems
- To facilitate the development of health information standards
- To implement security measures to safeguard the privacy of patient information inherent in electronic health records
- To ensure that all health care facilities have access to adequate ICT infrastructure
- To facilitate the development and implementation of a national telemedicine programme
- To develop and implement an integrated (national, provincial and local government) health promotion strategy using ICT
- To facilitate the development on ICT human resource strategy
- To develop an ethical framework for the effective use of e-health by health professionals.
- To promote e-health research and development programmes.

The success to mobile health adoption is viewed to be largely influenced by the five elements depicted in the diagram below:



**Figure 18: m-health Integrated Approach**

Source: (Holeni, 2012)

## **2.3 Development of Health Applications in South Africa**

### **2.3.1 Mobile messaging evolution:**

Atun & Sittampalam, (2006) argues, as mobile phone penetration continue to super exceed with a positive trend in many countries, the potential exists to utilise the distinctive characteristics of mobile and the SMS system to increase the efficiency and effectiveness of health service delivery. While there are a number of interesting and promising examples, “a systematic review of the opportunities to leverage SMS technology in health service provision has not been conducted and is long overdue” (Atun & Sittampalam, 2006).

Apart from the bearers widespread usage, the SMS application has many other characteristics that make it appropriate for use in a healthcare context. It is essential to highlight usage and capability of the SMS functionality. The ‘one-to-many’ (bulk messaging) feature of SMS systems implies that messages can be sent to many recipients simultaneously and potentially in several different languages. These messages can also be pre-written, minimising time and effort in data

entry and communication for providers, it also allows manual or custom messaging. Messages may be stored and pushed when the recipient can read them thereby increasing convenience. Furthermore, messages sent to a mobile phone that is switched off are stored at a SMS Centre and delivered when the handset is switched on again. SMS messages usually reach the recipient within seconds, allowing for an immediate response, and a delivery receipt can be added to the message to confirm that delivery has taken place. It is possible to save and store SMSes on a mobile phone to enable individuals to reference and access the content at their convenience and as often as is possible.

The Mobile messaging technology has evolved over the years with diverse person to person (P2P) and application to person (A2P) communication tools for mobile users. Most users are familiar with short messaging services (SMS), multimedia messaging services (MMS), mobile email, and mobile instant messaging (MIM). In South Africa, application to person services such as - bulk SMS/MMS and premier messaging content including music, games, genres, mobile marketing and SMS/MMS premium payments are on the rise but not popularly used (Hamilton, A et al, 2007).

Cisco, (2004) cites Existing Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) mobile networks use Short Message Service (SMS) as a multipurpose data service that enables rapid deployment of data applications without the need for 3G bandwidth capabilities. This is particularly relevant in South Africa, a country divided into first world economically affluent metropolitan areas and sub-minimal rural areas without sufficient 3G network coverage. Technology is transcending, a fair amount of South Africans who reside in areas that do not have full 3G network coverage. Although the majority of the South Africa population has access through the use of mobile cellular phones, there is still a large number of legacy devices not supported by modern technology, hence the relevance of the use of SMS technology by m-health professionals to bring services to the people.

Operator trends indicate that mobile messaging is the highest revenue generating service behind voice, with the person to person SMS being the key driver. This growth is greatly exacerbated by the bearers' ubiquity and simplicity of use. The SMS technology has been around and the majority of people are familiar with the technology and how to use it. (Informa, 2005)

There are three types of benefits from SMS applications which emerge from the systematic review. These include:

- Efficiency gains in the delivery of healthcare;
- Direct patient benefits in terms of better health outcomes and service quality
- Public health benefits.

Atun & Sittampalam, (2006) states, the use of text messages to deliver health services more efficiently, falls into four categories:

- Appointment reminders
- Safety of healthcare workers
- Management of human resources in health services, and
- Administration of health financing organisations.

## **2.4 m-health and Community Based Services**

Community based health services are currently undergoing a process of formalising and strengthening as part of a broader strategy of Primary Health Care (PHC) revitalisation in South Africa. The National Department of Health (2011) in the 'PHC-re-engineering' strategy, prioritises community based 'outreach' functions for greater investment and systems development. Outreach functions will include intensified household assessment and support, better referral to and integration with primary health care facilities and community mobilisation around priority health needs. Each health ward will have a number of PHC outreach teams, linked to local health facilities, and staffed by a combination of community health workers and professional staff Leon & Scheider, (2012).

South Africa is one of the countries with the highest proportion of mobile phone users per population, where most mobile phone users make use of short message services (SMS) as an affordable means of communicating, especially for those who cannot afford the high cost of cell-phone calls. Mobile phones in South Africa also provide the opportunity for its users to access

web-based services and information. Although the level of access to a computer and internet services in South Africa is low, a high proportion of cell phone users access the internet via their cell-phones. Thus the wide-scale availability of mobile phones and the potential for affordable communication and access to web-based services make this a potentially powerful tool for broader use in monitoring and evaluation of community-based healthcare settings (Leon & Scheider, 2012). On the other hand, Health service workers often face threats to their personal safety. These can be due to the abusive behaviour of patients, to contact with biological hazards, or to natural disasters or accidents. (Atun & Sittampalam, 2006).

#### **2.4.1 Lesson Learning Conceptual Framework**

There is very little that has been written on lesson learning conceptual framework particularly lessons derived from project implementation in the literature. Such paucity has made it difficult for the study to have a clearly defined conceptual framework that can guide this study on lesson learning. This vacuum in the body of knowledge has generated fuzziness around this study. Perhaps, this is an opportunity for this study to contribute to the body of knowledge in this regard. According to (Milton, 2010), there is a generalised fuzziness surrounding the topic of learning lessons. This void can hamper the delivery of value through effective learning particularly learning that is outside the educational and academic environment. Milton, (2010) indicates that the fuzziness surrounding lesson learning has led to a difficulty in defining a lesson learned. The author suggests that there are at least 5 definitions of lessons learned but only two are noted in this document, (i) The lesson learned is knowledge or understanding gained by experience that has a significant impact for an organisation or a project. The experience may be positive or negative. Successes are regarded as sources of learning as well. Another version of a definition for lesson learning is, (ii) the knowledge acquired from an innovation or an adverse experience that causes a worker or an organisation to improve a process or activity to work safer, more efficiently or within high quality.

According to Milton, (2010), there are three main steps in learning a lesson namely:

- Identification
- Action

- Institutionalisation

The study has been informed by these main steps. Firstly, the study identified people who were involved in the m-health project and thereby identified lessons learned through interviews conducted. The identified lessons will be put into action through using recommendations in either the development of m-health policies and regulation or in influencing the next m-health projects. The last step which is institutionalisation will take place when these policies and regulations which have been developed as results of the findings of the study become part of m-health implementation in the health environment.

#### **2.4.2 Identifying lessons**

The first step which is identifying lessons from experience is a process of reviewing, analysing and generalising. This process follows these further three steps as outlined:-

- **Review experience.** An individual or team of role players look back on a project and try to recall what happened. Activities are identified to assess whether there was a difference between what was planned and what actually happened. As mentioned before both positive and negative responses are possible. The study followed reviewing by interviewing all those who were involved in the project.
- **Analyse the learning points.** The participants provided data/ information about the project, articulating their points of learning which were analytically organised to become lessons learned from the project.
- **Generalise for the future.** Generalisation suggests further actions and in this study these lessons which were learned by participants have been coined into recommendations that will be generalised to all m-health projects. The reader must bear in mind that while this case study is based on just one project it provides valuable information since there are not many projects of this nature in the country.

Also, it should be borne in mind that this study has indirectly dealt with other steps of lessons learning although such steps have not been part of the study. Therefore, only the first step in

identifying lessons was fully engaged in the research study. More research is critical to engage in the remaining steps in future research.

Milton, (2010) further asserts that the process of identifying lessons learned need to follow certain characteristics:

- **Being grounded in solid performance data:** Lesson identification has to be based on facts and analysis of facts.
- **Looking at positive as well as negative experiences:** Any review of project activity or task should acknowledge what has gone well and what were the challenges faced by the project.
- **Referring back to the objectives of the task, project, activity or initiative:** Lessons often arise from positive and negative differences. This means there must be a comparison made between what actually happened and the objectives of the project.
- **Separating experience from opinion as much as possible.** A lesson is different from an opinion or an idea, because it is based on actual experience and it is an objective reflection on the results.
- **Generating unique and distinct lesson from which others can learn and take action:** Each learning point should be an individual lesson and careful attention should be given to making it usable and actionable (Milton, 2010).

Therefore the study having been informed by the above lesson learning framework coined the main question that is presented below. The main question has sub-questions in an attempt to provide answers required on the phenomenon under observation.

**Theme 1: Lessons Learned in rolling m-health initiatives** and associated challenges. The premise for lesson learning arises from the fact that mobile phones have other characteristics that are important in the context of healthcare and therefore a fertile ground for lessons to be learned for future m-health. Privacy and confidentiality is important and because mobile phones are essentially personal and not shared devices, it is more acceptable than an alternative means of communication to many users. People are likely to use their mobile phones to obtain

health advice as the mobile device enables them to conduct a call or send a text message in private without the risk of being overheard.

ICT has led to the creation of decision making tools, meaning that roles which were once the preservation of physicians can now be delegated to other health care professionals. For instance, while monitoring and evaluating community healthcare work is considered crucial, Leon & Scheider, (2012) argues, it remains a weak link in many CHW programmes, including those in South Africa. "CHW programmes tend to be on the periphery of the health services and this, together with poor governance and accountability mechanisms, may be contributing to the inadequacies" (Leon & Scheider, 2012).

**Theme 2: Legal and regulatory framework** - Given the potential improvement of SMS application in health outcomes and economic benefits indicated by the evidence available so far, the policy assessment should include consideration of how to introduce promising SMS applications on scale and in a systematic way, in order to ensure that their full potential is realised. At community level, there are stringent processes that are followed by Community Health Workers in delivering health services where consent is provided by the patients. However, there is no clear regulatory framework that guides their conduct.

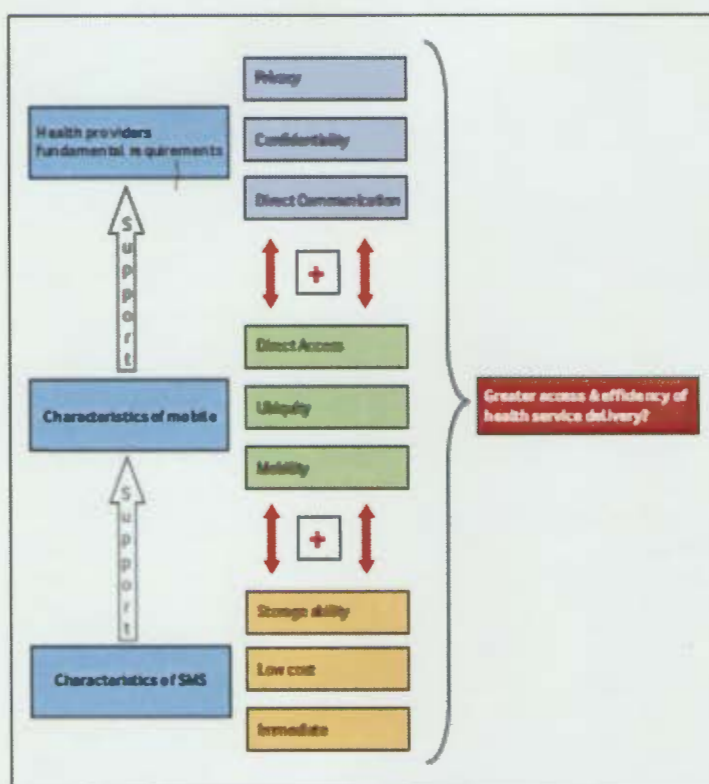
**Theme 3: Trust (Living Labs)** – Assess the accessibility to technology platforms (m-health applications, devices etc.) by potential m-health users – Community Health Workers (CHW).

The Vodafone Policy Paper (2006) states that some governments are considering implementing internet-based e-health interfaces between health service providers and customers. This is often viewed as a potential source of cost savings and efficiency improvements; yet this would seem to raise significant problems of access for some disadvantaged and mobile groups.

A study in South Africa which used Cell Phone Prompted Self Administered Therapy (PSAT) to improve adherence in tuberculosis patients treated according to the World Health Organisation-recommended protocol reported that the scheme had reduced the staff workload without an adverse effect on cure rates. The scheme was welcomed by staff and the local health authority officials (Atun & Sittampalam, 2006). The Living Labs provide a platform for real life situations to be tried and tested within a safe environment. It enables innovation where appropriate solutions are effectively rendered. For example, SMS notification is used to monitor HIV positive

individuals receiving anti-retroviral drugs, where side effects are reported directly by patients sending text messages to health workers.

**Theme 4: Affordability and convenience,** Atun, (2006) argues, that increased affordability and accessibility are the anticipated consequences of providing a telephony based m-health service to a market saturated with mobile phones. The SMS application has consequently revolutionised communications. The SMS has many characteristics that make it particularly suitable for use in a healthcare setting. The figure below identifies some of these characteristics and demonstrates how they support the fundamental requirements for the transfer of health information: privacy, confidentiality and direct communication. This Figure also shows how the mobile phone supports and builds on the characteristics of the SMS by adding further benefits to the transfer of health information whilst also maintaining the fundamental requirements of health providers.



**Figure 19: Use of SMS applications and mobile phones in health care**

Source: (Atun & Sittampalam, 2006)

The high penetration rate of mobiles in most social groups makes it possible for the SMS to be used as a core communications channel. The key benefits of this application include:

- improving the extent to which patients stick to their medications and treatment.
- Monitoring patients' conditions.
- Providing psychological support to patients.
- Communicating test results.
- Other areas including queue management (Atun & Sittampalam, 2006).

SMS applications are cost effective and their benefits in public health are listed above. They can cover the need to contact specific individuals, such as those thought to have been exposed to a communicable disease, or to everyone in a particular population group or geographic area. Text messages have also been used in public health campaigns such as anti-smoking campaigns.

**Theme 5: Technology literacy**– Assess the ability of m-health users to use the m-health applications based on their general literacy.

The SMS itself is a simple form of data transfer usually communicated from person to person but which can also be sent from computer to person and vice versa. The internet and email have some of the same characteristics but, in the context of healthcare management, the fact that the device is held by, and is personal to the user (patient) is of key importance. Mobility has the further potential to increase efficiency by the ability to reach the patient directly.

Apart from its widespread usage, the SMS application also has many additional characteristics that make it appropriate for use in a healthcare context. SMS reminders can be used to prompt patients to take medication at the correct time and to encourage them to continue and complete treatment regimens for a wide range of conditions, such as diabetes, tuberculosis, and HIV/AIDS. The SMS is proving to be most intuitive application after the voice. Most people have mastered the art of sending text messages and the application is effective across most devices.

## 2.5 Summary

In this chapter, a review of pertinent literature has been presented. While e-health/ m-health are transcending and being adopted in South Africa, it has also become apparent that in dealing with the entire healthcare value chain, legislation and policies that are currently in place must be reviewed to ensure that they promote access, affordability and quality of healthcare, in particular Primary Health Care.

It has also emerged that socio economic developments do not happen in silos, the presence of Living Labs as enablers of innovation addressing social and economic issues are vital. A policy such as the National Insurance Policy and the e-health strategy could be adopted but their success depends on those who implement the policy objectives. Understanding digital divide within context is crucial as it has a direct impact on the rollout and use of mobile applications in *primary* healthcare. As stated earlier, one could allude the lack of adoption of services to the lack of access, perceived relevance of the service offered, digital literacy and ultimately costs involved.

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## **CHAPTER 3 CASE STUDY RESEARCH METHODOLOGY FOR mHEALTH IN TSHWANE**

### **3.1 Research Methodology Outline**

This chapter looks at the research question and the methodology which the study employs. The study is empirically based, drawing from evidence obtained from systematic research methods, such as gaining opinions and views from authorities on the subject matter under study (McMillan & Schumacher, 2006).

The key areas discussed in the study under the research design are the approaches to qualitative methodology analysis framework. It applies a qualitative analysis to investigate the lessons learned in the implementation of m-health in bridging the health access gap in Tshwane. The study uses a case study approach; with a qualitative methodology and semi-structured interviews. The analysis seeks to understand phenomenon in the context-specific settings, such as real world setting. Patton, (2002) argues that, case study is the context where the researcher does not attempt to manipulate the phenomenon of interest. This implies that the researcher is the human instrument of data collection, using "naturalistic methods to obtain rich, useful data" and adopting an interpretive character within a changing phenomenon (Patton, 2002). The research question has numerous sub-questions that are structured to reflect the themes around which the analytical framework is structured.

### **3.2 Research Design and Methods**

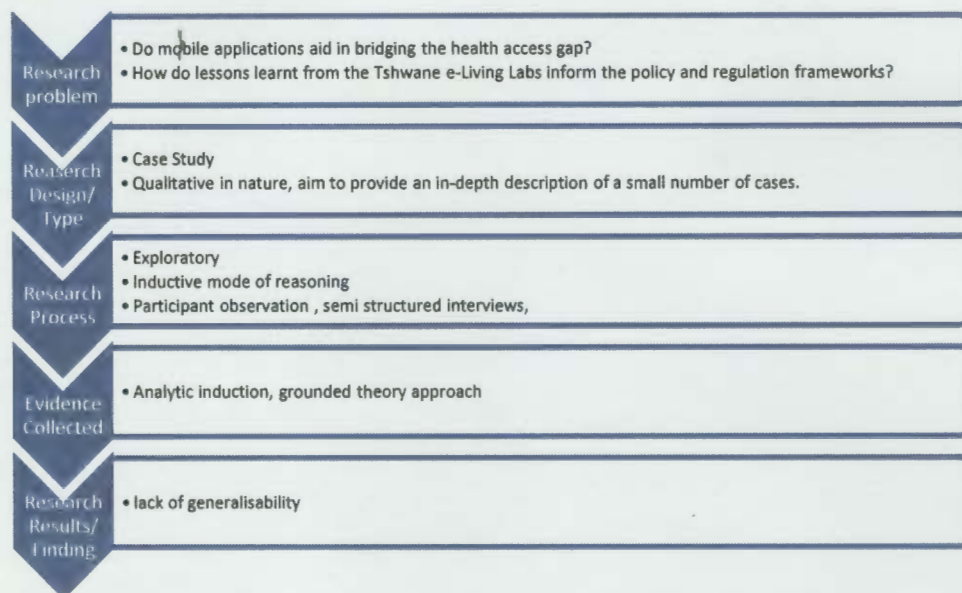
This study is structured around an empirical research approach where logic is built through identifying the research problem, research design, empirical evidence and conclusions commonly referred to as the ProDEC framework (Babbie & Mouton, 2012).

The ProDEC framework describes the design and methodology in terms of the population, sampling and administration of research instruments, data collection procedures and description of techniques used in data analysis. With this premise, the researcher is able to answer

research questions and overall research objectives. The conceptual perspective of this study is based on a qualitative methodology that includes designs, techniques and measures that do not produce discrete numerical data. In order to achieve the research objectives, the research design was based on an empirical and interpretive approach.

To articulate how this approach was adopted, the researcher referred back to the research problem. Access to good quality healthcare facility is a dominant challenge in most developing countries. South Africa has introduced the Health Insurance System which is embraced as a vehicle in addressing the right to good healthcare facility by every South African. Technology on the other hand is transcending and remains an enabler. As stated earlier, the purpose of this research report is to establish and narrate on lessons learned in using mobile applications in bridging the health access gap. The aim is to inform the body of knowledge for policy and regulation on the use of mobile application in bridging the health access gap.

The design of this research report was adopted following the steps outlined in the following diagram.



**Figure 20: Research Design**

Source: Holeni, 2012 (Adapted from (Mouton, 2005)

There are numerous types of qualitative research designs and these are listed in the table below.

| Design                         | Purpose                                                        |
|--------------------------------|----------------------------------------------------------------|
| Case Study                     | To understand one or more phenomena in great depth             |
| Ethnography                    | To understand how behaviour reflects the culture of a group    |
| Phenomenological Study         | To understand an experience from the participants' perspective |
| Grounded Theory Study          | To derive a theory from data collected in a natural setting    |
| Content Analysis               | To identify the specific characteristics of a body of material |
| Source: (Leedy & Ormrod, 2005) |                                                                |

**Figure 21: Research Study Types**

According to (Leedy & Ormrod, 2005) in a fully adopted case study design, a particular phenomenon is studied for a defined period of time. The phenomenological study "attempts to understand people's perceptions, perspectives, and understandings of a particular situation" (Leedy & Ormrod, 2005, p. 139). This approach was drawn as part of the case study approach applied in the study. The grounded theory design employs a set of processes for examining data from which to build a theoretical model – i.e. the theory is grounded in the data (Leedy & Ormrod, 2005, p. 140). This design is particularly useful when there are no theories about a specific phenomenon, or when the current ones are insufficient. The content analysis design is a methodical inspection of the contents of typically some form of communication material – e.g. books, music, films, etc – with the intention of discovering patterns or themes (Leedy & Ormrod, 2005, p. 142).

### 3.3 Interpretive Approach

There are three main approaches to research studies – positivism, interpretive social science and critical social science (Neuman, 1997). The positivism approach is concerned with testing

and confirming specific laws as captured in a particular theory, and is therefore associated with quantitative methods that seek precise measures (Neuman, 1997). Some of the important issues that this approach is concerned with include empirical evidence and verifiability of data (Babbie & Mouton, 2012). A common criticism of positivism is that, in its enquiry, it ignores the texture of peoples' social context and their ability to think and feel (Neuman, 1997). Conversely, interpretive social science acknowledges this social context and is more concerned with revealing how people feel and view their world, rather than testing or confirming laws on their behaviour (Neuman, 1997). This approach evaluates reality according to how people who experience it on an ongoing basis understand it (Babbie & Mouton, 2012). It is therefore associated with qualitative methods that seek to understand rather than measure. In essence, (Neuman, 1997) argues, that a positivist researcher will precisely measure selected quantitative details about thousands of people and use statistics, whereas; an interpretive researcher may live for years with a dozen people and use careful methods to gather large quantities of detailed qualitative data to acquire an in-depth understanding of how they create meaning in everyday life.

An important criticism of interpretive social science is that it treats all views as equal, irrespective of whether or not they are on the right side of social justice (Neuman, 1997). Critical social science is similar to interpretive social science in that it acknowledges the social context within which people exist. However, this approach deliberately enquires from a moral perspective, and as a result does not treat all views as equal. Critical social science is seen as an advocate for social justice, and tackles prejudice in whatever sphere of society it manifests itself – including sexism, racism and other forms of discrimination (Neuman, 1997). The table below displays differences in approaches.

**Figure 22: Differences between Approaches to Research**

|                            | <b>Positivism</b>                                                  | <b>Interpretive Social Science</b>                                        | <b>Critical Social Science</b>                                       |
|----------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------|
| <b>Reason for research</b> | To discover natural laws so people can predict and control events. | To understand and describe meaningful social action.                      | To smash myths and empower people to change society radically.       |
| <b>Theory looks like</b>   | A logical, deductive system of interconnected definitions, axioms, | A description of how a group's meaning system is generated and sustained. | A critique that reveals true conditions and helps people see the way |

|                                          |                                                                               |                                                                                          |                                                                                            |
|------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
|                                          | and laws.                                                                     |                                                                                          | to a better world.                                                                         |
| <b>Good evidence</b>                     | Is based on precise observations that others can repeat.                      | Is embedded in the context of fluid social interactions.                                 | Is informed by a theory that unveils illusions.                                            |
| <b>Place for values</b>                  | Science is value free, and values have no place except when choosing a topic. | Values are an integral part of social life: no group's values are wrong, only different. | All science must begin with a value proposition; some positions are right, some are wrong. |
| Source: Adapted from Neuman, 1997, p. 83 |                                                                               |                                                                                          |                                                                                            |

### 3.3.1 Qualitative Methodology

The most suitable option for the interpretive social science approach to research is a qualitative methodology (Babbie & Mouton, 2012). Qualitative methodology was employed in this study. This approach allows the researcher to apply a theoretical framework in seeking to find answers to the research questions through theory. The theoretical framework draws upon disciplines of public policy, economics, and management theory. The premise of using a qualitative approach is that it advocates the use of theory to test a social phenomenon. The goal of qualitative research is to understand issues or particular situations by investigating the perspectives and behaviour of the people in these situations and the context within which they act.

(Berg, 2007) states that qualitative research refers to the meanings, concepts, definitions, characteristics, metaphors, symbols and description of things. On the one hand, (Creswell, 2009) suggests that a good qualitative approach is characterised by the following attributes:

- Research study is conducted in the field, allowing direct interaction with the people being studied in their context.
- Researchers collect data themselves by examining documents, observing behaviour or interviewing participants.
- Multiple sources of data are preferred to a single source; this requires the researcher to review all data, make sense of it and organise it into categories or themes that cut across all sources.

- Researchers often build their patterns, categories and themes from the bottom up (inductive analysis).
- The focus is on learning, the meaning participants hold rather than the meaning brought in by the researcher.
- The qualitative researcher interprets what is seen, heard and understood. This must be seen in the light of the researcher's background, history, context and prior understanding.
- The researcher tries to develop a complex picture of the problem or issue by reporting multiple perspectives and identifying multiple factors involved.

It can be concluded that qualitative studies invariably have multiple perspectives. There isn't a single truth but the truth is influenced by the different school of thought the researcher alludes to. A common characteristic amongst them is that they all entail in-depth examination of phenomena in their natural or real world environment (Leedy & Ormrod, 2005)

### **3.4 Case Study**

#### ***3.4.1 Description of case study types***

(Babbie & Mouton, 2012) describe the case study as an intensive investigation of a single unit. During a case study conduct, multiple perspectives are taken into account to attempt to understand the influences of multilevel social systems on subjects' perspectives and behaviours (Babbie & Mouton, 2012). The defining characteristic of a case study becomes an emphasis on an individual unit. (Babbie & Mouton, 2012) refer to the various case study types which are tabulated below:

| Types of Case Studies                              |                                                                                                                                                |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Individual Case study                              | Involves a detailed account of one person.                                                                                                     |
| Community Studies                                  | The focus is on a description and analysis of the patterns of, and relations between, the main aspects of community life.                      |
| Social Group Studies                               | Studies of both small direct contact groups and larger more diffused groups.                                                                   |
| Studies of organisations and institutions          | Focus is on a firm or company. Focus is on organisational culture, policy implementation and evaluation, process of change and re-engineering. |
| Studies of events, roles and relationships         | Focus is on a specific event e.g. doctor-patient interactions.                                                                                 |
| Studies of countries and nations                   | Focus is often comparative. e.g. Studies of foreign policy where the focus is on a country or bloc of countries.                               |
| (Source Adapted from Babbie & Mouton: 2011) p. 281 |                                                                                                                                                |

**Figure 23: Types of Case Studies**

According to (Leedy & Ormrod, 2005) case studies are useful for learning more about a little known or poorly understood phenomenon. For the purposes of this study, a case study approach is adopted as there is very little known about m-health. It is identified as a suitable research methodology since it studies a contemporary phenomenon in its natural context. It is deemed more relevant for investigating complex real life issues, involving humans and their interactions with technology (Host, 2009). It is further argued that a case study method is normally employed for a variety of purposes including: description, exploration, prescription, and theory building (Gable, 1994). The use of case study methodology, allowed the researcher to observe certain behaviours within the environment. The case study approach allowed the researcher to conduct an intensive investigation into the use of mobile applications and lessons learned thereby in the delivery of health services in the Tshwane area.

### 3.4.2 Case study Approach in Action

The researcher, spent time in the field both at the Daspoort clinic which is a pilot site for the National Health Insurance. She observed how the officials embraced re-engineering and the use of mobile applications for enhanced health service delivery efficiency. She observed how the community health workers utilised the applications and the different modules. She engaged with several role players through scheduled in-depth interviews and casual discussions. The case study approach was a salient enabler and effective approach to establish the lessons for policy in the rollout of mobile application or use of m-health in bridging the health access gap.

In this study the researcher was able to establish a golden thread and establish interdependencies that intertwine m-health as a mode of service delivery, its dependency on an established e-health strategy and identifying lessons learned.

### 3.5 Population and Sampling Process of Key Informants

Purposive sampling was used for the purposes of this study. (Neuman, 1997) refers to this method of sampling as exploratory in nature and acceptable in special situations. It uses the judgement of an expert in selecting cases with a specific purpose in mind. It allows the researcher to select unique cases and members that are difficult to reach. It allows further in-depth investigation.

The universe was composed of knowledgeable expert representatives from the Innovation Hub, Geomed, Community Health Workers, university of Pretoria, Department of Science and Technology and the Department of Health. Geographically, the focus was on Tshwane City and Daspoort Clinic.

**Figure 24: Population size**

| Representatives                    |   |
|------------------------------------|---|
| Geomed                             | 2 |
| Innovation Hub                     | 2 |
| Department of Science & Technology | 1 |

|                                                                            |   |
|----------------------------------------------------------------------------|---|
| University of Pretoria: family Medicine Department.<br>Daspoort Polyclinic | 3 |
| University of Pretoria: family Medicine Department.                        | 1 |
| Department of Health                                                       | 1 |
| Community Health workers                                                   | 5 |

## 3.6 Data Collection Tools

### 3.6.1 *Description of the tools used to conduct and record results*

For the purpose of this study personal observation followed by unstructured and fully structured face to face interviews were used. The advantage of this approach is that it assisted the author to capture what people say through words, gestures and tone. Given the fact that not much research has been done, specifically, on the role that m-health plays in bridging the health access gap, elements of exploratory research may have featured.

In order to answer the sub-questions, in-depth interviews with the use of open-ended questions were used. The advantages of open-ended questions as (Neuman, 1997) states are that they permit an unlimited number of possible answers. Respondents can answer in detail and can qualify and clarify responses. Unanticipated findings can be discovered that permit adequate answers to complex issues, and allowing creativity, self-expression and richness in detail. They also reveal a respondent logical thinking process and frame of reference.

These interviews were conducted to examine the following themes which formed the basis for the semi-structured interview schedule development.

**Theme 1: Lessons learned in rolling m-health initiatives** and associated challenges.

**Theme 2: Legal and regulatory framework** – laws and regulations that affect the use on mobile technology in bridging access to public health.

**Theme 3: Usability Trust** – Assess the accessibility to technology platforms (m-health applications, devices etc.) by potential m-health users – community health workers.

**Theme 4: Affordability** – The technology used and its affordability.

**Theme 5: Technology literacy**– Assess the ability of m-health users to use the m-health applications based on their general literacy.

The author systematically used the following research tools for data collection.

**Figure 25: Data Collection Tools**

|                                      |                                                                                                                                                                                        |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Observations                         | Observations were applied in order to investigate how a certain task is conducted. Minimal video recording was done. Note taking was applied.                                          |
| Unstructured interviews              | How individuals qualitatively experience the phenomenon. This was captured by audio recordings and applying a think aloud method. Asking them questions as they carry out their tasks. |
| Fully structured in-depth interviews | Establish a relation between constructs. This was captured by audio recordings. An interview guide adopted from Industry Canada was used.                                              |

The following represented the plan that was used to solicit the necessary permission:

### **3.6.2 Soliciting Permission for Data Collection**

A great part of this research exploration included a snowball effect. Discussions began at the Innovation Hub with Mr Maleho in March 2012. The intention was to study the Tshwane e-health Living Lab, which in essence was a stepping stone to m-health. The researcher soon discovered that due to funding, the project was now run by the University of Pretoria. Daspoort Clinic is run by the University to give medical students from their second year of studies exposure to community service. There are assigned doctors, nurses, administrators and Community Health Workers.

The researcher was referred to the Daspoort Clinic by the Managing Director of Mezzamine / Geomed which does mobile application and development of m-health services. A considerable amount of time was spent in the field, exploring, observing and trying to understand the overall use and impact of mobile applications in bridging the health access gap.

### **Negotiating entry into Research Site -Daspoort Clinic:**

- Contacted Ellenore via e mail; to discuss the scope of the study.
- Provided a detailed description of the research objective and shared a high level research questionnaire.
- Highlighted the benefits of the derived outcomes of the study to the institution, Community Health Workers and the researcher.
- Sought permission for using the Daspoort Clinic as the case study to be researched.
- Once participation was agreed upon, a sensitisation meeting was held with each research respondent individually.

Respondents were given a brief introduction to the study that included the problem statement, aims and the rationale.

The process below as adopted from (Neuman, 1997) was followed by the researcher in the field.

### **3.7 Ethical Considerations**

Ethics arises as a result of the risks that respondents take when disclosing confidential information to the researcher. According to (Patton, 2002) respondents could be uncomfortable with some questions during the interview and reveal information that 'was not intended to be revealed'. When human beings are the focal point in any investigation, there are ethical issues that require careful consideration. Qualitative researchers in this instance are "guests in a private space of world, where their manners should be good and their code of ethics strict". This implies that researchers need to respect the rights, needs, values and desires of their respondents. Having stated this, it is crucial for the researcher to establish the truth at all times while ensuring that the welfare of the respondents is protected. Moreover, it is fundamental that respondents should be willing to participate in the study at their own free will. The overall conduct and the process that is followed must ensure that the necessary permission to access the research site is obtained. In this study, this did not pose a problem as the researcher was referred by credible officials from the Innovation Hub and the mobile application developers

themselves. Although the researcher came with strong support and recommendation from the project partners, cognisance was taken in ensuring that confidentiality is maintained. Anderson 1998 states, "Ethics in research includes the following key concepts: protection from harm, informed, consent, right to privacy and honesty with professional colleagues". These key principles were upheld in the execution of this case study research. Informed consent was obtained from all respondents who were invited to voluntarily participate in the study. To this effect a written consent sheet was handed to all respondents to indicate their consent.

### **3.8 Instrument Development and Data Collection Process**

Intensive primary research through informal and open-ended questions was carried out to collect data. Secondary research was conducted to complement qualitative data. There is a wide variety of data collection approaches available. For the purposes of this case study, two sources of data were drawn upon in the form of personal interviews with key stakeholders and an analysis of secondary data.

The researcher employed the use of semi-structured interviews as a "general interview guide approach" (Patton, 2002, p.280). The researcher developed a series of interview schedules and crafted specific questions that were appropriate for the research respondents. The schedules allowed the researcher to be flexible and responsive to unexpected outcomes and discoveries made during the interview. Hence "the interviewer remained free to build a conversation within a particular subject area, to word questions spontaneously and to establish a conversation style – but with the focus on a particular subject that had been predetermined" (Patton, 2002). Case Study researchers depend almost entirely on lengthy interviews with a carefully selected sample of participants (Leedy & Ormrod, 2005).

### **3.9 Individual Interviews**

The individual interview is an established data collection method in qualitative research (Babbie & Mouton, 2012). There are various types of individual interviews employed in qualitative research; they include open-ended interviews, focused or semi-structured interviews. In an open-ended interview, the researcher is able to question and probe – which gives participants

the space to respond in their own words (Babbie & Mouton, 2012). In a semi-structured interview, the researcher is guided by the interview protocol. This research study uses the semi-structured interview approach. As with the research sub-questions, interview protocol is structured to mirror the five themes around which the analytical framework is structured.

The semi-structured interview allows the researcher to engage the participants and collect their responses by personal means from personal interaction. Furthermore, in all interviews a tape recorder or dictaphone is used to ensure accurate data collection. The interview is preceded by a brief introduction, which outlines the purpose of the study and some of the key principles that guide it – e.g. confidentiality. The interviewer also records valuable demographic data before the interview begins – e.g. name, company, etc. The content of the interview is broken down into five sections:

| Theme                                               | Sub-Question                                                                                                                                          |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lessons Learned in rolling out m-health initiatives | What are the lessons learned for policy and regulation in the deployment of mobile health applications to bring public health services to the people? |
| Legal and regulatory framework                      | How do laws and regulations affect the use on mobile technology in bridging access to public health?                                                  |
| Trust                                               | Is there a need to deploy the Living Labs Concept to rollout m-health services?                                                                       |
|                                                     | How are m-health and the use of mobile applications deployed and used by primary health care workers?                                                 |
| Affordability                                       | Is the used technology affordable and easy to deploy by health entities?                                                                              |
|                                                     | Is the used technology affordable and easy to use by end users (CHW)?                                                                                 |
| Technology Literacy                                 | How intuitive are the applications and modules used to carry out primary health care?                                                                 |

## Figure 26: Research themes and sub-questions

As stated, the premise of this research methodology is qualitative. The researcher spent a considerable amount of time in the field at Tshwane. In that process, primary and secondary research was deployed. The researcher spent time observing how service is rendered and how the mobile application modules are used by the Community Health Workers to disseminate primary healthcare. Interviews were conducted with the Community Health Workers; recordings were made through the dictaphone and transcribed. The researcher also observed body language or unspoken words while the Community Health Worker engaged the different mobile applications to disseminate the primary healthcare service. Interviews were carried out with key participants in various organisations such as: Geomed, TeLL, University of Pretoria, Department of Science and Technology, Daspoort Clinic and Department of Health. The Key participants interviewed ranged from Professors, Managers, IT specialists to Health Professionals and Community Health Workers. The interview guide was modified from time to time to extract rich information from the different subject experts.

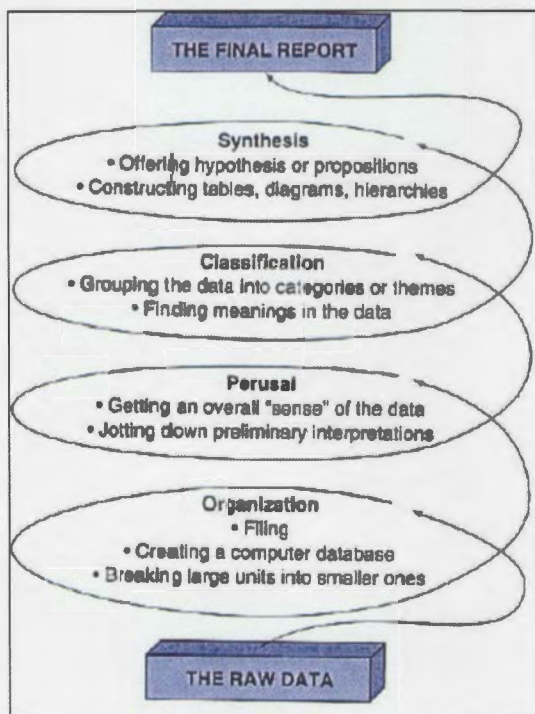
This analysis approach involves going through the data several times taking the following steps:

- Organisation of the data, using cards, folders or a database. Large bodies of text are broken down into smaller units, in the form of sentences or words.
- Perusal and interpretation of the data several times to get a sense of what it contains. This involves writing memos in the margins which suggest possible categories or interpretations.
- Categorisation and establishing themes and patterns and then classifying each piece of data accordingly. At this point a general sense of patterns will emerge.

The central task during the data analysis was to "identify common themes in people's descriptions of their experiences of the use of mobile applications to bring public health services to the communities" (Leedy & Ormrod, 2005). Importantly, the unearthed data was classified and analysed in terms of the themes from the analysis framework – which took the same structure as the interview protocol. The researcher looked wider than the views of individual role

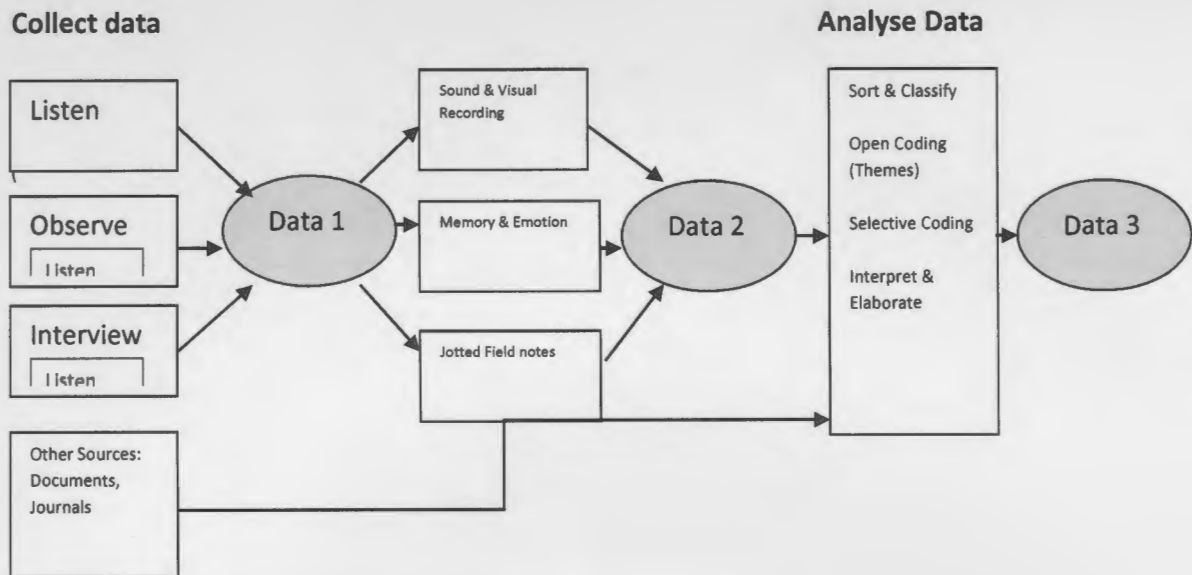
players on the issues raised and also took into account the views of groups of role players and how they related to each other. Finally, the researcher pulled together all the themes to create a singular picture of the lessons learned during the use of m-health.

The author acknowledges that in a case study analysis, ideas and evidence are mutually interdependent, (Neuman, 1997). Therefore, qualitative data analysis including successive appropriation and analytic comparison were used to analyse and interpret the data. Successive appropriation allowed for the researcher to modify concepts before reaching conclusive evidence. According to (Leedy & Omrod, 2005, p.150), there is no single 'right' way to analyse the data in a qualitative study. However, this research described the procedure of data analysis and linked this to the conceptual framework. A spiral data analysis approach as described by (Leedy & Omrod, 2005, p.106) and as depicted below in figure 27 is adopted.



**Figure 27: Spiral Data Analysis Approach**

Source: Leedy & Ormrod, 2005, p.106



**Figure 28:Data Collection Process and interpretation**

Source: Neuman, 1997

### ***Significance of the Proposed Research***

It is anticipated that the findings of this study will offer guidance to policy makers; it will provide key lessons learnt in deploying mobile applications to enhance the public health service delivery. The research will lead to recommendations on the effectiveness of mobile applications (m-health) in bridging the health access gap.

### **3.10 Limitations of the Research**

The single-case study approach employed in this research limits the extent to which one can fully assess the impact of mobile applications in bridging the health access gap and therefore, coming up with extensive lessons learned which is the focus of the study. However, it paves the way for a similar undertaking on a bigger scale. The researcher considers the overall state of health and how service is delivered. Consideration is given to the e-health Strategy and the National Health Insurance, two policies aimed at addressing the improvement of the health care service delivery. In Tshwane specifically, consideration is taken on the desire to pioneer the City

again using the Smart City Model, this in essence sets the tone for innovation, hence the consideration on the deployment of Living Labs.

A careful consideration was placed on how Tshwane (Daspoort Clinic) embraced e-health/ m-health and the use of mobile applications in re-engineering primary healthcare service delivery and implementing door to door municipal ward based health services. Although this research study is focused in Tshwane, it is anticipated it will provide insight to key lessons learned in the deployment of mobile applications towards improved door to door municipal ward based health services. Other municipalities can derive values and aims for improved public health service delivery.

### **3.11 Summary**

The research design and methodology of this study was presented in much detail in this chapter. An overall research methodology outline was discussed and was inclusive of data collection sources and instruments, the manner in which permission was solicited, sampling, data analysis, reliability and validity, respondent validation, ethical considerations and finally the limitations of the research. Overall, this chapter explained the manner in which the research was conducted. The following chapter provides the findings that this research sought to accomplish.

## CHAPTER 4 RESEARCH FINDINGS AND INSIGHTS

### 4.1 Format of presenting research findings

This chapter presents the findings of this case study which is a product of field research; where the researcher spent ample time walking the path of those who bring Primary health service to the residents of Tshwane. It presents the outcome of in-depth one to one interview with research respondents and document analysis. Interviews were used as the data collection method to address the research question whether mobile applications are an effective tool for bridging the health access gap. In this chapter the qualitative evidence obtained from these interviews is reviewed and the key findings of the evidence is presented.

Key respondents in this case study included officials at the Innovation Hub, Department of Science and Technology, Department of Health, Mobile Health Application Developers at Mezzanineware (GEOMed), Professors at the University of Pretoria (Family Medicine), Doctors and nurses at Daspoort Clinic, and Community Health Workers. Some level of magnitude is placed in presenting the data in a format that aligns to the themes identified; for a logical and coherent synthesis of data. All assertions made by research respondents are suitably highlighted under each of these themes.

The first theme dealt with the lessons learnt in rolling out the m-health initiatives. It explored the role of m-health in the deployment of primary health care services. The objective was to derive at some key lessons and narrate their relevance for policy and regulation particularly on e-health, living labs and mobile applications that are used in health outreach programs at community level.

The second theme explores the legal and regulatory framework necessary to the deployment of m-health services. While the researcher acknowledges that the National Health Policy, e-health strategy and Protection of Information Act were all enabled or rolled out to address a social and economic need, it is imperative to understand how the implementers of community health services are protected by law. Are there guiding regulatory principles that govern their conduct? Do laws and regulations affect the use on mobile technology in bridging access to public health/ primary health care?

The third theme investigates the relevance of the Living Labs. It must be borne in mind that Living Labs call for collaboration between all the stakeholders to enable the process of innovation to happen. The focus of this research was to understand the role of Living Labs on innovation and how the users of mobile applications and the associated stakeholders have adopted the concept. An additional focus was on understanding how the resultant innovation derived from the Living Labs in the form of new technology is adopted, appreciated and used by primary health workers. The researcher assessed the confidence and trust that community health workers have on mobile applications and how they accessed the m-health platform.

The Fourth theme examined two aspects that relate to the aptitude of the users and the cost of deploying the m-Health solution as well as maintaining it. The researcher assessed the users' aptitude to interact and use the mobile applications to collect data from the patients. An attempt was made to quantify the cost of deployment and maintenance of the mobile applications and the platform. The aim of quantifying the cost was to establish the amount of money that would have to be budgeted to roll out the m-Health solution. The estimated amount that will be arrived at will be useful in guiding the policy makers and custodians of the budget. The question that must be answered clearly: is the m-health applications and platform affordable to roll out across the primary health care?

The fifth and final theme focused on the relevance of mobile applications on enabling users to access m-health platform and the ease of use thereof. The researcher aimed to establish the usability of the mobile applications. Based on the aim of this theme, it was important to understand if Community Health Workers felt that the new technology has brought efficiencies to how they carry out their primary health care tasks.

The respondents had different views however these views were found to be in line with the government's public health re-engineering process. The respondents generally acknowledged the impact of mobile applications on primary healthcare service delivery.

The overarching synthesis in this case study considered the current health policy status, the introduction of the National Health Insurance Policy and its impending objectives. The researcher believes that consideration must also be placed on the e-health strategy as well as the Protection of Information Act. These three pieces of documents set the premise for the

review of policy and legal framework for m-health as outlined after the schedule of research respondents.

**Figure 29: Schedule of Research Respondents**

| <b>Respondent Code</b> | <b>Company</b>                                                                | <b>Title</b>                  |
|------------------------|-------------------------------------------------------------------------------|-------------------------------|
| ER 1                   | University of Pretoria                                                        | Doctor- family medicine       |
| DD 2                   | University of Pretoria: family Medicine Department.<br>Daspoort Polyclinic    | Doctor- Daspoort Polyclinic   |
| DD 3                   | University of Pretoria: family Medicine Department.<br>Daspoort Polyclinic    | Doctor - Daspoort Polyclinic  |
| UP 4                   | University of Pretoria                                                        | Professor                     |
| MD 5                   | GEOmed/ Mezzanineware                                                         | Managing Director             |
| MA 6                   | GEOmed/ Mezzanineware                                                         | Mobile Applications Developer |
| ST 7                   | Department of Science & Technology                                            | Director                      |
| IH 8                   | Innovation Hub                                                                | Senior Manager                |
| IH 9                   | Innovation Hub                                                                | Manager                       |
| DH 10                  | Department of Health                                                          | Senior Manager                |
| HW 11                  | Community Health Workers: University of Pretoria- Family Medicine Department. | Senior Manager                |
| HW 12                  | Community Health Workers: University of Pretoria- Family Medicine Department. | Senior Manager                |
| HW 13                  | Community Health Workers: University of Pretoria- Family Medicine Department. | supervisor                    |
| HW 14                  | Community Health Workers: Daspoort Clinic                                     | Community Health Worker       |
| HW 15                  | Community Health Workers: Daspoort Clinic                                     | Community Health worker       |

## 4.2 Policy and legal framework implications for m-health

According to the census conducted in 2011, the population of South African has grown to just over 50 million people. With this growth trend, there is a corresponding growth in the burden of disease which is confronting the country. The country is faced with a quadruple burden of:

- Diseases consisting of HIV & AIDS and TB,
- High maternal and child mortality,
- Non communicable diseases,
- Violence and injuries.

To circumvent the situation, the country introduced the National Health Insurance in 2011 and it has become part of the health policies that are aimed at revamping the health sector. The initial focus of the national Health Policy is on the piloting programme and re-engineering of the Primary Health care system. Subsequent to the introduction of the National Health Insurance, the e-health strategy was introduced In September 2012.

The primary healthcare re-engineering or make over brought with it a major mind set shift from curative to preventative and the promotion of wellness. It is a ward based outreach initiative and location based approach to Primary healthcare. The South African health system is largely paper based where the majority of patient records are recorded on paper and stored away in filing cabinets. These records are not easily accessible even in the medical facilities where patients present themselves to access medical assistance. The medical records of the patients may even be held at various locations where the patient has presented themselves to and none of these records may ever be consolidated as long as they are still paper based. It has been recognised that these paper based records must be converted to electronic records to enable efficiency and effectiveness of health care service delivery and to deploy the m-health solution. It must be noted that various attempts have been made by four provinces (Gauteng, Limpopo, KwaZulu Natal and the Western Cape) to implement Health Information Management Systems to automate the capturing and storage of patient information and consultation.

It has been discovered that the success of deploying any system or technology rests in the quality of data that is captured and retrieved in the form of reports with key insights. The m-health solution has brought to the fore the urgent need to move from the heavily paper-based system to a system that can be accessible to a wide range of users. Innovative interventions are therefore required to enable a giant leap from the manual to the automated state. mHealth addresses a specific part of this automation as it enable the capturing and updating of information in real time and storing it in a server that will make the information available for years to come. With this in mind the key participants were asked to reflect on the need for a mHhealth policy and legal framework to guide the conversion of paper based information to electronic records and to deal with the resultant issues of access to information and how the information is protected from abuse. The aim of probing for responses on the implication of having electronic records on the policy and legal framework was to gain first-hand information from them based on their experience. it is the experience of the researcher that in as much as technology and electronic systems are desirable and play a key role in improving efficiency and streamlining processes, the legal and ethical consideration must be considered.

The researcher discovered that, there is an overwhelming need and support for a m-health policy and legal framework. Respondents stated the policy and legal shall provide a conducive environment in ensuring that the rules of the game are clearly defined. Users must feel comfortable that they are protected by law as they carry out their work. Safety and quality assurance must be a priority for both users and providers of health services when deploying the m-health solution. In probing for answers, it was discovered that participants were thinking about issues of policy and regulation requirements in a wider sense. Thus, they did not confine themselves to the policy and regulation requirements with respect to m-health only, but extended it to e-health as they thought that m-health is part of e-health. One participant (JR 4) said: *"in fact we should not be talking about m-health only in isolation of e-health in general because m-health is just a component of e-health or ICT health". He continued to state that "m-health is a technology function. There is no difference between e-health and m- Health".*

The respondents acknowledged that there is a South African e-health policy and m-health is mentioned in the policy. One respondent (ER 2) stated: *"look at the health policy and look at the communication policy of the country, then the information policy, Health, Communication, Information, Science and technology, those are the intersecting policy functions, the e-health*

*Policy exists*". To some of these participants, e-health extends to other policies of different departments. In other words, these participants are of the opinion that if there is a health policy, communication policy, information policy, science and technology policy; integration of these policies will be equal to e-health policy. This wave of thinking may be acceptable if such policies refer to issues of malpractice and other guidelines that are pertaining to m-health. If, for instance, a patient did not get a SMS on important results, who will take responsibility if there is no policy or legal framework that deals specifically with such risks? Although these policies exist they are not addressing m-health policy and legal issues. Another example: if a malpractice is taken to a court of law because of m-health, which policy or legal framework will be used in analysing the case? Surely, all of the above policies as mentioned by participants will not apply as they do not deal with specific issues that are m-health specifically. Over and above the Health Policy and Act, the country needs to develop an e-health policy and legal framework that includes m-health.

Participants made it clear that m-health is a technology enabler and it must be understood as such. The overriding policy is e-health and there is no specific requirement for a standalone policy on m-health. Participants reviewed the implication of a policy on m-health, as having astounding impediments except that e-health/ m-health are overdue in a highly mobile saturated country such as South Africa. Respondents further reflected that the issue of policy can be reviewed based on accomplishments and possible shortcomings as well as the lessons that emerged from implementing some policy objectives.

As a country, South Africa has realised accomplishments with the introduction of the National Health Insurance, the e-health strategy, and m-health is perhaps to follow. However, some respondents differ on one critical issue; that in the execution or implementation of these policy objectives one grasps the lack of collaboration as reflected by disjointed efforts in project implementation. There are existing silos which stretch the limited capacity skills and expertise in the country leading to poor accomplishment of various projects. Respondents believe that this occurs because there are few collaborative policy measures and regulations in place for e-health and m-health. For key informants, these silos that are observed in project implementation and management have extended to an area of enablers which are ICT systems in this case.

The issue of system interoperability is another shortcoming in the country; despite the fact that the State Information Technology Agency (SITA) was established to ensure interoperability of

systems, this problem is currently plaguing the government. There are policies and legislation to govern system interoperability in the country but these seem to be ineffective. One participant asked: *"What makes us believe that the e-health or m-health policy and regulation will make any difference if current policies and regulations are not implemented?"* He (JR 3) continued: *"on the m-health initiative, there is no absolute buy in from the funders leaving projects with poor funding, while monitoring and evaluation of health workers is finally possible, there is no clear regulatory framework that guides Community Health Workers' conduct"*. He continued: *"if there is a case of misconduct among Community Health Workers how is that dealt with in a vacuum of policy or regulations? These individuals will be victims of criminal justice as criminal law will be the only law available rather than e-health law"*.

These results reveal quite a number of lessons that have been identified rather than learned. Participants have identified lessons such as: (i) operating outside a m-health policy and legal framework is very risky. (ii) Poor co-ordination of initiatives as a result of a lack of a collaborative policy and regulation results in silo efforts which lead to limited results. (iii) Community Health Workers although they are part of the m-health project are not covered by any legal framework thus they can be exposed to criminal justice. (iv) a m-health policy and legal vacuum result in poor buy in of m-health project as managers are not accountable to take the project forward (v) poor end of project plan as funded by donors leads to the death of m-health.

The regulatory framework was seen as a guiding principle. However, one of the concerns highlighted was that there is still a need for much clearer guidance and mentorship at a national level for m-health. One participant (JR 3) stated, *"We need guidance on those three layers of the legal and regulatory framework. What we currently do is we've derived our own understanding as to what the law requires. So in our function and services delivery, we took all of those acts and say what functions within these acts do we need to accommodate or comply or adhere to in delivering our service?"* These results reflect frustration and despondence among those who are involved in m-health. **Lesson identified is that where there is no policy and regulatory framework low morale and uncertainty prevails.**

In summary, m-health is part of the journey and it seems it will take a while before we arrive at the right destination. Below is summary of some of the accomplishments and shortcomings as highlighted earlier on.

**Figure 30: Summary of Policy Accomplishments and perceived shortcomings**

| Accomplishments                                                              | Shortcomings                                                          |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>National Health Insurance</b>                                             | <b>Lack of Collaboration</b>                                          |
| 1. Re-engineering Primary Health Care                                        | 1. Disjointed approach to projects                                    |
| 2. Allows innovation for better primary care service delivery                | 2. Lack of sharing due to 'silo' based approach on strategic projects |
| 3. In support of initiatives that strengthen the Health system effectiveness | 3. Lack of requisite skills                                           |
| 4. promotes early detection and prevention of diseases                       |                                                                       |
| <b>e-health Strategy/ plan</b>                                               | <b>Real time records and systems interoperability</b>                 |
| 5. m-health evolution                                                        | 4. System integration                                                 |
|                                                                              | 5. Clinics governance                                                 |
| <b>m-health</b>                                                              | <b>m-health</b>                                                       |
| 6. Enables monitoring and evaluation of community healthcare workers         | 6. Funding                                                            |
|                                                                              | 7. No clear regulatory framework that guides CHW conduct.             |

Source: Holeni, 2012

## 4.3 Living Labs

### 4.3.1 Views on living labs from stakeholders

Having looked at the National Health Insurance Policy objectives, it is extremely essential to recognise that both policy objectives embrace innovation and enhancements to the health systems and processes. The Living Labs concept is greatly acknowledged by most respondents as a platform or thinking tank for innovation. Participants in various organisations were asked to provide their views regarding the Living Labs and the lessons they have learned in using this platform to provide health services.

Respondents explained that the e-health Living Lab is an affluent concept that allows for innovation. It provides system integrators, developers or anyone with a great idea that

addresses a social or economic opportunity to work on their idea and present it to the funders for the solution to be implemented. The Living Lab is viewed by participants as a m-health innovation platform.

One participant (ER 2) at the University of Pretoria commented: *"The Department of family medicine at the University of Pretoria as an entire Department is committed to the concept of the health Living Lab"*. She said: *"So with our focus on community orientated Primary healthcare, we believe that technology should be harnessed to bring about better health outcomes. She continued: "we are therefore exploring options such as the hand held device and linking networks to better our outreach programmes"*.

*The lessons identified regarding the Living Lab are positive. Firstly, the Lab is observed as an innovation platform that can improve health service delivery. Secondly, those who are intimately involved with the Living Lab are committed to ensuring that it works and this suggests that a great deal of commitment, enthusiasm and passion are key factors to the success of m-health"*.

#### **4.3.2 Accessibility and Affordability of Living Lab leading to m-health**

Respondents were asked to deliberate on accessibility and affordability of the Living Lab including m-health. Respondents in the solution development institution expressed their views in confidence regarding the overwhelming success of mobile technology. This success was not acknowledged by the developers only but by other participants operating at different levels. One respondent who is a solution developer echoed the following about the Living Lab: *"The idea was to leverage on the up take of mobile and endorse or open ways for access to health services"*. This statement is pregnant with passion and enthusiasm on the perceived possibilities brought about by m-health.

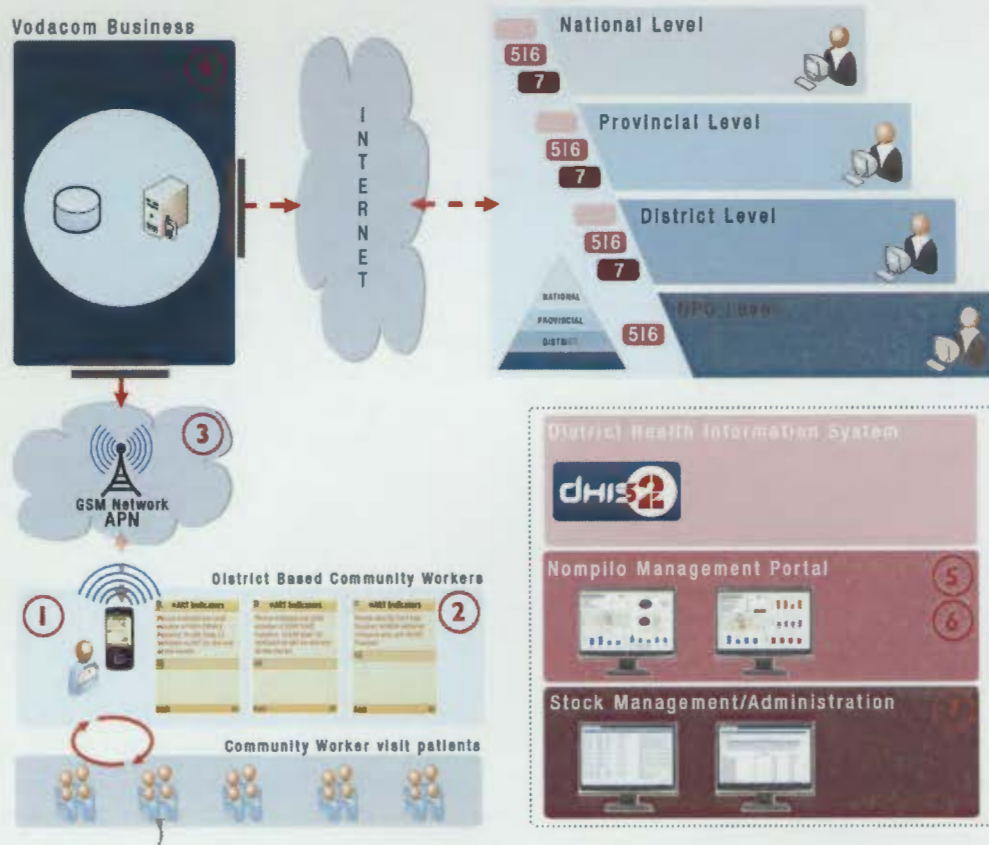
Some participants further reported that there are three components which are critical for mobile contribution to health: a) Enhance access to health services. b) Increase quality of service at the point of care. C) Cost efficiency of providing these services". Increase of quality of service at the point of care is the essence of e-health, and health informatics. Therefore the Living Lab platform and m-health are at the centre of patient safety.

Practical references were made to some of the initiatives that respondents had been involved with other organisations such as Love Life which uses the m-health technology. *“Love Life has mobile workers who are called ground breakers. These ground breakers use mobile technology to visit the schools to provide material on HIV/Aids, sexual wellness and record all their visits or transactions on a mobile phone”*. The general use of mobile technology in health within South Africa has gone beyond any one’s imagination. However, what is of concern is the extent to which the use of these mobile gadgets and application are in line with health regulations and policies, a matter that was alluded to above. Could it be that such a ground breaking technological discovery of m-health is contravening the law and violating the constitution? This question requires an urgent answer in the form of a policy that takes all the aspects of other pieces of existing legislation to give birth to regulations that will govern the development, deployment, usage, standards and access.

#### **4.3.3 m-health at the City of Tshwane**

The researcher visited Tshwane in order to obtain a complete picture of what constitutes this m-health technology. The Mobile Health Enabling Platform in Tshwane is commonly explained by the developers as a centralised m-health service environment that enables cross platform health and social care service deployment by 3rd party service providers.

The m-health functionality affords community healthcare workers the ability to deliver content and execute other services via a cellphone. There is also a location based component and wellness solutions. This solution is integrated to the department or the clinic monitoring and evaluation systems. A typical workflow is presented in the diagram below.



**Figure 31: m-Health workflow in Tshwane**

Source: (Geomed, 2010)

With this solution, the Community Health Worker is given a cellphone that is configured with the relevant modules for them to carry out their duties. With the consent from the patients, information is gathered and captured on the cellphone and sent to the mobile health platform server through the mobile network, and breaking out into the internet, the information is received at the department or at the clinic. Through the Nompilo management platform the information is disseminated accordingly to the relevant stakeholders and action is immediately taken.

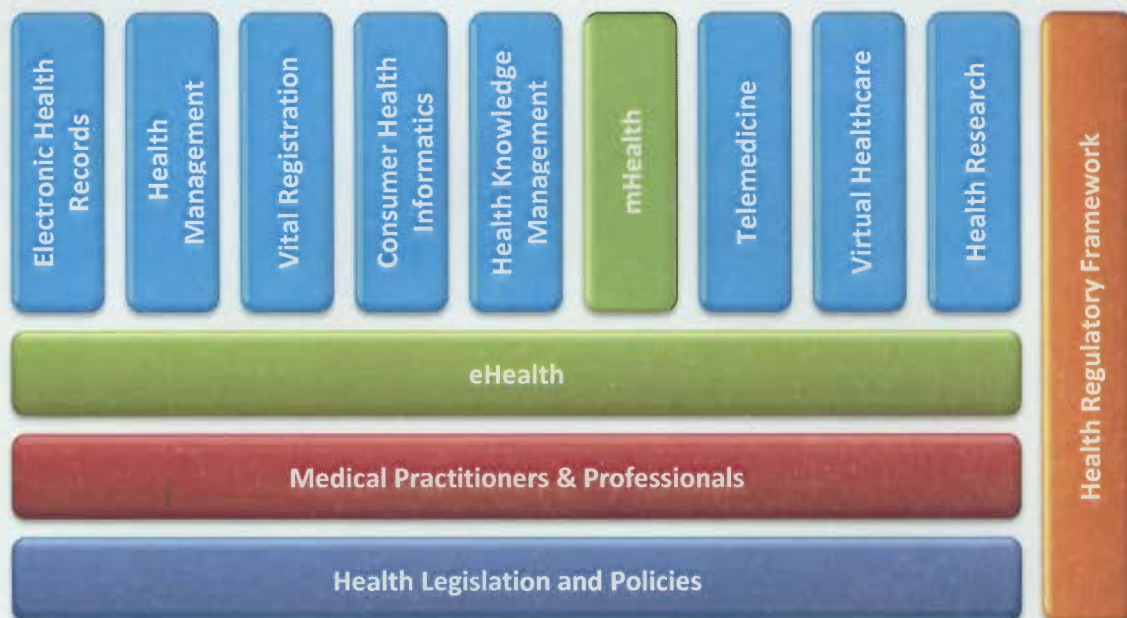
The relevance and use of m-health in this instance cannot be emphasised enough. Currently it allows for the immediate intervention and preventative measures to take place, hence the idea of a m-health 999 is not a “dream”.

Mobile has taken over most of everyday life activities and promises a world of greater possibilities than human kind has experienced in recent years. Mobile is considered a private

device and it's a tool that users rely on and use confidently. Some participants said: *"it is the only option"* while others said: *"it is more critical in Primary care"* others stated that *"Mobile technology fears no landscape and reaches most communities in different geographical settings, knows no boundaries and is not bound by time, therefore, it is the only reliable technology anytime and anywhere. It is actually as simple as that"* asserted one respondent. These statements reflect the accessibility that is provided by mobile technology and consequently the m-health. This means that m-health is ever accessible regardless of geographical positioning in the country. While this is correct, it should be borne in mind that mobile technology requires mobile network connectivity and availability. One would need to explore the consistency of network available from mobile service providers because if this is not constant, access it could become problematic. *The lesson that has been identified is that using mobile technology is a better option for delivery of health services through m-health. Also, another lesson learned is that ensuring connectivity is critical for such services to be rendered. It is available 24 hours a day for any m-health users and it is therefore better than an ordinary ambulance that leaves far away from the consumers of health services. This suggests that there is a need for an ambulance at users' disposal 24 hours through m-health to provide life saving first aid treatment while waiting for the ambulance. Therefore, the future includes "m-health 999" just as Netcare 911 does.*

In using m-health in the absence of a policy and regulatory framework, as alluded to earlier, some participants indicated that there have been attempts to develop an internal policy and strategy. These documents are not necessarily part of a national policy and regulatory framework as it ought to be in an ideal environment. As indicated above the policy and strategy is rather broad and not specific as it is derived from a wide range of other policies and regulatory framework. The results often reflect a health environment that has not been properly standardised and regulated. This poses challenges for patient safety as well as health professional protection of nurses, doctors and Community Health Workers. This leads to a question around the role of the Health Professional and Alliance Council, Medical Association of South Africa, Nursing Council of South Africa, Nursing Association of South Africa and Democratic Nurses' Association of South Africa. What role can these institutions play in order to influence m-health practice and the setting up of standards of practice in this area? A lesson identified in this regard is that *the lack of professional organisation in influencing practice and policy places health professionals at risk of litigation when things go wrong.*

On the other hand there was a common agreement that standards are more specific and they typically speak to health informatics. One responded (JR2): *"In the world there are about 215 of these standards, if one looks at risk management, how do we manage the risk of providing the m-health solution in a setting where paramedic use is a solution or a setting where specialist use is a solution and then this is an actual solution"*. The results led to the conclusion that e-health (m-health as component thereof) architecture is presented in the diagram below:



**Figure 32: e-health architectural model**

Source: Holeni, 2012 (Adapted from, DepartmentofHealth, 2012)

In order to develop a comprehensive e-health policy, synergies across all the individual stacks on electronic health must be harmonized. There is a prevalent interdependency that must be natured for an effective e-health policy to emerge.

## **4.4 Lessons learnt in the deployment of mobile applications to redress public health access**

### **4.4.1 Summary of lessons learnt in deploying mobile applications**

A mobile application in this context is commonly understood as a module used on the cellphone to assist in the rendering of Primary health care services. This view is also maintained in the Tshwane (Daspoort clinic) area where the Primary health care re-engineering is embraced. There are various health posts being set up around Tshwane, in partnership with the University of Pretoria (Department of Family Medicine), Department of Health and the Foundation for Professional Development. The objective is to effectively implement door to door municipal ward based health services. This is done to fulfill the National Health imperatives as set out by the National Health Insurance Policy.

The main focus and objective of this study was to identify lessons learned in the implementation of m-health to deliver health services. Participants were interviewed and asked to specifically explain the lessons they have identified and perhaps learned in the process of implementing m-health.

In the interaction with participants it appeared that there is a general recognition that health service delivery improvement is necessary in South Africa, a country plagued with limited health professionals to service the population. At community level, Community Health Workers who are mostly volunteers are deployed to render Primary health care services.

In this expedition, the researcher interviewed Community Health Workers, Professors at the University, doctors at the clinic, nurses, Department of Health officials and mobile applications software developers. The resounding challenge with the roll out of mobile applications in primary and public healthcare shifts from time to time.

For mobile application developers the biggest challenge is the *technology uptake by the public sector*. "Our biggest challenge has been to get our clients especially in public sector to take ownership of the initiative or intervention that we introduce".

The general view is that change management would play a bigger role with ensuring that the department adapts to using the new technology. The participant continued : *"One would think that the benefit of using a cell phone justify the change management process, but a lot of people are still resistant and getting buy in from government remains a challenge"*.

On the other hand, the university sees *the understanding of cost effectiveness* as a big challenge which *hinders innovation*. They argue that most solutions if taken to scale are cost effective and the same goes for the mobile applications. *"The major challenge is mobilising enough resources and not necessarily financial resources"* one informant indicated. Respondents argue the challenge is based on the fact that they go into communities where nothing exists, hence the importance of mobilising enough resources. Primary health care is mainly carried out by volunteers, and although training is offered working with a laptop some people are left uneasy. However, the cell phone provides familiarity and comfort to health workers. One participant (JR 4) said, *"We have to train our staff to be able to go on a paperless system; we have to now convert twelve thousand hand written files into electronic family files. So that's a major challenge for us, moving with the ideas, catching up with technology"*.

Although there was much anticipated resistance with clinical discipline as it is believed to have a very specific way of dealing with medicine, *"we found within our own department an overwhelming buying, it's coming from the top down and the bottom up"* one key informant (ER 1) reported.

The success of m-health at community level is dependent on early community involvement. One participant (NR 8) said *"I think early on community involvement, if the community is not informed, it doesn't help. And that's why we're trying to get local Community Health Workers and we've had these discussions for almost a year now to develop Daspoort into such a site and still only now we're going to install the electronic data capturing system in our clinic"*.

*"It takes very long to mobilise people, so that's definitely one of the challenges for us, you must be motivated and you must take your team with you"* one participant (ER 2) reported.

#### **4.4.2 Key Lessons identified in the implementation of m-health**

While m-health is considered as the 'next best thing' it remains vital to comprehend that this is a technology enabler and the complexity that comes with it like any other technology must not be imposed on the service users.

While there were varying views around the key lessons learned one respondent hinted: *"The key is to keep it as simple as possible, sell a proposition, don't sell a product or present and train and educate the benefit, the value proposition is critical not the technology"* commented one participant (JR 4). It is known that technology is not the problem; it is often created as a problem because of the lack of understanding of its critical components. It is all the soft issues that fall under technology that are important, which must be sold to the user.

On the other hand, miscommunication is highlighted as a challenge. One key informant reported: *"one of the problems with the current roll out at national level is lack of communication. We find out haphazardly that people in other provinces or regions or even within the same university or same city, are doing projects that are similar to ours. There is no collaboration, people should not see this as not a race against each other, it is a race against the diseases and the ailments of health"*! This is the problem cited earlier in this document and was associated with the lack of a collaborative policy and regulation.

The one thing most respondents attest to is that innovation is a never-ending process. What is one's achievement today requires enhancement or additional support tomorrow. It was important to constantly revisit the actual objective why m-health is deployed to fulfil the Primary health care and ask oneself if it's doing that what it was intended to do. This was important to tie up with the steps outlined in the lesson learning conceptual framework. *"What is happening here is real. We as academics and managers in the area must constantly go back and do validity checks"* stressed one academic.

#### **4.4.3 Changes required on m-health implementation**

There were mixed feelings as to whether given a second chance that m-health will be implemented in the same way. Others felt, to alleviate the challenges of 'silos' it may be necessary to create a national platform where projects are managed in a safe but open

environment. Reference was made to the use of Living Labs which is one of the focus areas in this case study. One respondent mentioned: *"Just as we've now established the e-health Living Lab as a regional platform, to try and motivate people to collaborate within this regional province I think from government there should be a national listing of what type of projects are already in progress. We'll come up with better answers and we'll come up with the answers more quickly if we collaborate nationally"*.

*"The important thing in health", I usually say to student, "it is not a picture, it is a video. You know the health is an on-going thing which we call continuity of care"*.

Other respondents argue that doing things differently would get to a point of removing the M and providing the user with the health experience.

*"Enough should be implemented in a way that you can delete the M, it should be health. It should be implemented in a way that the technology and the complexities of technology and communication systems and protocols and regulations and policies hidden are obstructed from the user experience. The user experience should be the health experience"* asserted one informant.

*What is seen today is based on a long term planning and experience, all that happens "is not book knowledge, it is based on practical experience. You need to be in the field, on the ground, get feedback and do it better"*.

#### **4.4.4 How should m-health be implemented in the future? Futurist view on m-health:**

While the concept of m-health is embraced by most informants, we also realised that technology is an enabler; if there's too much focus on technology it defeats the purpose because the users of technology are interested in the experience not the complexities. It is important to always be aware that even in the future what sells and appeals to the end user is the value proposition. One informant said, *"You buy a solution to your problem, you don't buy technology"*.

What Africa needs is an enterprise offering that strengthens our health system, providing everything in the below the line functions. People are incorrectly focusing on the above the line functions. Participants are of the opinion that m-health is not the solution to all problems, but it is

an enabling function that can support a lot of agriculture, food, security, education, security transport you can solve a lot of those functions. One said: *"Mobile is definitely a contributing factor or value to most secondary functions"*.

At Primary health care people deal with prevention and promotion and that relies a lot on information transmission. The future of m-health shall exist for a long time. *"In a way Primary healthcare is not so strong on x-ray issues for example, laboratory issues, theatre equipment and those things but it's very much reliant on information technology one participant stated"*. "Therefore, for health delivery in Primary care in South Africa m-health is, an option, it's the way to go, it's the future. We'll definitely see, you can see Bill Gates is giving money, we'll see more and more philanthropists and just normal companies getting into business with mobile health" one participant said.

*"We have started sms-ing our patients when to come for follow ups. We don't sms them specific results, but we do sms them when they have results that need to be discussed"*.

#### **4.4.5 Effectiveness and efficiency measure on m-health service delivery**

Efficiency and effectiveness measures exist for different reasons for each role player. What would be critical to the solution developer is a non-issue to the academic or clinic manager of community health worker.

Participants assert that for the solution developer effectiveness and efficiency measure would in ensuring that naming is done as part of the implementation and validation and verification of the offering. They would get independent parties to evaluate the implementation. *"For example we work with John Hopkins University or the University in Italy or the University of Pretoria or KZN to evaluate cost benefits, the ease of use, the value add"*. The effectiveness and efficiency measures for them could easily be based on a) cost benefits, b) solution ease of use, c) the impact of the value being added, one academic reported.

To the clinic manager and academics the effectiveness and efficiency measures are the health indicators. *"We have to develop things like the time it takes for a person from becoming ill with TB to treatment. For example, we need to see with this system whether we can shorten that period,"* one health professional stated. She continued: *"We will specifically look at children's*

deaths and maternal deaths and then also factors like how chronic illnesses are controlled. Although I wouldn't call those health indicators, this is more than disease management". "Our efforts always have to move back to the think tank, and we invite industry leaders from across the country, so that we don't develop our NHI site in isolation. The indicators will be developed there, so that we have national accountability of what we want to do, by when and how it's going to be measured".

In the future one of the effectiveness and efficiency measures will include solutions focused on capturing data and data on a management level. One informant said: "If you want the quality of the service that is being delivered to increase, you need to make the life of the person responsible for the service easier".

Another measure would be on the improvement of the two way SMS communication between the clinic and community workers or patients. "Currently the community health worker doesn't send the sms but the clinic does. The SMS communication is one way. But that's one of the issues that we're trying to explore now, this is the entire concept of the NHI research, how we can have not only two way, but up- to- date communication".

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## **4.5 Usability of the m-health applications**

### **4.5.1 User experience of m-health applications**

One would allude to the fact that while m-health is still in its infancy, efforts must be made to ensure a smooth user experience. "currently applications are Intuitive to use, Easy to use, One question at a time, Skip Logic (Intelligent program flow), Build in Decision Support (Clinical and Administrative), Notifications- and Reminders Services, Store-and-forward (Support Data Gathering in areas with no GSM coverage), Robust and Tested, Take pictures, scan bar codes, capture patient signature, Location Based services (Time, Date and Location)". It appears that while the devices that are used are familiar to the Community Health Worker, there are instances where the term **intuitive** is illusive and it does not apply to all CHW. Constant training is necessary.

#### 4.5.2 Living Labs Relevance

Living Labs have evolved into something much bigger than it was three years ago, It was taken over by the University of Pretoria, Department of Family Medicine and Local Government, Department of Health. The idea of a living/learning lab is to say you want a representative environment in which you can test and verify and validate solutions and services. This environment is now open to introduce third party solutions and services and to test them. If people that use them find them useful and they solve a problem, they introduce them into the Department of Health evaluation process. But all these initiatives are only of value if the Department really buys into it!

Participants perceive a living/learning lab as just a way to take a paper into a living format. *One participant said: "Living Labs provide exposure to insights that are not readily available. You can invite participants and they come and visit the sites, they talk to the people, they look at the reports, they visit homes, they visit health centres, they visit clinics, they feel and they touch and they use, and hopefully that experiential tangible makes it easier for them to say ok what are the lessons learned that we can take forward?"* This suggests that the Living Lab is the pride and joy of all those who are involved and a platform whose agility is to be shared.

A living/learning lab lies between a basic applied research and hope. *"Like today initially cellphones are basic research and applied research which they build prototypes the size of this room, but today we've a phone in our hand".*

Now the problem is that in Africa with its resource limited countries the gap between applied usage and commercial use is ever increasing. This leads to a huge divide or gap, so a learning lab really provides an idea of how things or a concept would be.

Living Labs are the future of innovation. It is a great concept that was brought about by the Innovation Hub and later adopted by the University of Pretoria. "You know we're running it here and it involves patients and doctors and Community Health Workers. It's the real thing, it's not just an idea".

"My view with the health living laboratory in an academic setting in which we are, is not to wait for government but to actually push it to innovate and come up with concepts because it is

possible". So the NHI takes Living Labs and innovation seriously into account, not only focusing on hospitals.

Living Labs provide an opportunity for people to collaborate and innovate at a much quicker rate than they would have done in isolation. *"It's the private and public sector combining their efforts and ideas that even compete, it's a space where competitors are now actually working together and that's rare"*.

#### **4.5.3 Effectiveness of Living Labs on m-health**

Living labs are gaining popularity with most users and participants. *"I'm a strong believer that this is the only way to go about things as the complexity of health care is adaptive! Health care is complex in its nature and it is adaptive to numbers of change. So you can't do applied research and say this is how we treat tuberculosis and take it to a commercial environment, because the way in which we treat tuberculosis is adaptive. So a living/learning lab environment allows you to the adaptive nature of healthcare"* participants reported.

*"The health Living Lab isn't a very old concept, it was born last year. So it's still in its early days, but I think it has a good history if you look at where it started"*.

It started with a small idea and a little bit of money from government and eight sites, and within two years there was wonderful data, community healthcare workers going out at all those sites, and we've had a very, very positive outcome.

"The health Living Lab has specific principles and those principles coincide very much with community orientated Primary health care approach. CAPC so it's all about equity, universal access to healthcare, innovation specifically focusing on the health Living Lab sites".

#### **4.5.4 m-health usage penetration in Tshwane**

The statistics from November 2012 indicate there were over 55,000 people registered and 37% percent of those had been assessed. Percentage of the households covered in these areas is estimated at about 80%. These percentages reflect the growing pattern of m-health services in

Tshwane and it promises to become an effective service delivery system. The table below indicates m-health services coverage and it is impressive.

**Figure 33: m-health usage penetration in Tshwane – Community Outreach Programme**

| Health Post <sup>1</sup><br>(NGO name, area, ward) | No. households mapped | No. households registered | Percent (%) households covered | No. people registered | Average No. people per household | No. people assessed <sup>2</sup> | Percent (%) people assessed <sup>3</sup> |
|----------------------------------------------------|-----------------------|---------------------------|--------------------------------|-----------------------|----------------------------------|----------------------------------|------------------------------------------|
| King's hope Olievenhoutbosch Ward 77               | 3250                  | 1131                      | 34.83                          | 3442                  | 6.8                              | 1061                             | 31.9                                     |
| Kopano ke matla Atteridgeville Ward 63             | 3024                  | 3974                      | 131.32                         | 8440                  | 2.2                              | 4040                             | 47.9                                     |
| Masibambane Refilwe Wards 99, 100                  | 3780                  | 3232                      | 85.5                           | 6375                  | 2                                | 3276                             | 51.4                                     |
| Rona rea Shoma Atteridgeville Ward 7               | 3250                  | 1782                      | 54.83                          | 6682                  | 4.8                              | 1865                             | 27.9                                     |
| Tateni <sup>2</sup> Mamelodi West Wards 6, 28, 38  | 2052                  | 910                       | 39.86                          | 3011                  | 3                                | 909                              | 34.5                                     |
| Thembelisha1 CSN Mamelodi East Ward 40             | 3060                  | 3400                      | 111.11                         | 7979                  | 2.4                              | 3150                             | 39.5                                     |
| Thembelisha NGO Mamelodi East Wards 20, 97, 99     | 3240                  | 3492                      | 107.8                          | 9084                  | 4.1                              | 3482                             | 38.3                                     |
| Thusanang Hammanskraal Ward 73                     | 4035                  | 2675                      | 66.36                          | 10306                 | 3.9                              | 2698                             | 26.4                                     |
| <b>TOTAL</b>                                       | <b>25691</b>          | <b>20596</b>              | <b>80.16</b>                   | <b>55319</b>          | <b>3.1</b>                       | <b>20481</b>                     | <b>37.0</b>                              |

Source: MHEP data base. Collection period: 01 October 2011 until 07 November 2012.

1. Sizanani health post (9th health post) is not represented in this table. Sizanani was only set up in August 2012 and has not yet started with household registrations.

2. Tateni started 20 May 2012

3. A person can be registered, but it is possible that no health assessment has been done yet

Source: (Bam, 2012)

#### **4.5.5 m-health Service administration at Community Level**

The users of the Nompilo m-health service are Community Health Workers and nurses including management. The Community Health Workers visit the residents or patients and ask them questions, register them and provide services to them.

Community Health Workers are based in a specific ward, the entire country was divided into municipal wards. Daspoort which was used in this case study falls under region three ward one. Daspoort has about twelve to fifteen community health workers. Community Health Workers either work for free or they get a stipend. They receive a stipend and they go from house to house delivering Primary healthcare.

The University works together with Simaxon, and with MezzanineWare (Geomed), for the handheld device to collect data and to interpret the data with an actuarial company - Wellnicity. The role of the Community Health Worker is supported by the nurse and the clinic who make diagnoses and the University responds to try and influence timely interventions to ensure better health outcomes.

CWH uses a module in a form of a questionnaire that can be modified. The questionnaire consists of about thirty questions. *"Within the health living lab because we're going to focus on Daspoort on the NHI, we're going to add a certain number of questions that will specifically address the issues we want to explore"* one participant said. She continued: *"the same handheld device, the same questionnaire with the added top up questions within the health living lab will be used and the clinic will be able to report on the same data whether it's on safe sex, how many people have been circumcised, how many children need to be immunised, questions regarding water sanitation, sleeping habits, lack of basic health care necessities in the house, those types of issues were explored, social and health issues."* m-health has an important role in capturing household data. This is an idea that can be linked to census and can cut a lot of money that is used for census. *This can assist in the integrated data analysis approach that is required in the country.*

*"At Daspoort clinic, we're linking job system, the Mezzanine system, the handheld device with an IT system in the clinic and we're linking that to forty healthcare providers or other social providers within our network. Everyone will get up to date information and will now be able to have two way communication on where the patient is, and how he's responding to the intervention. Within this municipal ward, the Daspoort ward will have about forty two thousand patients. So we calculate that each Community Health Worker will see around about five hundred to a thousand people and she is issued with a handheld device and a little stick. She asks the family member can she interview him/her. They give their consent and she clicks with a digital pen on the handheld device. This informant is providing complex multiple tasks that are integrated into m-health services which is what National Health is yearning for in order to make relevant decisions and policies.*

From there onwards the Community Health Workers ask the thirty questions. That data is updated immediately so the moment the phone gets within a range where there is reception, it downloads it to a server, that is then given to the actuarial company which interprets the data,

gives it back to team in a form that can be used. Currently, there are graphs and statistics which have been broken down per household. *"So we can speak to the individual health worker and say in this house, please follow this, this and this up. But in this street and in this community these are the problems we're seeing"* one participant reported. The idea of giving data to a company may not be the best way of analysing this data. Health professionals and academics involved should be the ones that are analysing this data in order to get value that can improve health. Data analysis requires an element of context understanding which may not be available in the company. Therefore, data analysis centres from m-health services need to be established either at Tshwane or the University of Pretoria. This is critical since there is no Personal Data Protection Act in the country.

The plan of government is to have the entire country served in a municipal ward based approach. It's based on the Cuban health system. The Cuban health system has nurses going from house to house in small areas or wards, and following patients. *"Now we're asking yes, we can do that, but this is a big country with many people and we need to use e-health resources. To get to the point where we can really interpret the data, because it's not five people we have to remember, it's five hundred and therefore we're looking at applications*

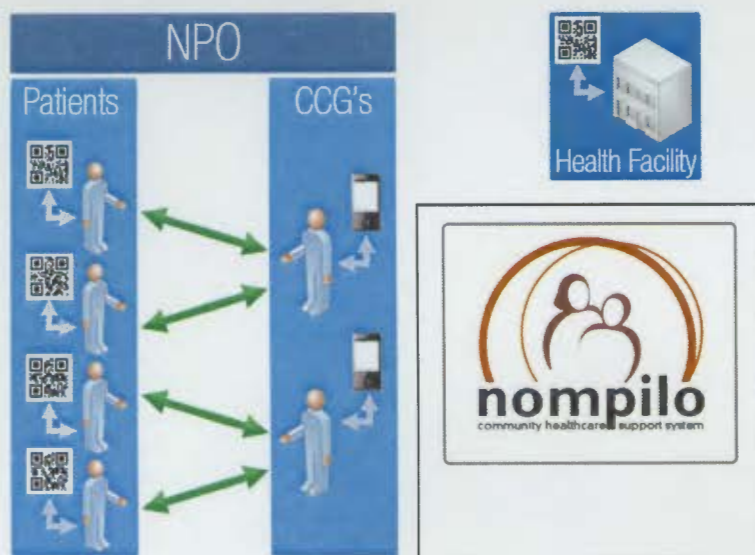
*and handheld devices to assist us"*. Community Health Workers reported are shown in the picture below including the devices that they use as well as the process they follow during their Primary healthcare conduct.



**Figure 34: Nompilo Device**

Source: Geomed, 2010, CHW with the Nompilo device

**Figure 35: Primary Health Care Delivery Process via Nompilo m-health platform**



Source: Geomed, 2010

The requirement is that Community Health Workers should be able to use the module without much assistance. The module should be structured to cover quite a lot of information. *The difference between community oriented primary care and with community oriented primary care is that you want the information to be immediately available for the practitioners to make decisions and interventions and monitoring. So it's not like a survey to say this is the situation, it's like what is the situation, what are the priorities and how are the interventions and, how can we work with that?* One participant explained: *"The second thing is that after one has created a management system, you know you've now got the survey, now you identify people at risk, you follow it up, that person at risk now becomes a patient and then that patient needs to be followed through. So then you also need to manage that information which then comes to something that looks like a patient management system or a patient records system. Once again m-health is most of what is required as it is an integrated medical record and health information system all in one".*

*"So what we do now and that's only now, this month, is to put our family medicine master students into these sites. So now you've got a medical practitioner who is a master's student, who is becoming a specialist in Primary care in that system to be able to make intellectual decisions based on the ground of that sophisticated data, which you cannot expect from a nurse and a Community Health Worker".*

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*“Not initially, over time it will but, so we are actually involved in high level intellectual capacity at ground level and we’ve just started to address that. So I think those are the types of challenges faced” one academic explained.*

## **4.6 Monitoring and Evaluation m-health service delivery**

m-health solution provides a cost-effective and easy-to-implement workforce management tool for Health and Social Care service provider companies. The solution monitors and evaluates the performance of an individual, based on the job description, thereby assuring the quality of the service being provided. The information that is recorded per visit or per transaction includes date, time, location, time of visit and any qualitative and/or quantitative data measurements, as well as entries specific to the service that is provided.

Training is provided. There’s a definite effort to improve the quality of data collection, however, challenges arise; the question remains, *“is it the handheld device or is it lack of knowledge and skill from the Community Health Care Workers?”*

## **4.7 m-health cost and return on investments**

### **4.7.1 Is there a return on investment for m-health**

There is a common undertaking that with m-health deployment investors would realise their return on investments. m-health assures quality of decentralised (primary, community and home based) healthcare services; allows delivery of public health services in a standardised and replicable manner; provides a transparent means to audit fund allocations and health programmes and discourages corruption and fraud on all levels of implementation.

The participants did not have a conclusive figure, however, the general consensus was that m-health deployment is more affordable. *“With the Community Health Worker, it costs on this one model about fourteen rand per month per person. Now only the technology part of it would probably be a third of that or I’m not sure. It would cost round about between two hundred and two hundred and fifty rand per Community Health Worker per month. So in terms of a health*

*budget, it's very affordable. So it's not, the cost that is prohibitive and when you go on scale the cost will come down. I actually think it's more affordable than we think".*

Return on investments can be reflected by the benefits associated with m-health as shown by the bullets in the next paragraph:

- Enables the increase in accessibility and cost effectiveness of healthcare services;
- Assures quality of decentralised (primary, community and home based) healthcare services;
- Allows delivery of public health services in a standardised and replicable manner;
- Provides a transparent means to audit fund allocations and health programmes;
- Discourages corruption and fraud on all levels of implementation;
- Automated Mobile Workforce Management, Automates the monitoring and evaluation activities required by government/sponsors;
- Increases data accuracy, integrity and storage;
- Possibility of automatically linking the remuneration to performance of the mobile worker;
- Real-time and intelligent data reporting;
- Multi-point access to data and bi-directional flow of information;
- Accommodates unlimited third party application/content layers and contributes to the establishment of interoperable reporting and information interchange between the respective solution providers;
- Assures patient information confidentiality with the unique bar code as identifier.

On the basis of these benefits which are experienced in real time m-health is exceeding the expectations even on Return on Investments and in other aspects that promote quality services and quality of life.

#### **4.7.2 Project Financing**

The m-health initiative is partially funded by government. One respondent ER 5 stated *"The government has just taken over the staff, but for the m-health part we don't have funding". But we would find funding for our laboratories in terms of rolling out into the rest of the City or the rest of the province thus there would have to be public funding. Government is giving us a lot in terms of paying the salaries and giving us access to medicine, and other normal things that are sustaining what we're trying to initiate, because the health Living Lab or mobilising e-health without service means nothing. The health Living Lab in my mind now, and what we're going to do with our project will be to look for external funding. "Privately we're looking for funds but I mean some of our grant money now came for the health Living Lab from the NRF".*

It is concerning to realise that government has not decided to be fully responsible for funding m-health, which is a new integrated primary healthcare service that can change the face of health service delivery in the country. Government is one of the key stakeholders and in fact they should be a key driver in the process of funding the research and piloting of the m-health platform. M-health represents a complete departure from the manual way which the health system runs and requires significant support to get accepted as one of the ways of conducting medical consultations. Perhaps in the not so distant future, it can be taken as the only way that medical consultations are conducted.

## **4.8 Summary**

In dealing with the entire healthcare value chain, legislation and policies that are currently in place must be reviewed to ensure that they promote access, affordability and quality of healthcare, in particular, to the public healthcare sector. This chapter reviewed the discussion based on findings from the field work. The five thematic themes and sub themes were reviewed.

Discussions reveal that e-health including health services do not have adequate policies and regulations. This situation poses a threat to the implementation of such services either by health professionals or community health workers.

The m-health Community Care Support System in Tshwane provides a standard and integrated mechanism with which South African community based care services can be effectively recorded, analysed, improved and subsequently reported to the relevant stakeholders (e.g. government health departments, funding parties). The m-health market is niche and largely untapped. As an enterprise market, it is possibly the most fragmented and diverse of all enterprise markets, comprising a myriad of clinical environments, work forces both in the field and on site, varied end-users and wholly variable management depending on how care provision is funded. It is a market that requires robust and reliable telecommunications for health-critical, as well as business-critical, decision-making.

## **CHAPTER 5 ANALYSIS AND REFLECTION ON THE LESSONS LEARNT IN PROVIDING PRIMARY HEALTH CARE SERVICES THROUGH THE USE OF MOBILE APPLICATIONS.**

### **5.1 Discussion on key themes**

This chapter is drawn from the findings of the case study presented in the preceding chapter. It first presents an analysis of the findings and presents the views that have been deduced from the literature, responses and the understanding of the researcher. In this section, the researcher wishes to express their opinions and share their take on the findings. The researcher will highlight the challenges that have arisen with the use of mobile applications in bridging the health access gap. The researcher will reflect in more detail on the lessons learnt and good practices that have been discovered in to providing primary healthcare services through the use of mobile applications.

This chapter concludes with a synthesis of the key issues that lead to answering the main research question. In answering the main question, the researcher will reflect on the sub questions as they support the main question. This brings together the seemingly disjointed issues, and correlates the findings in the preceding chapter and the analysis in this chapter. The context of this case study was based around the following themes:

**Figure 36: Themes used in the case study**

| Theme 1                                                                                                   | Theme 2                                                                                                                   | Theme 3                                                                                                           | Theme 4                                                                                                               | Theme 5                                                                                                  |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Lessons learnt in the roll out of m-Health initiatives.</li></ul> | <ul style="list-style-type: none"><li>• Legal and regulatory framework necessary to the deployment of m-Health.</li></ul> | <ul style="list-style-type: none"><li>• Relevance of Living Labs and their role in promoting Innovation</li></ul> | <ul style="list-style-type: none"><li>• Users aptitude on m-Health and the solutions' Return on Investment.</li></ul> | <ul style="list-style-type: none"><li>• Mobile applications relevance on Access and Usability.</li></ul> |

Source: (Holeni, 2012)

In this process the researcher discovered that the cause and effect rule applies on how socio-economic issues are addressed. As stated earlier, South Africa struggles with accessible healthcare facilities and limited health professionals, the Living Labs concept has become relevant where the role players in the eco system collaborated, embraced e-health; and m-health was born.

It must be stated that in as much as the medical and health fields have embraced high tech machines over the years and use these sophisticated machines to perform diagnosis on patients; they have however not yet embraced the simple technologies that would make their work even more efficient. The medical profession is rooted in science and has developed complex algorithms and terms to explain various diseases. A life support system is a sophisticated piece of machinery in comparison to a mobile phone, however a mobile phone remains a simple device. A mobile phone has since its invention matured to carry tremendous computing power and processing capability that it can run a number of life support machines across a number of hospitals across the continents. It is a startling fact that medical practitioners may and in deed display suspicion and resistance to using a mobile phone to carry out their work or even make it part of their consultation. On the other hand, a group of ICT enthusiasts are toiling with the task of developing mobile applications that will assist medical practitioners to

do their work of diagnosis and capturing of patient information. Instead of the medical practitioners leading the way in the development of applications that will serve them, a “bunch of techies” have taken on this task. Of course the “bunch of techies” would not succeed on their own and have partnered with the medical academics from the University of Pretoria. The researcher observes that the mobile applications are leading the way, and it can be said that the “tail is wagging the dog” instead of “the dog wagging the tail”.

Mobile applications were developed to support the m-health concept and have brought to bear the need for medical practitioners, health policy experts and, ICT experts to work together to develop a solution instead of a collection of mobile applications. All the stakeholders have realized that concepts such as m-health do not exist in a vacuum, they normally emerge to address or are in support of a particular policy imperatives. In this case, the National Health Insurance and e-health strategy are the key drivers. In as much as the medical field is as old as civilisation, its development can be likened to the process of evolution. The development of the medical field is littered with a collection of small discoveries that when put together have with hindsight become major breakthroughs. In comparison to the medical field, the mobile technology is an infant and yet it has had major breakthroughs that it has exceed the medical field. This leads to the researcher pondering how these two giants can work together.

For the medical and the mobile technology field to work in harmony, they must be tied together by well-defined regulations borne in policy. This however, requires to be taken a step further and for projects to be implemented in order to expedite the lessons that must be learned and to align the two giants. After the implementation of the m-health, whether in a pilot mode or real life, there is a greater need to monitor and evaluate the results and to unpack the prevailing reactions, data and responses from various stakeholders both negative and positive. The analysis would give stakeholders a true reflection of the relevance of a new initiative and whether it meets the socio-economic need.

This cause and effect rule is depicted in the table below which reflects the potential systematic process as well as the underpinning measures that occur under each stage.

**Figure 37: Cause and effect rule and impact on policy formation, implementation and evaluation.**



Source: Holeni, 2012

The Living Lab concept call for policy makers to wear their thinking caps and wade through the myriad of policy, legislation, regulations and other documents of strategic importance to formulate specific policy positions and statements. These policy positions and statements must be extracted from existing documents of law and be open to develop new laws. The policy framework is important in that is set the rules, the norms and the standards that must be followed. At best they form a point of reference against which all actions and activities can be tested against. The policy positions and statements will also serve to legitimise the development of m-health into a serious solution that will attract the interest of stakeholders outside of the immediate vicinity of the medical and mobile applications fields. The living labs can therefore be referred to as a test bed for innovation; a place where new ideas can be born, nurtured and released in to wider world. Living Labs can be used to imitate real life situations in a controlled environments and the results from the living lab can be extrapolated to address specific issues of concern in the socio-economic milieu or a scientific setting or any other concept that require

thorough testing without spending large sums of money. It is for this reason that it is an express condition that the policy environment be created in parallel to the testing.

Policy formulation can be exciting and often lead to idealistic documents that read well and contain lofty concepts and ideas. The implementation of such a policy is an important stage, not only because it assesses if the policy is pitched correctly but brings a reality check of whether the policy may breed unintended consequences. All the actors are required to play their role to ensure that the policy is fully tested through a monitoring and evaluation mechanisms. The monitoring and evaluation mechanisms are a process of collecting learning and outcomes of implementing the policy.

Thereafter adjustments, changes and improvement must be made to the policy and assimilated to the policy position and statements. Below are some of the aspects that were considered in the review of m-health in this case study:

**Figure 38: Pertinent aspects to be considered**

|                                         |                                                                                                                                                                   |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Living Labs                             | Accessibility and affordability of Living Labs leading to m-health                                                                                                |
| Implementation of m-health.             | Effectiveness and efficiency measures on m-health service delivery                                                                                                |
| Location based approach to m-health     | m-health service administration at community level, who will take this responsibility                                                                             |
| m-health at the City of Tshwane         | Access Lessons learned in the deployment of mobile applications to redress the public health access and usability of m-health applications                        |
| m-health service penetration in Tshwane | m-health cost and return on Investment, will the people of Tshwane embrace m-health and use it.<br><br>Will m-health contribute to closing the health access gap? |

The findings of this case study are reflected upon and key learning depicted under the cause and effect framework above is highlighted. The objective is to highlight how this study advances the views in the literature. Instead of the initial themes firmly used for investigation, the conceptual framework findings of this research will be discussed based on the measures under policy formulation, policy implementation, monitoring and evaluation. The objective is to synthesise the key issues that answer the main research question.

## 5.2 Policy Issues and Challenges

### 5.2.1 *Exploration of policy challenges*

Policy is commonly understood as a written statement to describe principles, requirements and limitations. It normally states "what" needs to be done rather than how to do it. It is with this premise that the researcher looked at the relevant policies first in seeking to address the research question.

Policies addressing the health issues were released, and in support of that; innovations were introduced to further address the socio-economic needs. As time transcends, it becomes imperative to look at the policy objectives, associated innovations or solutions and the uptake of those solutions in society and understanding if they are addressing what they were set out to do and what the potential loop holes are that must be addressed.

(Buse, et al., 2005) suggests; "health policies are formed through a complex inter-relationship of context, process and actors". A systematic thinking process is deployed and all the potential role players to be affected by the outcome are identified. The impending factors that must be taken into account include the following:

- **Situational factors-** non permanent conditions such as (shortage of skills in health, disease )
- **Structural factors-** unchanging elements of society (technology advancements, type of economy, demographic features)
- **Cultural factors-** religion, ethnicity, gender

- **International factors-** some policies require cooperation between national, regional or multilateral organisations” (Buse, et al., 2005).

### ***5.2.2 Conducive Environment and Implications for m-health***

Policy and new ideas thrive in environments which have the right mix of elements that display willingness, preparation and resources. The impact of a non-conductive environment on policy and new ideas is that both will be still born.

In realizing that m-health cans suffer the fate of being still born if the general environment that it will be introduced to is not conducive. This is one of the issues that stand out the most from respondents’, they have made expressions that support the need for an m-health policy and legal framework; they argued that the m-health policy and legal framework would provide a conducive environment which would induce safety and quality assurance for both users and providers of health services. The general view is that although there are several interlinking policies, the country over and above the health policy and Act need to develop an e-health policy and legal framework that includes m-health.

Participants reviewed the implications of policy on m-health; as having astounding hindrance besides that e-health/ m-health are overdue in a highly mobile saturated country such as South Africa.

One would argue that there is a need for e-health policy that fully caters for m-health both from a legal and regulatory point of view. Although policy is the overriding factor, there is still a need to synergise at implementation phase for the policy objectives to be efficiently realised. The lack of collaboration in the way projects of a similar nature are implemented was highlighted as a potential obstacle. It is also generally believed such silos occur because there are few collaborative policy measures and regulations in place for e-health and m-health. There is a need to establish the best ways or bench mark on best practices as there are disjointed efforts in the way projects of a similar nature are implemented.

The chronic lack of system interoperability also emerged as a cause for concern. The respondents have raised the need for greater attention to be directed at improving system interoperability and to push for systems to “talk to each other”. The mobile phone and all the

associated applications are a critical enabler of m-health and the other spheres in the health system need to be opened up and improved to realise the full effective benefit of m-health.

There is anecdotal evidence that m-health is being treated as an exciting disruption to a health sector which has over the centuries organised itself in a manner which upholds the status and the prestige of the respective professions. M-Health is regarded by some in the health sector and outside as a pet project of some “clever” adults who are either “bored” or are short of hobbies. On the other hand the m-health solution is heralded as a strategic initiative, which will change the course of public health and the life of my “Grand Mother” who lives many hours away from civilisation. The researcher finds it ironic that this exciting disruption is being starved of critical funding. The responses from the respondents corroborate this fact by citing the lack funding as an obstacle to m-health.

M-health is open to many possibilities and it is a technology that must be leveraged on to achieve an improvement in national health outcomes. M-health presents the possibility for monitoring and evaluation, which is difficult in a highly paper based environment. The monitoring and evaluation aspect of m-health is crucial towards:

- Guiding government policy,
- Identifying areas of need,
- Distribution of resources in the form of money, equipment and medicine
- Understanding the health profile of a ward and any interventions required
- Allocation of medical practitioners,
- Training of medical practitioners,
- Encouraging the local people to take responsibility for their health and that of others

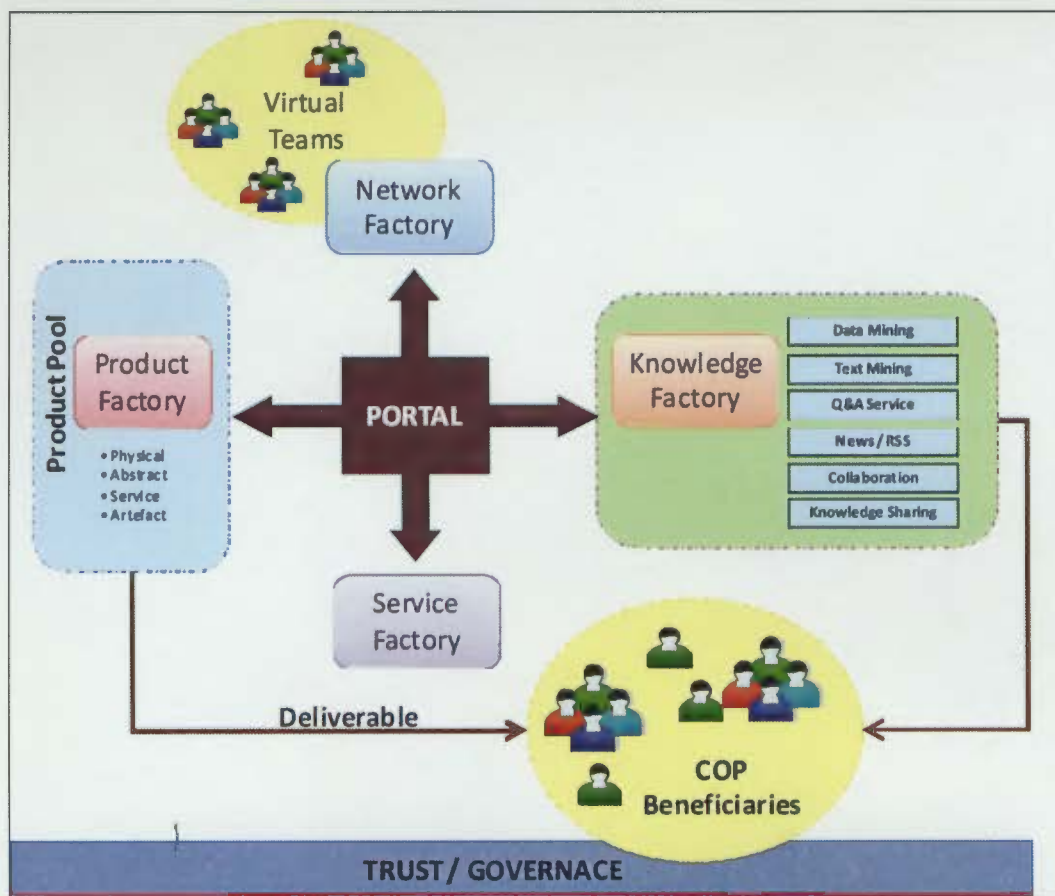
### **5.2.3 *m-health an Innovation Product of the Living Lab***

Living Labs are a concept that emerged in support for innovation. The best policies may be developed but if an environment for innovation is not created to bring effective solutions, policy formulation becomes a futile exercise.

There is resounding support and enthusiasm for Living Labs. Respondents view them as the future for innovation and the only way to bring effective solutions. It allows for the relevant stakeholders to get together and develop or agree on solutions that address the socio-economic issues. The relevance and importance of Living Labs to healthcare was highlighted by one respondent who stated: "You can't do applied research and say this is how we treat tuberculosis and take it to a commercial environment; because the way in which we treat tuberculosis is adaptive, so, a Living Lab environment allows you to do the adaptive nature of healthcare".

One realises that Living Labs have specific principles which coincide with the re-engineered community oriented Primary healthcare approach, which is an outcome of the National Health Insurance Policy. In essence, the focus and measurement is on quality, universal access to healthcare and innovation. Living labs have enabled innovators to leverage on the uptake of mobile technology and open ways for effective access to health services.

Authors such as (Van der Walt & Buitendag, 2009) allude to the fact that all Living Labs share the human-centric involvement and its potential for development of new ICT-based services and products. This is done by assembling different stakeholders in a co-creative way.



**Figure 39: Living Labs Conceptual Framework**

Source: Van der Walt & Buitendag, 2009, p426

The above Living Labs governance framework attests to the fact that the best way to promote innovation is through collaboration and information sharing; stakeholders must share their experiences and successes to provide some key learning and improve service to the end-user.

If one used the above illustration on the current case study-mobile health service delivery, the product factory which includes policy makers and other relevant stake holders analysed and identified key issues that needed to be addressed and introduced e-health strategy to enhance and expedite health service delivery particularly Primary health care. Living Labs then become relevant where solution technology enablers developed and rolled out innovative solutions (m-

health). This brief process would have happened within a Living Lab and a suitable solution of m-health identified and rolled out in Tshwane focusing on Primary healthcare.

In the continuous evaluation process, researchers discovered that m-health implementers, while they are supportive of the Living Labs concept as an enabler for innovation, their biggest concern is the lack of collaboration.

### **5.3 Lessons Identified, Actioned and Institutionalised in Implementation**

Policy sets the tone and provides development direction. Looking at the measures that the researcher classified under policy implementation, reflection and discussion would be centered on the lessons learned in the deployment of mobile applications to redress public health access. This will be followed by reflecting on the key lessons identified in the implementation of m-health in Tshwane. The m-health service administration at community level as well as m-health at the City of Tshwane will be reflected on.

#### ***5.3.1 Lessons learned in the deployment of m-health to redress public health access:***

Mobile applications are commonly understood as modules used on the cellphone to assist in the rendering of Primary healthcare services. While there was a general appreciation that health service delivery improvement is necessary in South Africa, the challenge with the roll out of mobile applications in Primary and public health care remained a moving target based on the diverse nature of respondents that the researcher interviewed.

*Technology adoption* and uptake was highlighted as a challenge in the deployment of mobile applications. Respondents attest that this challenge may be met by change management which is deemed necessary particularly in the public sector.

*Mental shift* is another challenge that was highlighted particularly for the Community Health Workers. Statements such as the following were recorded: "*We have to train our staff to be able*

*to go to a paperless system; we have to now convert twelve thousand hand written files into electronic family files. So that's a major challenge for us, moving with the ideas and catching up with technology".* In the same token one would pick up that moving from a heavily paper based system to an electronic environment requires some level of system readiness and this posed some challenge.

*Mobilization of resources* was highlighted as another challenge. Respondents indicated that community environment is an area that requires full mobilization for any service to be adopted, accepted and used. They raised the importance of working with the people on the ground to overcome cultural indifference and overcome the communication barrier. *"It takes very long to mobilize people, so that's definitely one of the challenges for us, you must be motivated and you must take your team with you".* The key learning is that for any initiative to work the environment must be prepared and people made ready to adopt the new change. This is achieved through mobilization. It involves selling the concept features and benefits to the end-users.

### **5.3.2 Key lessons identified in the implementation of m-health and changes required in Tshwane:**

Interestingly, the biggest mistake that is commonly made is the focus on technology and not what it can do. The key lesson in this regard centers around appreciation of the fact that *m-health is a technology enabler*. The success of its implementations rides of focus being placed on what it can do to enhance the Primary healthcare service delivery. The salient features and benefits are what the focus should be more than the actual technology. Because of the technology complexity and lack of general understanding of its component, when implementing the mobile applications, the trick is to keep it simple. *Keeping it simple* is the key and this stood out in the lessons learned on the lessons identified in the implementation of m-health. m-health is a technology enabler, keep it simple! Some respondents maintained, *"You buy a solution to your problem, you don't buy technology"*.

m-health deployment is a unique proposition and its success requires fundamental changes to the status quo. Generally, things must be done differently. One of the key learning areas that requires change is the functioning in 'silos'. Collaboration is necessary, as one of the respondents highlighted: *"from government there should be a national listing of what type of*

*projects are in progress. We'll come up with better answers and we'll come up with the answers more quickly if we collaborate nationally". It is believed this will address functioning in silos.*

The researcher gathers that other respondents maintain a different view to m-health. The focus is on providing an overall health experience. *"Enough should be implemented in a way that you can delete the M, it should be health. It should be implemented in a way that the technology and the complexities of technology and communication systems, protocols, regulations and hidden policies are abstracted from the user experience. The user experience should be health experience".*

### **5.3.3 m-health service administration at community level in Tshwane**

In Tshwane m-health is utilised through the nompilo platform by the Community Health Workers and nurses as well as management. The Community Health Worker visits residents or patients and asks them questions, registers them and provides services to them.

Community Health Workers interviewed in this case study are based at Daspoort in region three ward one servicing the Daspoort clinic.

Community Health Workers operate from a mobile module which is adaptable and can be modified from time to time. Interestingly, the number of households and the type of engagements that the Community Health Worker has with the service users could easily render the nompilo platform m-health as an alternative or a service that complements national census. With the government plan to have the entire country served in a municipal ward based approach, this could be an idea that can be linked to census and can cut a lot of money that is used for census. *This can assist in the integrated data analysis approach that is required in the country.*

The researcher discovered that the data that is captured is analysed by the third party. While skills are short, health professionals and academics involved should be the ones that are analysing this data in order to get value that can improve health. Data analysis requires an element of context understanding which may not be available in the company. Therefore, data analysis centres from m-health services need to be established either at Tshwane or the

University of Pretoria. This is critical since there is no Personal Data Protection Act in the country.

m-health is proving to be the next best thing and a proven alternative to Primary healthcare service.

#### ***5.3.4 Who is looking after the Community Health Worker?***

This benefit of using the m-health can be enjoyed by most users of this technology yet there is no clear regulatory framework that guides Community Health Workers' conduct. To most respondents, it remains vague how Community Health Workers' misconduct would be dealt with in this vacuum of policy or regulations. The concern is that these individuals could become victims of criminal injustice as criminal law remains the only law available rather than m-health law.

The profile of the Community Health Worker is such that the person is not highly educated and may not be seeking to further their studies in the nursing or social work. The highest qualification was a nursing diploma where the Community Health Worker had worked as a nurse. The other Community health Workers have taken this job because it is the job that was available. The researcher observes that the CHW is possibly the lowest qualified person in comparison to the other medical practitioners who are interacting with patients. The question and concern that came to the mind of the researcher is which of the members of staff has the most difficult and possibly the most crucial job to fulfil. The concern that struck the researcher is why is it that the Community Health Workers are not highly educated and possibly being trained further in the nursing and or social work.

The recruitment of the Community Health Worker must be designed in such a way that it attracts people with a positive attitude and outlook, qualified in a vocation and are highly trainable. The Community Health Worker plays one of the key roles and thus should be looked after from a career development point of view, challenged to excel and paid well. The Community Health Worker is the person who makes the first contact with a patient and or family and can influence them positively or negatively or give advice that is detrimental to the patient.

The training of a community health worker must include other life skills that will ensure that they are adaptable to various circumstances and can handle difficult cases of unreasonable patients. They must be well schooled in the basic nursing skills, human psychology, negotiation skills, analytical skills and technology applications. Of utmost importance is that the job of a Community Health Worker must be recognised by the SETA and educational institutions must design curriculum to train them. Legislation is the best way to legitimise the job profile of the Community Health Worker. They must be protected by the laws, policies, regulations of South Africa.

The regulatory framework is seen as a guiding principle. There is a need for a strict e-health and m-health policy and regulation to bring certainty on m-health and improve the morale of those deploying it.

## **5.4 Measuring Service Relevance**

### **5.4.1 *Monitoring and evaluation***

Monitoring and evaluation is a critical component in ascertaining service relevance towards policy objectives. In addressing the main research question, the following measures which the researcher classified under monitoring and evaluation will be reflected upon. This will include accessibility and affordability of Living Labs leading to m-health. A further reflection will be on the effectiveness and efficiency measure on m-health service delivery. M-health service penetration in Tshwane will also be reflected upon as well as m-health service access and usability and m-health cost and return on investments.

### **5.4.2 *Accessibility and affordability of Living Labs leading to m-health***

South Africa is a health resource limited country. The gap between applied usage and commercial use is ever increasing. This leads to a huge divide or gap between innovation and reality. Living Labs provide an opportunity for people to collaborate and innovate at a much quicker rate than they would have done in isolation.

### **5.4.3 Effectiveness and efficiency measures on m-health service delivery**

The researcher discovered efficiency and effectiveness measures exist for different reasons for each role player. What would be critical to the solution developer is a non-issue to the academic or clinic the solution developer is based on a solution that would provide a great level of cost benefits, a solution easy to use, a solution that performs well and adds value to people's lives. To the solution developer, m-health is believed to be all this and more.

On the other hand the effectiveness and efficiency measures of m-health to other users imply a solution with a measure on health indicators. *"We have to develop measures around the time it takes from a person becoming ill with TB to treatment"*. The success of m-health to the healthcare profession would be based on the solutions capability to assist with the measures such as the one stated above. *"If you want the quality of service that is being delivered to increase, you need to make the life of the person responsible for service delivery easier"*. One of the areas that was highlighted as necessary for effectiveness and efficiency of mobile applications at community level includes the improvement of the two way SMS communication between the clinic and community workers.

### **5.4.4 m-health service penetration in Tshwane**

There were over 55000 people registered for Primary health care programmes in Tshwane. At least 37% (thirty seven percent) of those had been assessed. Percentage of the households covered in these areas is estimated at about 80%. These percentages reflect the growing pattern of m-health services in Tshwane and promise to be an effective service delivery system. The table below indicates m-health services coverage and it is impressive. The number of households covered is increasing month after month.

**Figure 40: Health Posts and Performance Indicators**

| Health Post <sup>1</sup><br>(NGO name, area, ward) | No. households mapped | No. households registered | Percent (%) households covered | No. people registered | Average No. people per household | No. people assessed <sup>2</sup> | Percent (%) people assessed <sup>3</sup> |
|----------------------------------------------------|-----------------------|---------------------------|--------------------------------|-----------------------|----------------------------------|----------------------------------|------------------------------------------|
| King's hope Olivenhoutbosch Ward 77                | 3250                  | 1131                      | 34.83                          | 3442                  | 6.8                              | 1061                             | 31.9                                     |
| Kopano ke matle Atteridgeville Ward 63             | 3024                  | 3974                      | 131.32                         | 8440                  | 2.2                              | 4040                             | 47.9                                     |
| Masibambane Refilwe Wards 99, 100                  | 3780                  | 3232                      | 85.5                           | 6375                  | 2                                | 3276                             | 51.4                                     |
| Rona rea Shoma Atteridgeville Ward 7               | 3250                  | 1782                      | 54.83                          | 6682                  | 4.8                              | 1865                             | 27.9                                     |
| Tatani <sup>2</sup> Mamelodi West Wards 6, 28, 38  | 2052                  | 910                       | 39.86                          | 3011                  | 4                                | 909                              | 34.5                                     |
| Thembelisha1 CSN Mamelodi East Ward 40             | 3060                  | 3400                      | 111.11                         | 7979                  | 2.4                              | 3150                             | 39.5                                     |
| Thembelisha NGO Mamelodi East Wards 20, 97, 99     | 3240                  | 3492                      | 107.8                          | 9084                  | 4.1                              | 3482                             | 38.3                                     |
| Thusanang Hammanskraal Ward 73                     | 4035                  | 2675                      | 66.36                          | 10306                 | 3.9                              | 2698                             | 26.4                                     |
| <b>TOTAL</b>                                       | <b>25691</b>          | <b>20596</b>              | <b>80.16</b>                   | <b>55319</b>          | <b>3.1</b>                       | <b>20481</b>                     | <b>37.0</b>                              |

Source: MHEP data base; Collection period: 01 October 2011 until 07 November 2012

1. Sizanani health post (9th health post) is not represented in this table. Sizanani was only set up in August 2012 and has not yet started with household registrations.

2. Tatani started 20 May 2012

3. A person can be registered, but it is possible that no health assessment has been done yet

Source: (Bam, 2012)

#### 5.4.5 m-health service access and usability

There is some correlation between service access and usability and service efficiency and effectiveness discussed earlier. Solution developers state their objective is to come up with a solution that would provide a great level of cost benefits, a solution that is easy to use, a solution that performs well and adds value to people's lives.

The researcher discovered the modules used in the nompilo platform are intuitive and easy to use. Unlike in the past when Community Health Workers captured the information on heaps of paper, the information is captured electronically leaving the community worker with *better quality time to spend with the patients*.

The solution used the store and forward capability meaning, in areas where there is poor network coverage, the information is stored and transmitted as soon as the community worker moved to an area with adequate GSM network coverage. The modules are equipped with location based services functionality, making it easier to improve efficiencies on monitoring and evaluation.

It appears because of the cellphone technology used, the community health workers are familiar with the devices making it easier to operate.

#### **5.4.6 *m-health cost and return on investments***

As with any service delivery, the question of costs of solution and return on investments always come up. There were no conclusive figures that were shared with the researcher but the general consensus is that the m-health is an affordable alternative. The return on investments could be realised in the quality of decentralised (primary, community and home based) healthcare services. The return on investments could also be realised in the solution flexibility as it allows delivery of public health services in a standardised and replicable manner. The solution also provides a transparent means to audit fund allocations and health programmes. It discourages corruption and fraud on all levels of implementation. The solution provided an automated mobile workforce management. It increases data accuracy, integrity and storage. It provides real-time and intelligent data reporting as well as Multi-point access to data and the bi-directional flow of information.

### **5.5 Answering the Research question**

The research question for this case study was to establish the effectiveness of mobile applications used in m-health to bridge the health access gap. The aim was to provide a library of lessons learned and good practices in providing health services through the use of mobile applications.

It became evident that m-health has indeed revolutionized the way Primary health service is administered in Tshwane. There are interdependencies from policy, regulation and the overall regulatory framework required for this technology to be harnessed efficiently.

The researcher discovered that policy does not exist in a vacuum. It is there to address the social and economic impediments for better enhancement and growth of the country's development indicators. The researcher further established, for effective growth and development, supporting environments must be created to promote innovation, in this case, Tshwane introduced the concept of Living Labs to support the overall policy and their

development objectives. Living Labs are proving to have provided an effective platform where stakeholders in the health ecosystem got together and came up with innovative solutions to address the health impediments.

The researcher observed a systematic approach in deployment of m-health services in Tshwane. This was observed in a form of policy formation in this case the National Insurance Policy was considered, the e-health strategy and m-health were looked at. What emerged is that policy does not exist in isolation, there are implications on implementation and in seeking to address the research question, and the researcher dived in on the lessons learned in the deployment of mobile applications. A further consideration under policy implementation was how the m-health service is administered at community level in the City of Tshwane.

Monitoring and evaluation phases required the following to be looked at and were answered in line with the research question. This included establishing the accessibility and affordability of Living Labs as a test bed for bringing about innovative services such m-health. The researcher looked at effective and efficiency measures put in place by the developers, implementers and users of the m-health solution. The researcher also looked at the m-health service penetration level in the delivery of Primary health care. Service accessibility and usage as well as m-health costs and return on investments were dwelled on in addressing the main issues. While one can conclude that the m-health technology has revolutionized the way Primary healthcare service is administered, careful consideration must be placed on a strong supportive policy and legal framework.

## **CHAPTER 6 CONCLUSION AND RECOMMENDATIONS**

### **6.1 Paradigm shift from traditional health offering to electronic platform**

This case study focused on examining the e-health paradigm with a special emphasis on m-health. The m-health was investigated in the context of assessing its capability to provide effective Primary healthcare services. The study assessed the lessons learnt and their relevance in the process of developing new policies and legislation that creates an enabling environment for e-health and living labs and the use of mobile applications to bring healthcare services to the communities.

The study used a case study approach with a qualitative methodology and semi-structured interviews. The researcher, spent time in the field both at the Daspoort clinic which is a pilot site for the National Health Insurance. She observed how the officials embraced re-engineering and the use of mobile applications for enhanced health service delivery efficiency. She observed how the Community Health Workers utilised the applications and the different modules. She engaged with several role players through scheduled in-depth interviews and casual discussions. m-health is becoming an effective tool for health information transfer including making patient information portable.

### **6.2 m-health initiative, a global perspective:**

At this juncture, and leading to the conclusion of this case study, the researcher highlights a brief global perspective on how this new emerging technology is being used in other parts of the world. According to the World Health Organisation, second global survey on e-health (2011), it is argued that this emerging technology is used to address several health issues and the following categories are reported:

#### **Communication between individuals and health services**

- Health call centers/ Healthcare telephone help line

- Emergency toll-free telephone services

#### **Communication between health services and individuals**

- Treatment compliance
- Appointment reminders
- Community mobilization
- Raising awareness over health issues

#### **Consultation between healthcare professionals**

- Mobile telemedicine

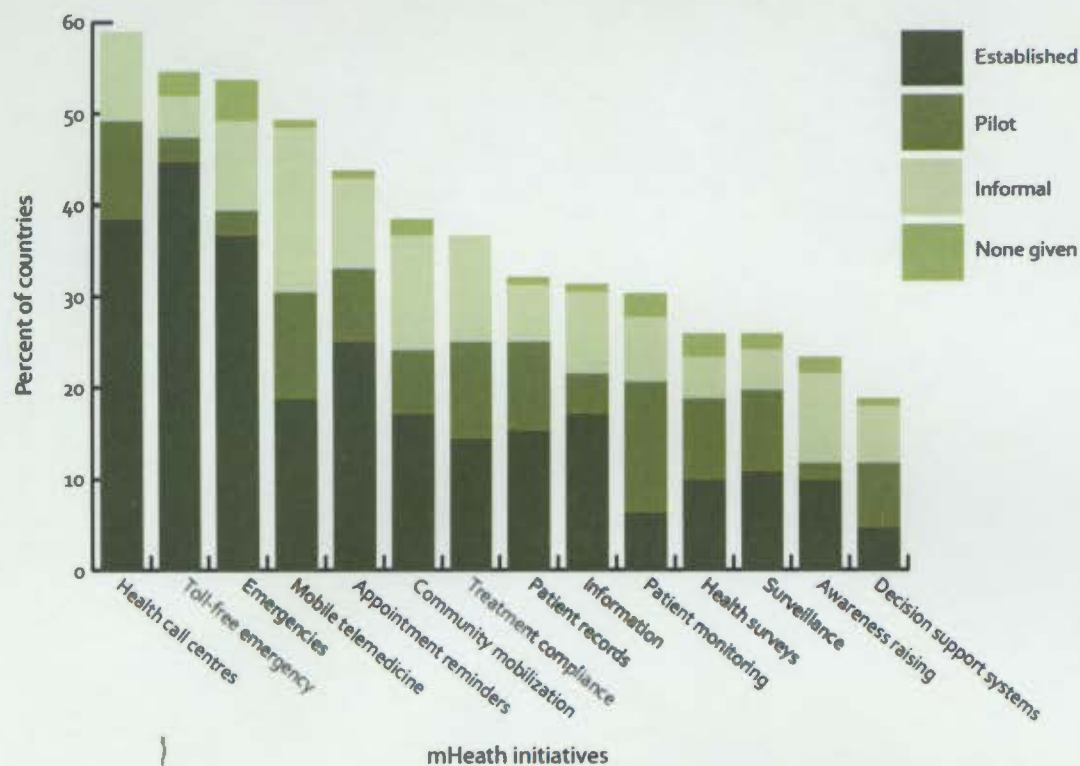
#### **Intersectorial communication in emergencies**

- Emergencies

#### **Health monitoring and surveillance**

- Mobile surveys (surveys by mobile phone)
- Surveillance
- Patient monitoring
- Access to information for health care professionals at point of care category
- Information and decision support systems
- Patient records

Figure 41: m-health initiatives and phases, globally.

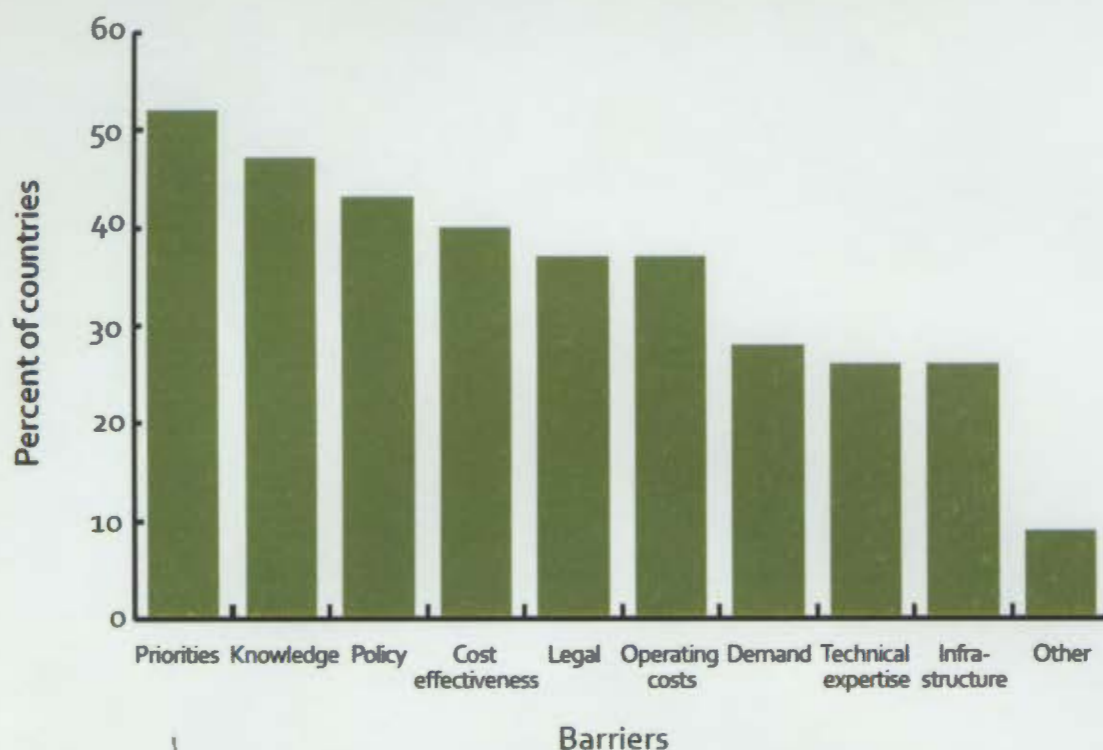


Source: WorldHealthOrganisation, 2012, p13

Globally m-health applications are used in the collection of community and clinical health data, delivery of healthcare information to practitioners, and to provide real-time monitoring of patient vital signs, and direct provision of care (WorldHealthOrganisation, 2012).

These initiatives also encounter a number of barriers in their implementation. The World Health Organization summarises those barriers as follows:

**Figure 42: Barriers to m-Health Implementation Globally**



Source: WorldHealthOrganisation, 2012, p, 64

Highlighting these barriers is important in the m-health context of this case study. It is imperative to understand if the experience in a form of lessons learned in the deployment of m-health in Tshwane is different to those experienced by the global counterparts.

### **6.3 Lessons for policy and regulation in the deployment of m-health in Tshwane:**

Findings from this case study reveal quite a number of lessons have been identified rather than learned. Participants have identified lessons such as:

- Operating outside a m-health policy and legal framework is very risky. Policy and legal framework is needed in this regard. There is a need for an e-health policy that fully supports m-health from both a legal and regulatory point of view.

- Poor coordination of initiatives as a result of the lack of a collaborative policy and regulation results in silo efforts which lead to limited results. Promoting a collaborative effort at national level will improve efficiency. It will improve the process of monitoring and evaluation of strategic initiatives. Ultimately, stakeholders will start working towards a common goal.
- Community Health Workers although they are part of the m-health project are not covered by any legal framework, thus something can expose them to criminal justice. A clear legal framework is necessary to guide and protect m-health implementers.
- M-health policy and legal vacuum results into poor buy in of m-health project as managers are not accountable to take the project forward.
- Poor end of project plan as funded by donors leads to the death of m-health.
- Necessity to keep solutions simple. It is imperative to promote the solution not the technology behind the solution.

## 6.4 Recommendations

### 6.4.1 *Revisiting the problem statement*

In seeking the way forward from this research, It is important that the researcher highlights the reason why this research was undertaken. This research was undertaken due to the concern that the researcher developed after reading about the state of public health care in South Africa. The key problem that this research seeks to answer is rooted in the current approach of the healthcare system that emphasises the curing of diseases and performance of procedures. This is against the backdrop of a public health care system that is under pressure to serve 80% of the population of South Africa. South Africans face a challenge of limited access to quality health care that is affordable coupled with a chronic shortage of qualified doctors and medical practitioners. This is called the "health access gap".

The health care system in South Africa has two sides to it, a private sector side that serves a minority of people who belong to medical aid schemes and has seemingly managed to meet

their needs and expectations. This is the good side of the healthcare system, and it does not come cheap. A vast majority of the people have to contend with using public healthcare facilities that are cheaper, but crowded, plagued with mismanagement, lack of resources (not enough beds, medicines) and qualified medical practitioners. The South African health care system desperately needs a complete makeover to close the divide between the private and public sector to bring up the standards, improve quality; attract skills and increase access while making the health care system more affordable.

The figure below summarises the current situation between private and public health care:



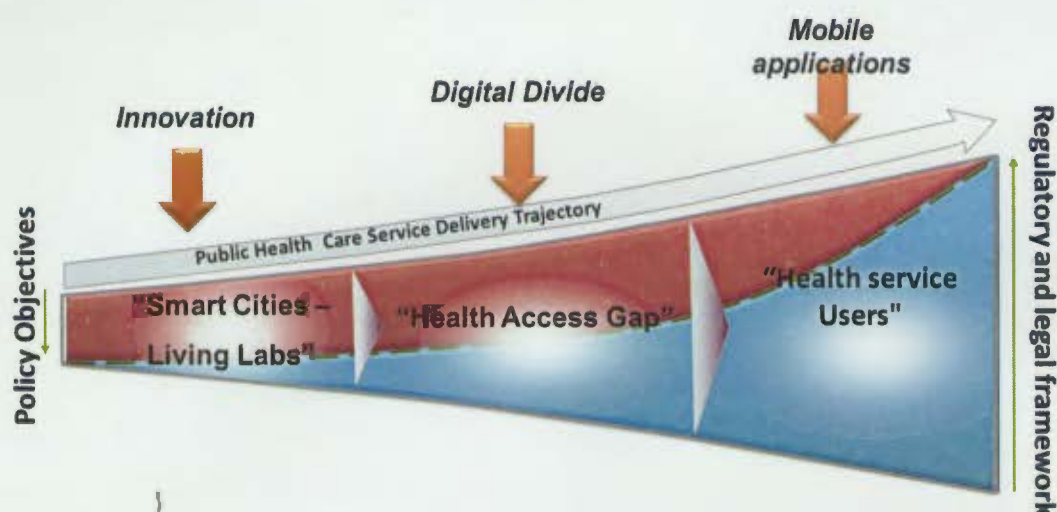
**Figure 43: Summary of the two sides of the South African health care**

Source: (Holeni, 2012)

The public health care is crumbling and without any intervention it may collapse.

The recommendations emanating from this research will be structured around three areas namely: the smart city and living labs, the health access gap and the healthcare users. A reflection of the health care trajectory is considered to point out the relevance of eHealth and mHealth in bridging the health access gap.

**Figure 44: Summary of Health Care Trajectory**



(Holeni, K.2013)

On the one hand are frantic efforts to find new ways of delivering health care to as many as possible by exploring digital medium. This is regarded as innovation and it is required, if the current burden that is upon the public health system is to be alleviated. In this paper, the researcher has explored the offering of health services through mobile health platforms and realized that there is a space for this solution. However, the innovation of mobile health platform is running far ahead of the current policy. Frantic as the efforts, it would appear that the efforts at this stage may come to zero; if the legislatures do not draft legislation to enable the usage of the mobile health service.

On the other hand is a ticking time bomb whose explosion may reduce the public health system to ashes. The public health care system is riddled with shortages of staff, equipment, medicines and old facilities. These challenges continue to plaque and cause the public health system to falter and fail to deliver quality and affordable health care where it's needed most. The health care users will be left destitute beyond the current state of frustration.

It is therefore imperative that legislation leap frogs the current situation and provide regulations on eHealth and specifically mHealth. The current policy directives must pave the way for drafting legislation for eHealth and specifically mHealth.

#### **6.4.2 National Health Legislative and policy framework**

The National Health Insurance policy that is currently being drafted into legislation is the most significant policy since the various pieces of legislation that oversaw the consolidation of various health care systems and facilities. It is currently the most talked about legislation where fault lines have developed between the proponents and sceptics. The National Health Insurance policy seeks to deal with the access, skilled medical practitioners and improve the affordability. The National Health Insurance policy must be read with the e-health strategy of 2012. The two documents must be aligned to ensure that they address common concerns and seek the same *outcomes* albeit through different routes. The e-health strategy is the document that espouses strategic imperatives of automating of the paper based health care system to become electronic. However, policy is one aspect that must be worked on diligently. There are other aspects that require policy makers to get involved in sooner, in the form of defining a process for introducing new services.

In the first instance policy must take a lead in defining the rules, norms and standards and the regulations that will govern the provision of new services and development of new channels to render services. However policy cannot and should not move too far ahead of the very services it seeks to give birth to. In the case of the current m-health initiatives underway, policy is lagging far behind the developments that are taking place. Leadership is urgently required from the Department of Health in taking the lessons that are being learnt to shape the legislation to enable the birth of m-health. The National Department of Health must establish a working group made up of representatives from:

- National
- Provincial
- Municipal

- Academia
- Industry (medical, ICT etc.)
- Sector Education and Training Authority (SETA)
- State Information Technology Agency (SITA)
- Civil Society

The aim of the working group would be to work with new services that are emerging within the health sector and develop guidelines early in the process of innovation. The group may be convened at defined intervals and given a scope of delivery where they would work towards attaining all the requirements. The working group would meet to consolidate the work. The inputs would cover all the elements required to ensure that a policy can be drafted. This working group must be led by the Department of Health. This group must also study other pieces of legislation which are not directly related to the m-health but may have an impact on the final policy. The working group may be directed to other emerging services and or technologies. The working group must guide the process of innovation, allocation of resources and monitoring of projects to ensure success.

The recommended process above is informed by the stages of innovation model for managing new ideas and services illustrated in figure 45 below:



**Figure 45: Adapted stages of innovation model for managing new ideas and services**

Source: (Kasper & Clohesy, 2008)

It is imperative to have a clearly defined and all-encompassing plan where all the various stakeholders converge in support of innovation. If properly addressed, "Innovation can become a more consistent and reliable commodity for social good" (Kasper & Clohesy, 2008).

### **6.4.3 Health Access Gap**

The health care system in South Africa requires a makeover and re-engineering to eliminate the chasm between the public and private sectors. This is one of the reasons why skilled medical practitioners have left the public service and opted for private practice and working for private sector hospital and pharmaceutical groups. The National Health Insurance policy has begun a process of closing the chasm that currently exists. However there is still a lot of work that must be done by all stakeholders.

The change<sup>1</sup> from a curative and procedure driven public health care must be addressed with urgency as it leaves matter to develop to a point where complications creep in. The sector must implement Living Labs that will be replicated in all the provinces and scaled up with the use of mobile applications to reach more people. The purpose of the roll out of m-health is to change the focus from curative to preventative and early detection.

### **6.4.4 M-health adoption**

The adoption of m-health requires champions on all sides of the stakeholder spheres. The barriers that have been cited are the fact that "technology" in the form of mobile phones and applications has been introduced. The medical profession is run by "pen, clip board and paper" where Doctors, nurses, and practically everyone has to write information down on paper.

It is recommended that the mobile applications be made subservient to the actual diagnosis or recording of observations by using an electronic/digital pen with an enabled form which will essentially replace the need to even use the key board of the phone. The digital pen and the

enabled paper will capture the information and transmit through the same mobile phone applications and send through GPRS to the central server. The mobile phone will serve as means of transmitting data and not the focus of the m-health solution.

m-health is a technology that must be leveraged. It would be critical to include it in to the City's Integrated Development Plan (IDP) as it supports the National Health objective. This way, the city would be compelled to get on board to support and provide funding. Again, there is a need to focus on how the health policy could be improved to cater fully for the electronic delivery of health services in South Africa.

The researcher recommends a further study exploring the potential of mobile through well-designed clinical studies incorporating an economic evaluation.

## **6.5 Conclusion**

Mobile technologies are likely to offer opportunities to improve public health service delivery, with major health and economic benefits, in a country such as South Africa where the communications between patients and health clinics are difficult and access to services is poor due to a weak infrastructure and geographical barriers.

With these challenges, the focus must be placed on how to use scarce resources more effectively through an appropriate technology (m-health). This would circumvent the problem of the shortage of medical professionals, deteriorating infrastructure under funding and poor management, it will further enable effective monitoring and evaluation.

The success to mobile health adoption is viewed to be largely influenced by the different spheres collaborating to meet Primary health objectives. m-health calls for an efficient mobile health policy. It calls for a clear legal and regulatory framework. It calls for informed institutional change. Its success is dependent on a solution that is affordable and accessible, that is, a solution that cuts through socio and cultural factors. This emphasis is illustrated by figure 46 below:



**Figure 46: m-health Adoption Dependencies**

Source: (Holeni, 2012)

With efficient synergies and support in a form of mobile health policy, legal and regulatory frameworks, institutional change, access and affordability, mHealth can become the heart beat and the answer to the eminent health access gap challenges.

The findings in Tshwane reveal that m-health and re-engineering of community outreach in has enable and empowered community health workers with the ability to reach people before they get sick. Community Health Workers are more equipped and spent more quality time with their patients leading to an improved quality of service. The mHealth solution promotes better access to health services, assists in the prevention of diseases, and affords early identification of health problems. m-health is the cause with the power to transform health services.

As mentioned in the conceptual framework, lesson learning appeared to be subjective rather than objective and that has posed challenges in separating what a person has learned from his or her personal opinion. Whilst this might have been the case, the study has provided valuable information, especially since this study is one of the very few studies conducted in the country. There is an urgent need from this study and in future studies to improve on a lesson learning conceptual framework.

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## APPENDIX A

### Actual Research Instrument: Sample of Interview Schedule

|                                                                                                                                                                                                                                                                                                                                     |                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>Introduction</b>                                                                                                                                                                                                                                                                                                                 | <b>To introduce the interview, the following remarks shall be narrated.</b>             |
| <ul style="list-style-type: none"> <li>• Thank you for your time. This is an independent study. Your responses will be treated with confidentiality.</li> </ul>                                                                                                                                                                     |                                                                                         |
| <ul style="list-style-type: none"> <li>• The purpose of this study is to provide a library of lessons learned and good practices in providing mobile health services.</li> <li>• The study will provide information and knowledge that can be used in informing the e-health-lab policies and regulation in the country.</li> </ul> |                                                                                         |
| The full research report will be made available to you.                                                                                                                                                                                                                                                                             |                                                                                         |
| May I record the interview to help with note-taking?                                                                                                                                                                                                                                                                                |                                                                                         |
| <b>Demographic information</b>                                                                                                                                                                                                                                                                                                      | <b>Participants information</b>                                                         |
| Name                                                                                                                                                                                                                                                                                                                                |                                                                                         |
| Job Title                                                                                                                                                                                                                                                                                                                           |                                                                                         |
| Company                                                                                                                                                                                                                                                                                                                             |                                                                                         |
| <b>Qualitative Information</b>                                                                                                                                                                                                                                                                                                      | <b>The following questions (within the identified themes) will guide the interview.</b> |
| <b>Policies and legislation</b>                                                                                                                                                                                                                                                                                                     |                                                                                         |
| <ul style="list-style-type: none"> <li>• Who are the key stakeholders or the drivers of m-health in South Africa?</li> <li>• Why did you choose to use mobile applications to bring public health to the</li> </ul>                                                                                                                 |                                                                                         |

communities?

- What is the policy regarding the use of m-health in the country?
- Are there plans to further enhance the current m-health policies and legislation?
- Are there any legal frame work in this regard?
- How are m-health implementers protected from being accused of implementing illegal services?
- In the case of litigation how are implementers protected by the laws?
- Are the internal policies or white paper in this regard?
- What are the efforts to ensure that policies and legislation is put in place?
- Is m-health included in the health Act? If not, how could it be included?

#### **Lessons identified and learnt**

- Since your engagement on m-health, what has been your major challenge?
- What are the key lessons you have identified and learnt in the course of implementing m-health?
- In your opinion, would you have implemented m-health in the same way you have?
- If not how significantly different would you have implemented this service?
- In the future how should m-health be implemented?
- Are there specific measures in place to measure the effectiveness and efficiency of m-health service delivery?
- What is your view regarding the future of m-health as a mechanism to bring services closer to the people?
- What are some of the things that should be done differently to enhance to effective administering and use of m-health in public health?

#### **Accessibility of m-health**

|                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>• What is your feeling regarding the TELL initiative?</li> <li>• Do you believe it (TELL) fulfils what it was set out to do?</li> <li>• Of the people residing in Tshwane, how many make use of the m-health (TELL) services?</li> <li>• How is the service at community level administered?</li> <li>• How do end users make use of the service?</li> </ul> |  |
| <b>Technology Literacy</b>                                                                                                                                                                                                                                                                                                                                                                          |  |
| <ul style="list-style-type: none"> <li>• What is required for people to effectively make use of the service?</li> <li>• How intuitive is the application to the users?</li> </ul>                                                                                                                                                                                                                   |  |
| <b>Affordability }</b>                                                                                                                                                                                                                                                                                                                                                                              |  |
| <ul style="list-style-type: none"> <li>• How affordable is it to deploy the m-health services?</li> <li>• At national level, what percentage of spend is required to fulfil the m-health initiative?</li> <li>• How are you as an entity subsidised?</li> <li>• Is the technology used affordable for people to use?</li> </ul>                                                                     |  |
| Source: Adopted from Industry Canada, 2002,p.12-21                                                                                                                                                                                                                                                                                                                                                  |  |