



**CHALLENGES IN THE DESIGN OF A SMART PHONE (MOBILE) APPLICATION  
FOR GENERAL PRACTITIONERS: AN INTERACTION DESIGN APPROACH.**

by

**SHAEEMA BOER (203008251)**

**Thesis submitted in fulfilment of the requirements for the degree**

**Master of Technology: Design**

**in the Faculty of Informatics and Design**

**at the Cape Peninsula University of Technology**

**Supervisor: Prof. Jörn Messeter**

**Co-supervisor: Prof. Retha de la Harpe**

**Co-supervisor: Prof. Mugendi K. M'Rithaa**

**Cape Town**

**March 2014**

**CPUT copyright information**

The dissertation/thesis may not be published either in part (in scholarly, scientific or technical journals), or as a whole (as a monograph), unless permission has been obtained from the University

## **DECLARATION**

I, Shaeema Boer declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

---

**Signed**

---

**Date**

## **ABSTRACT**

If a patient arrives at a general practice whether with a scheduled appointment or at random during office hours, the general practitioner should be able to assist the patient's with direct access to the patient folder which is stored at the office. What this research study focuses on is the accessing of patient information when the general practitioner is not at the office (usually after working hours). The research study takes place within the Durbanville suburb of Cape Town, South Africa. Interaction design is used as a framework to develop a solution by using smartphone technology.

## ACKNOWLEDGEMENTS

### I wish to thank:

- All the research participants involved in the study, thank you for your cooperation and patience, without you the project would not be possible.
- To Jörn Messeter, my supervisor who has introduced me to Interaction design and expanding my mind, thank you for your guidance.
- To Prof. Retha de le Harpe for your advice and assistance and for the opportunity to explore the possibilities within IT in the Kujali Living Lab.
- To Prof. Mugendi K. M'Rithaa who has provided assistance and advice throughout the research study and who has shown that design is more a part of life than merely a subject in a classroom.
- To Mari Arnott for your advice and assistance in the final steps of completing my paper, thank you for your time and your dedication, I appreciate it whole heartedly.
- To my parents Shamiel and Sheree for their support, patience and encouragement throughout my entire academic career, shukran. (Especially to my Father).
- To Zainoenisa Manuel who has constantly provided encouragement and support throughout my masters, shukran.
- The research team members who have started and joined throughout the project these are Siviwe Henda, Mlindisi Khoza, Roeghshana Mukaddam, Cecil Van Der Watt and Chantell Witbooi, thank you guys.
- To my family who have sat through the many months of moaning and discussions and who have encouraged me none the less, thank you.
- To Tracy Engel, Zaynab Falal, Shweta Ghosh, Chantal Muller and Layla Solomons who have always been there to lend an ear, thank you for your time and I appreciate it my friends.
- To you who have been a large source of motivation even without knowing it yourself, shukran Shweta Khanna for the push when I needed it the most especially when I started.
- To the Creator for granting me everything I need to accomplish this achievement, nothing can be done without you.

The financial assistance of the Kujali Living Lab (Safipa and CPUT) towards this research is acknowledged. Opinions expressed in this thesis and the conclusions arrived at, are those of the author, and are not necessarily to be attributed to the Kujali Living Lab (Safipa and CPUT).

## **DEDICATION**

“To the ACL (Anterior Cruciate Ligament) injury that led me to pursue my master’s while in recovery, from a misfortune to something else and I can run again.”

~ Shaeema Boer (author)

## TABLE OF CONTENTS

### CHAPTER ONE: INTRODUCTION

1.0	Introduction	1
1.1	Background to the research problem	2
1.2	Statement of research problem	3
1.3	Research question, sub – questions and objectives	3
1.3.1	Research question	3
1.3.2	Sub - questions	3
1.4	Current status of research area	4
1.5	Thesis structure	7
1.6	Delineation of the research	8
1.7	Significance of the research	8

### CHAPTER TWO: LITERATURE REVIEW

2.0	Introduction	9
2.1	The consultation	9
2.2	Understanding the working realities	11
2.3	Mobile technology	11
2.4	Summary	16

### CHAPTER THREE: METHODOLOGY

3.0	Introduction	18
3.1	Understanding research	18
3.2	Interaction design	22
3.3	Research through design as an underlining framework	23
3.4	Epistemological viewpoint	24
3.5	Qualitative approach	25
3.6	Ontological viewpoint	26
3.7	Research methodology	29
3.8	Sampling	30
3.9	Case study approach	32
3.10	Relationship between researcher and research participants	32
3.11	Ethics	33
3.12	Data collection methods	35
3.13	Design methods (Tools)	37
3.13.1	Contextual inquiry (Design tool)	37
3.13.2	Personas (Design tool)	37
3.13.3	Storyboard and scenarios (Design tools)	38
3.13.4	Interface sketch and sketching (Design tools)	38
3.13.5	Dynamic paper prototype (Design tool)	38
3.13.6	Dynamic digital prototype (Design tool)	39
3.14	Constraints of the research study	41
3.15	Analysis for the research study	41
3.16	Validation for the research study	42
3.17	Summary	44

## **CHAPTER FOUR: THE DESIGN PROCESS**

<b>4.0</b>	<b>Introduction</b>	<b>45</b>
<b>4.1</b>	<b>Overview of the research project</b>	<b>46</b>
<b>4.1.1</b>	<b>Interview study</b>	<b>47</b>
<b>4.1.2</b>	<b>SAFIPA - CSIR Conference showcase event</b>	<b>47</b>
<b>4.1.3</b>	<b>Design workshops</b>	<b>48</b>
<b>4.1.4</b>	<b>Self – reporting diaries</b>	<b>49</b>
<b>4.2</b>	<b>The interview study</b>	<b>50</b>
<b>4.2.1</b>	<b>Interview with the GPs based in Durbanville</b>	<b>50</b>
<b>4.2.2</b>	<b>Interview with public doctor in the health sector hospital environment</b>	<b>51</b>
<b>4.2.3</b>	<b>Interview with the GP based in Athlone</b>	<b>52</b>
<b>4.2.4</b>	<b>Interview with Pathology Company</b>	<b>54</b>
<b>4.2.5</b>	<b>Interview with the secretary from the Durbanville general practice</b>	<b>55</b>
<b>4.3</b>	<b>Self- reporting diaries</b>	<b>57</b>
<b>4.3.1</b>	<b>Research findings</b>	<b>58</b>
<b>4.3.2</b>	<b>Summary</b>	<b>60</b>
<b>4.4</b>	<b>The design workshops</b>	<b>61</b>
<b>4.4.1</b>	<b>Design Workshop 1</b>	<b>61</b>
<b>4.4.1.1</b>	<b>Design Workshop 1 findings</b>	<b>64</b>
<b>4.4.1.2</b>	<b>Summary</b>	<b>67</b>
<b>4.4.2</b>	<b>Design Workshop 2</b>	<b>68</b>
<b>4.4.2.1</b>	<b>Design Workshop 2 findings</b>	<b>69</b>
<b>4.4.2.2</b>	<b>Summary</b>	<b>75</b>
<b>4.4.3</b>	<b>Design Workshop 3</b>	<b>75</b>
<b>4.4.3.1</b>	<b>Design workshop 3 findings</b>	<b>77</b>
<b>4.4.3.2</b>	<b>Summary</b>	<b>80</b>
<b>4.5</b>	<b>SAFIPA – CSIR Conference Showcase event</b>	<b>80</b>
<b>4.6</b>	<b>The patient file application prototype given to Durbanville GPs</b>	<b>82</b>
<b>4.6.1</b>	<b>Feedback session about the dynamic digital prototype for the GPs</b>	<b>86</b>
<b>4.6.2</b>	<b>Findings from the feedback session</b>	<b>86</b>
<b>4.6.2.1</b>	<b>Technology and interactions</b>	<b>87</b>
<b>4.6.2.2</b>	<b>Design and design criteria</b>	<b>87</b>
<b>4.6.2.3</b>	<b>Motivation</b>	<b>87</b>
<b>4.6.3</b>	<b>Further reflections about the dynamic digital prototype</b>	<b>88</b>
<b>4.6.4</b>	<b>Summary of the feedback session</b>	<b>88</b>
<b>4.7</b>	<b>Themes that emerged during the research process</b>	<b>89</b>
<b>4.7.1</b>	<b>Themes</b>	<b>90</b>
<b>4.8</b>	<b>Summary</b>	<b>95</b>

## **CHAPTER FIVE: DISCUSSION**

<b>5.0</b>	<b>Introduction</b>	<b>93</b>
<b>5.1</b>	<b>Discussion</b>	<b>93</b>
<b>5.1.1</b>	<b>Objective 1: To understand what characterises a GP's work practice in Cape Town, this involved identifying the context in which the possible solution could work.</b>	<b>94</b>
<b>5.1.2</b>	<b>Objective 2: To identify the situations in which the GP's would need such an application, which also entailed defining the user requirements and design parameters.</b>	<b>94</b>

5.1.2.1 Use situations for the patient file application	95
5.1.2.2 User requirements for the patient file application	96
5.1.2.3 Design parameters of the patient file application	96
5.1.3 Objective 3: To identify the tools which could be used to design and develop such an application.	97
5.2 Summary	99

## CHAPTER SIX: CONCLUSION

6.0 Introduction	101
6.1 Chapter overview	101
6.2 Research question revisited	102
6.2.1 Statement of the research problem	102
6.2.2 Research question:	102
6.2.3 Sub - questions:	102
6.3 Answering the research question: How can mobile applications contribute to a possible solution to support general practitioners with the accessing of patient information when not at the office?	104
6.4 Conclusion	105
6.5 Reflection	105
6.6 Recommendation	107

REFERENCES	108
------------	-----

## LIST OF FIGURES

Figure 2.0: Depiction of a consultation session between a GP and a patient	9
Figure 2.1: Survey results for mHealth initiatives in participating countries	14
Figure 2.2: Images of patient ID tag being photographed by android device, mHealth initiative example	15
Figure 3.0: PLD model for deriving study type	19
Figure 3.1: Three World's model	20
Figure 3.2: Literature review within the study	29
Figure 3.3: Qualitative approach within the study	30
Figure 4.0: Research process feeding into the design process and vice versa within the study	46
Figure 4.1: Durbanville GPs in an interview	47
Figure 4.2: Image of research team member in design workshop with Durbanville GP	48
Figure 4.3: Interface sketches done in design workshops	49
Figure 4.4: The researcher explaining the use of the diaries to the GP's	57
Figure 4.5: The diaries front cover and the recording sheet	57
Figure 4.6: How the design tools were generated in the study	60
Figure 4.7: How the interfaces take shape in the design process	60
Figure 4.8: Image of scenario storyboard used in Design Workshop 1	62
Figure 4.9: Image of scenario storyboard used in Design Workshop 1	63
Figure 4.10: Image of interface sketches used by research team and GPs in Design Workshop 1	63
Figure 4.11: Partial image of paper interface sketch (1) (above) with sketch wireframe (bottom) showing the patient search bar where the GP would enter the patient name or surname on the patient file	65



application and partial image of paper prototype (2) displaying a drop down menu showing the patient identifiers which is the patient's surname, name, identity number, the medical aid scheme and a picture of the patient.	
<b>Figure 4.12:</b> Image of paper interface sketch with headings to indicate different sections clearly. Interface wireframe sketches at the bottom show the patient file layout clearer.	<b>66</b>
<b>Figure 4.13:</b> Image of refined interface sketches shown to the GP by the researcher	<b>68</b>
<b>Figure 4.14:</b> Refined interface sketch showing numbered password for logging into the application	<b>71</b>
<b>Figure 4.15:</b> Refined interface sketch showing the patient, Jason Peterson's family folder when searching for his patient folder	<b>72</b>
<b>Figure 4.16:</b> Refined interface sketch showing the patient, Jason Peterson's patient folder once he was selected	<b>73</b>
<b>Figure 4.17:</b> Refined interface sketch showing a detailed diagnosis screen	<b>74</b>
<b>Figure 4.18:</b> Image of digital prototype being used by Durbanville GP. Images were taken from the video recording footage	<b>76</b>
<b>Figure 4.19:</b> Image of digital prototype being viewed and discussed by Durbanville GPs and research team member. Images were taken from the video recording footage	<b>76</b>
<b>Figure 4.20:</b> Image of digital prototype "patient search" page. The patient list is presented to the GP. In this example the GP has chosen the first patient "Chantell Witbooi". Image was taken from the video recording footage	<b>79</b>
<b>Figure 4.21:</b> Image of digital prototype "family folder" page of patient Chantell Witbooi. The GP chooses the patient Chantell Witbooi on this page. Image was taken from the video recording footage	<b>79</b>
<b>Figure 4.22:</b> Image of digital prototype "patient summary" page of the patient Chantell Witbooi. Image was taken from the video recording footage	<b>80</b>
<b>Figure 4.23:</b> Research team members of Kujali Living Lab presenting the application at the SAFIPA - CSIR Conference showcase event	<b>81</b>
<b>Figure 4.24:</b> Reflection packages used by the Durbanville GPs	<b>82</b>
<b>Figure 4.25:</b> Storyboard 1, the arrow on top (1) is the General Practitioner Davis office, the arrow below (2) is where he lives. Sometimes GP Davis receives calls from patients in the evenings at home or when "out on the town", at times he would need to travel back to the office to retrieve patient information in order to assist the patient.	<b>83</b>
<b>Figure 4.26:</b> Storyboard 2, General Practitioner Davis receives a call at 9:41 PM. It's a call from a patient; he answers the call, speaks for a few minutes and ends the call. He needs to get to the office in order to retrieve patient information needed to better assist the patient.	<b>84</b>
<b>Figure 4.27:</b> Storyboard 3, rather than rushing to the office over a great distance, the GP uses the Mobi-Here patient file android application. (Mobi-Here is the application name given by the research team)	<b>84</b>
<b>Figure 4.28:</b> Storyboard 4, the GP logs into the application and then starts to search for the patient who had contacted him.	<b>85</b>
<b>Figure 4.29:</b> Storyboard 5, the GP searches through the application for the information that he needs to assist the patient	<b>85</b>
<b>Figure 4.30:</b> Storyboard 6, GP Davis exits the Mobi-Here patient file application after he has read the patient information that he had been searching for and then calls the patient to assist. By using the Mobi-Here patient file android application GP Davis was able	<b>86</b>

to save time by accessing his patient's information via his mobile smartphone instead of commuting to the office to retrieve the information.

Figure 5.1: Image of scenario storyboard and line drawing interface sketch design tools in Design Workshop 1	98
Figure 5.2: Refined interface sketch design tool in Design Workshop 2	98
Figure 5.3: Image of dynamic digital prototype design tool in Design Workshop 3	99

## LIST OF TABLES

Table 1.0: Sub - questions, methods and objectives	4
Table 2.0: Aims of the consultation	10
Table 2.1: Seven key tasks in a consultation	10
Table 3.0: PLD model	19
Table 3.1: Researcher's study within the PLD model and the three world's model	21
Table 3.2: Steps in qualitative approach to social research	26
Table 3.3: Influences and how it fits into the researcher's study	27
Table 3.4: Design tools, method secured and data derived in study	39
Table 4.0: Team members of research study	45
Table 4.1: Timeline of the different sessions in research study	49
Table 4.2: Major results from in the self-reporting diaries kept by the Durbanville GPs	58
Table 4.3: Functional Requirement for the patient file application	59
Table 4.4: Research findings and design actions done in Design Workshop 1	64
Table 4.5: Research findings and design actions done in Design Workshop 2	69
Table 4.6: Research findings and design actions done in Design Workshop 3	77
Table 4.7: Examples of themes found in research process	90

## APPENDICES 117

APPENDIX A: INFORMED CONSENT FORM	117
APPENDIX B: INTERVIEW QUESTIONS FOR GENERAL PRACTITIONERS AND DOCTOR	119
APPENDIX C: ACTIVITY DIAGRAMS FOR PATIENT SEARCH, VIEWING A PATIENT FOLDER AND UPDATING A PATIENT FOLDER FUNCTIONS	121
APPENDIX D: GENERAL PRACTITIONER PERSONAS	124
APPENDIX E: SCENARIO STORYBOARD	126
APPENDIX F: DYNAMIC DIGITAL PROTOTYPE	127
APPENDIX G: DYNAMIC DIGITAL PROTOTYPE USER MANUAL	129
APPENDIX H: THEMES GRAPH	142

# GLOSSARY

<b>Acronyms</b>	<b>Explanation</b>
3G	Third generation of wireless technologies, 3G is mostly used with mobile phones and handsets as a means to connect to the internet (Unuth,2013).
4G	Fourth generation broadband mobile capabilities which enable the access of data and streaming multimedia at higher speeds (Webopedia, 2013).
CPUT	Cape Peninsula University of Technology
CSIR	Council for Scientific and Industrial Research
EHR	Electronic health record
ELMR	Efficient lightweight mobile record
EMR	Electronic medical record
GP	General Practitioner, referred to as family doctors as well, these are doctors who work in the private sector of the health care industry.
GPRS	General packet radio service
GPS	Global positioning system
HCI	Human computer interaction
ICT	Information and communications technologies
ID	Industrial Design
IT	Information Technology
IxD	Interaction Design
MMS	Multimedia Messaging Service
PC	Personal computer
QR code	Quick Response Code
SAFIPA	South African – Finland Partnership
SMS	Short message service
UCD	User centered design
WHO	World Health Organisation

## Definitions

Back end system	Back end systems are corporate systems that are used to run a company such as systems to manage orders, inventory and supply processing. Back end systems support the company's back office. This system collects input from users or other systems for processing (Webopedia, 2014).
Bandwidth	This is the maximum rate of data which can be transferred over an internet or network connection (TechTerms, 2013).
Bluetooth	Wireless technology enables communication between Bluetooth-compatible devices. It is used for short-range connections between desktop and laptop computers, PDAs (like the Palm Pilot or Handspring Visor), digital cameras, scanners, cellular phones, and printers (TechTerms, 2013).
Broadband	This is a single cable which is able to transfer large amounts data at high speeds (TechTerms, 2013).
E-Agriculture	Exchanging of information, ideas and resources about the use of information and communication technologies for sustainable agriculture and rural development (e-Agriculture, n.d.)
Health system	Health care system is an organization to deliver health care (The free dictionary, 2013).
Interactive system	Interactive systems can be defined as the class of systems whose operations involve a significant degree of user interaction (Kotonya & Sommerville, 1998).
mHealth	Mobile health is the use of mobile devices to support the practise of medicine and health care.
M-Learning	Mobile learning is the ability to obtain or provide educational content on personal pocket devices such as PDAs, smartphones and mobile phones (Mobl21, 2013).
Medical record	Information of a patient which can be the identity details of a patient and medical history of a patient.
Patient data	These are details of the patient being treated e.g. name, initials, sex, address, postcode, phone number (The free dictionary, 2013).
Proof of concept	The stage during the development of a product when it is established that the product will function as intended (Collins English Dictionary, 2014).
Public doctor	These are doctors who work for the state/ government.
Smartphone	A smartphone is a mobile phone built on a specific mobile operating system, which has capabilities more advanced than a regular feature phone e.g. iPhone and Android.

Specialist

A physician whose practice is limited to a particular branch of medicine or surgery (The free dictionary, 2013).

Wireless technology

The use of energy between electronic devices which enable communication and exchanging of information (Wireless Technology Advisor, 2013).

# CHAPTER ONE INTRODUCTION

## 1.0 Introduction

Information technology (IT) has influenced our world to such an extent that it is present in almost every segment of our lives whether it is for work or pleasure. Technology influences the way the people interact with each other socially and in the work place. Some of these digital artefacts come in the form of smartphones and personal computing. If one has to think about the opening sentence one would see references relating to one's own life when thinking about technologies that influence our lives, few examples are social networks sites and shopping done via the internet.

There are a variety of professionals in information technology who produce digital artefacts such as software engineers, software programmers and user interface designers. Coming from an Industrial design background, my perspective was more orientated towards product development, yet when exposed to Interaction design, I could not help but notice how my background of Industrial design and the recent exposure to Interaction design overlap one another. This confirms what has been noted by Binder et al. (2011) that for the last 15 years these two disciplines have evolved side by side. Industrial design (ID) has its roots predominantly in products of a material nature and Interaction design has its roots in the computer sciences. However with time it has been noted that professionals from each of these fields have been exposed to each other, when it comes to IT problems within specific environments (Binder et al, 2011). Binder et al (2011:9) points out that "Importantly, information technologies have no obvious shape. The key skills in coping with IT are not redoing and refining existing forms but imagining interesting and useful concepts that people want."

My research project was initiated within the Kujali Living Lab which was started by the Department of Information Technology at the Cape Peninsula University of Technology (CPUT) in association with the South African – Finland Partnership (SAFIPA) which aims at starting innovative projects within the field of IT.

The area of the research study focuses on the medical sector more precisely that of general practice. General Practitioners (GPs) unlike public health doctors do not have the advantage of a work- shift- system. Work-shift-systems allow the current doctor on duty to leave when their shift is over and another to fill their place. This system allows the doctor who is working to access a patient's record as the need arises. Although GPs tend to consult the same patient on a regular basis, these

consultations are always within normal working hours, unlike 24 hour working schedule in public hospital. General Practitioner's normal working hours could be extended into after hours, should a patient contact them in case of an emergency. Unlike a public hospital which has doctors present on a 24 hour basis, who have access to a patient's record for emergency purposes, the GP would have to deal with such a situation differently. In the research study Interaction design will be used to provide a possible solution for GPs to access patient records after office hours.

The primary reason for my research study is the efficient accessing of patient data when GPs are primarily away from the office during and after office hours. Musen (1997) mentions that in clinical settings, clinicians can access patient documents and that this is done mostly after hours, but does not mention where patient data can be checked. Finding an efficient way to access patient information outside the office environment was considered important by some general practitioners in private practice in the vicinity of Cape Town. This confirmed a study conducted with physicians and the testing of ubiquitous mobile access of patient vital signs and data on and off site, which showed that the access of data proved to be convenient and useful in offsite situations (Klootwijk *et al.*, 2002).

## **1.1 Background to the research problem**

General practitioners are the caretakers of the people within their communities. The World Health Organisation (WHO) defines a practitioner as being "concerned with maintaining or restoring human health through the study, diagnosis and treatment of disease and injury, through the science of medicine and the applied practice of that science" (World Health Organization. n.d.). GPs are often the first point of contact for people when an illness arrives. The duty that a general practitioner would perform ranges from diagnosis, examinations, prescribing medication, performing minor scale operations and the treatment of ailments from which their patients suffer from (GoStudy, 2008).

Before a GP can actually diagnose a patient, the doctor first needs to assemble a clinical history / patient health folder of a particular patient which acts as a record that is updated every time the patient comes to see the GP. The work of a GP is very demanding due to long working hours, interrupted leisure time because of patient emergencies and having to keep abreast with developments in the industry (GoStudy, 2008).

South Africa's general working hours are usually Mondays to Fridays from 8-8:30 am to 5pm. Some companies have working hours on Saturdays and Sundays, but most South Africans rarely work on the weekend (Communicaid Group Ltd, 2009). These hours could however be longer for professionals working within the medical sector such as doctors and nurses. In a study conducted by Chandratheva et al. (2008) the main outcome was to measure events that resulted in the contacting of general practitioners during working hours, after office hours and on weekends. What the study revealed was that between the period 1 April 2002 to 31 March 2006, 91000 patients were assessed which showed that when an event occurred (health incident e.g. stroke), 73 percent of the group first contacted a general practitioner. It also shows that calls were greater after office hour period than during normal office hours. Patients were classified as high risk (stroke patients) it was noted that immediate response from a GP could substantially reduce an early reoccurring stroke. A minor number of high risk patients chose to call a general practice service while 72 percent preferred to call their registered general practitioner.

## **1.2 Statement of research problem**

Although general practitioners attend to patients during office hours when they have access to patient information it is not clear how they would react to situations outside of the office environment when access to patient information is not possible, but necessary and even vital at times.

## **1.3 Research question, sub – questions and objectives**

### **1.3.1 Research question:**

How can mobile applications contribute to a possible solution to support general practitioners with the accessing of patient information when not at the office?

### **1.3.2 Sub - questions:**

- What characterises the work practice of general practitioners in Cape Town, South Africa?
- What characterises the use situations where general practitioners need access to patient information?
- How can a smartphone application be designed to provide adequate access to patient information for general practitioners when not at their office?



**Table 1.0: Sub - questions, methods and objectives**

<b>Sub - questions</b>	<b>Research method(s)</b>	<b>Objectives</b>
What characterises the work practice of general practitioners in Cape Town, South Africa?	Literature review and case studies (within literature sources and actual research process)	To identify the context in which the possible solution will be developed.
What characterises the use situations where general practitioners need access to patient information?	(Literature sources) case study and design (actual design process) (actual research process)	Define the user requirements and design parameters.
How can a smartphone application be designed to provide adequate access to patient information for general practitioners when not at their office?	Literature sources; design (actual design process) and (Literature sources) case study (actual research process)	Identify tools used to design and develop a smart phone application.

#### **1.4 Current status of research area**

Accessing a patient's medical record is being addressed in a variety of different ways. There is the traditional method of accessing a patient folder at the hospital, clinic and general practice in a paper format. With technology influencing almost all facets of life including in the work place, medical records are accessed in electronic format as well. Medical records that are accessed electronically are referred to as electronic health records (EHRs) or electronic medical records (EMRs). These are often accessed within traditional settings such as hospitals and general practices. Al-Mujaini and Ganesh (2009:1) note that EMR is a tool which supports administration and management purposes and that "The EMR system offers support in medical decision-making, promotes use of guidelines, increases coordination between different health care providers and is believed to improve overall quality of care."

Mars and Seebregts (n.d.) note that within South Africa only a third of the provincial hospitals use some form of functioning medical record system and that there are seven types of systems which are used and on computers. South Africa is currently in the process of developing a national electronic health system. Besides being accessed within hospital environments EHRs are being developed in so that patients can access their patient records as well, an example of this is the "MyChart" application for smartphones (e.g. iPhone and Android), "MyChart" provide access to

patients who would like to view certain aspects of their health record (University of Michigan Health System, 2012). Another application developed in South Africa within 2012 which provides access of patient medical records is the Discovery “HealthID” application which grants access to a patient’s medical record. This application allows the patient’s medical record to become digitized and access is granted to a specific patient’s GP’s. In order for this to happen the patient would have to give consent. Once the consent has been approved, a GP is able to make referrals to other physicians and prescriptions are made possible. Other functions are the accessing of a patient’s medical record if an accident occurs, the emergency personnel can scan the patients QR Code to digitally access the patient’s medical record (Discovery, n.d.).

Another method of providing access to medical records is the development of “walk-in-clinics” (Campbell et al., 2007). Although this is not a form of accessing medical records in an electronic format it is a service which provides longer opening hours for patients who wish to see a GP. Salisbury (2007) notes that South Africa is one of several countries that have incorporated “walk-in-clinics” in the health sector industry.

Another method is the access to GPs after-hours through a service known as “GP Assist” which is provided by the Australian Government. “GP Assist is an innovative service which is delivering the most progressive After Hours General Practice solution in Australia. GP Assist provides after hours support to rural General Practitioners (GPs)” (Davis & Law, 2007). This service is provided by a team of doctors and nurses over the telephone to patients within Tasmania, Australia.

The importance of medical records is vital to the health care of patients. It is a record of every aspect relating to a patient’s health, this record is important and essential to providing a continuity of care for the patient (Medical Protection Society, 2013). It is for these reasons that access to a medical record is essentially for a patient’s general practitioner.

Mars and Seebregts (n.d.:29) had made a prediction that mobile technologies will advance within the medical area which is evidenced by the multitude of health applications that are available on smartphones such as the “MYChart” application for iPhone and Android as previously mentioned. In China there has also been a development of a mobile healthcare cardiovascular diagnosis service which is aimed at helping community clinics, townships and village medical institutions (Jie, 2012). South Africa’s mobile statistics according to the 2012 African Mobile Phone Market

fact book show that South Africa's mobile phone penetration is over the 100 percent mark. Smartphone penetration in Africa is between 17 percent and 19 percent currently (Kujawski, 2013).

All applications which were discussed were designed with a specific purpose in mind. The "MYChart" application gives patients access to their medical record at home and the "walk- in- clinics" which enable patients to access a GP with longer working hours. However there is no application which caters for all medical purposes.

The successful design of any application is to understand the intentions for which it will be used. Interaction design is seen as developing applications or rather user experiences for screens, how the content is presented or interacted with, whether it is on a mobile, PC and other screen orientated technology, however the importance of designing an application does not merely stop at the content or how it will be seen.

Robert Fabricant who is the "vice president of creative" at the Frog Design company explains that:

Interaction design, five or six years ago meant solving and thinking through kind of a choreography of information and feedback and interfaces around a product, but the big step was going from thinking about it as being contained in each of those things to now thinking about it as something that's existing across them (Connecting, 2012).

By using interaction design is not only designing for a specific product but it is important to understand the context for a product, Liz Danzico who is the chairman at the MFA Interaction design school in New York elaborates that "It's understanding that ecosystem where the human is at the centre and understanding that network of things and how they all work together rather than your device..." (Connecting, 2012). Interaction design used within the medical sector or more specifically the GP environment could transform the traditional method of a patient visiting in one time when they are only sick to a number of different possibilities e.g. maintenance of care in the form of a system where appointments, reminders and results are done on a digital platform which engages the patient to actively and constantly take part in their well-being by being informed and by interacting with the GP on a regular basis.

## **1.5 Thesis structure**

### **Chapter 1: Introduction**

Chapter 1 introduces the thesis with a brief introduction and background on the explored topic, the aims, the structure, the significance and the delineation of the study. The research questions are presented as well as the methods which will be used to answer them.

### **Chapter 2: The literature review**

This section provides the literature review of the thesis, this section provides an understanding and an overview of the medical record in the various forms in which it has manifest, another aspect which is looked at is the role of the GP, the operations of a general practice, the overview of a consultation and how it is recorded. A global view of mHealth and its influence within the South African setting and where mobile technology is positioned with in the health sector are also investigated.

### **Chapter 3: Research methodology**

The research methodology for the study is presented in chapter 3. In this section the research frame work of interaction design and research through design are explained. The interpretive research paradigm and qualitative approach are discussed, in particular how these approaches have influenced the choice of methods used to gather data in the study. The ontological viewpoint of the study is briefly discussed as well as the designed methods used in the study.

### **Chapter 4: Design process**

The design process which I have studied is presented. This process is shown chronologically by the researcher. The design process, methods and progress of the design as experienced by the researcher is described in this section.

### **Chapter 5: Findings and analysis**

The findings which emerged from the design process conducted in the previous chapter are analysed and then discussed in chapter 5.

### **Chapter 6: Conclusion**

In the conclusion the research question is answered, the researcher discusses her reflections experienced in the study and recommends further investigations.

## **1.6 Delineation of the research**

The thesis will only be covering the designing of a mobile phone/smart phone application relating only to the private general practitioners in the Western Cape being used as examples in the project. It will only be focusing on the developmental stages being the conceptualization until the proof of concept within the project and will be taking a look at the Interaction design methods used to reach the stages. It will not focus on the actual production and implementation stage of the application. It will not focus on other health organisation environments such as hospitals or clinics.

## **1.7 Significance of the research**

The research done in this project will contribute to the body of knowledge within the field of Interaction design as well as in the field of mobile electronic health records and also within mobile technology in healthcare. As well as add to the knowledge contribution within the South African health industry itself. The research generated could act as a model for designing mobile applications not only for the health industry but in other sectors as well. A realistic product could be the by-product of the research conducted. It could lead to new technologies within the health sector.

## CHAPTER TWO LITERATURE REVIEW

### 2.0 Introduction

The study focuses on the accessing of patient data for general practitioners when they are not in the office. The patient data of a patient comes in the form of a medical health record, thus it's needed to understand what the consultation is; what the medical record is, which data goes into it and how data is recorded. It is important to understand the inner workings of the general practice as well; this information is needed to understand how the GP operates within their working environment. All of these aspects feed into the designing of the interactive system for the GP's of the Durbanville practice. In the literature review the researcher had gathered information of a general nature pertaining to the different sections.

### 2.1 The consultation

The way data is captured is not necessarily with a pen and paper or computer it is firstly done through a consultation. Why is the consultation being explored? For the study it is better to understand what the GP needs to know about a patient in order to know how the patient folder and data is arranged to develop a system that would be able to display information in a way which the GP will understand. As interaction design is about gathering an understanding for the design situation and the context within the accessing of patient information through technology, it will be beneficial to understand how data is gathered and how it is arranged.



**Figure 2.0: Depiction of a consultation session between a GP and a patient (SAFPJ, 1981)**

The basis for the consultation is to find out what the problem is and how to treat it.

**Table 2.0: Aims of the consultation (Simon, 2009)**

<ul style="list-style-type: none"> <li>• Establish a constructive relationship with the patient (and carer if needed) to enable effective communication and serve as the basis for any subsequent therapeutic relationship.</li> </ul>
<ul style="list-style-type: none"> <li>• Determine whether the individual has any health problems or any health promotion needs and, if so, what they are.</li> </ul>
<ul style="list-style-type: none"> <li>• Find out (where possible) what caused those problems.</li> </ul>
<ul style="list-style-type: none"> <li>• Assess the patient and family's emotions and attitudes towards the problems.</li> </ul>
<ul style="list-style-type: none"> <li>• Establish how they might be managed.</li> </ul>

Murtagh (2007) mentions a model which gives a clearer description of the consultation; there are seven key tasks within this model that are helpful in the consultation.

**Table 2.1: Seven key tasks in a consultation (Murtagh, 2007)**

1. To define the reason for the patient's attendance, including:	<ul style="list-style-type: none"> <li>• The nature and history of problems,</li> <li>• Their aetiology,</li> <li>• The patient's ideas, concerns and expectations,</li> <li>• The effect of the problems</li> </ul>
2. To consider other issues:	<ul style="list-style-type: none"> <li>• Continuing problems</li> <li>• Risk factors</li> </ul>
3. To choose, with the patient, an appropriate action for each problem.	
4. To achieve a shared understanding of the problems with the patient.	
5. To involve the patient in the management and encourage him or her to accept appropriate responsibility	
6. To use time and resources efficiently and appropriately:	<ul style="list-style-type: none"> <li>• In the consultation</li> <li>• In the long term</li> </ul>
7. To establish or maintain a relationship with the patient that helps to achieve the other tasks.	

The design situation of the research study deals with the accessing of patient data, this is primarily the reason why all of the above has been added into the research paper because in order for an interactive system to be designed to cater for a design situation, the consultation needed to be looked at in order to understand what exactly goes into a medical record, what it is primarily compiled of and how it is compiled, this enables the researcher to understand how information can be managed in a manner which will not be confusing for a GP to understand and navigate through.

## **2.2 Understanding the working realities**

Musen (1997:106) describes that the difference between general practitioners and specialists is that GPs tend to take care of patients over a longer period of time than specialists. The GP would receive a detailed analysis of the patient while the specialist would receive disjointed data of the patient. It is more likely that GPs would be running their own practice or working in a small group where there is limited input in regards to managing the practice as opposed to a specialist who would be working in a more complex environment. GP's notes are not as extensive as those of the specialist's and there may be different needs in regards to content within a patient record for a specialist.

Understanding of these working realities is where interaction design comes into use in the study. To understand the meaning of the working realities Fitzpatrick (2000:7) who emphasises the notion of understanding the practice of the health recording in the working environment, mentions the following:

We need to know more about how clinical practice really happens, not just as abstracted in protocols or procedure manuals, but in all its messiness, richness, complexity, and subtlety.

A General practice could consist of a single GP and a nurse or it could consist of a multidisciplinary team of up to thirty professionals within a practice.

## **2.3 Mobile technology**

The gap between the user and the desktop computer has increased throughout the years. Devices have been constructed in such a way that they incorporate a multiple features which were not there in the past. The mobile phone is one of those products which have changed considerably with time. Currently mobile phones are used for more than just making and receiving phone calls or sending a Short Message Service (SMS). The mobile device is seen as more than just a basic communication tool in today's technological age. It is used as an entertainment tool, a business tool, a high definition camera and ever more as a platform to incorporate a variety of applications that interact with the user's daily life.

Heath and Luff (1998:14-15) note that technology has the ability to alter how interactions are conducted in business, medical or transportation processes and continue to mention that



By constraining the movement of individuals, and burdening the user with a complex, yet inflexible technology, we run the risk of undermining an important resource in collaboration, namely, an individual's ability to reconfigure him or herself with regard to on-going demands of the activity in which they are engaged.

Devices such as tablets and laptops allow users to be mobile, but the mobile phone is the most dominant in this category. It is reported that there are over 500 million mobile phone users in Africa now, with South Africa being one of the four largest markets in Africa (Mobile Monday, 2011). The integration of mobile phones in everyday life is undeniable, Botha and Ford (2010) note that with the large mobile phone surge in South Africa predominantly amongst the youth cell phones have the potential to be integrated into the education system as a learning tool for children. As they are able to interact with a mobile phone before using a computer. Huang (2009) notes that schools and universities are using mobile learning known as m-learning for specific applications for students. Another use of the mobile phone is the global positioning system (GPS) which allows users of mobile phones to pinpoint geographical locations.

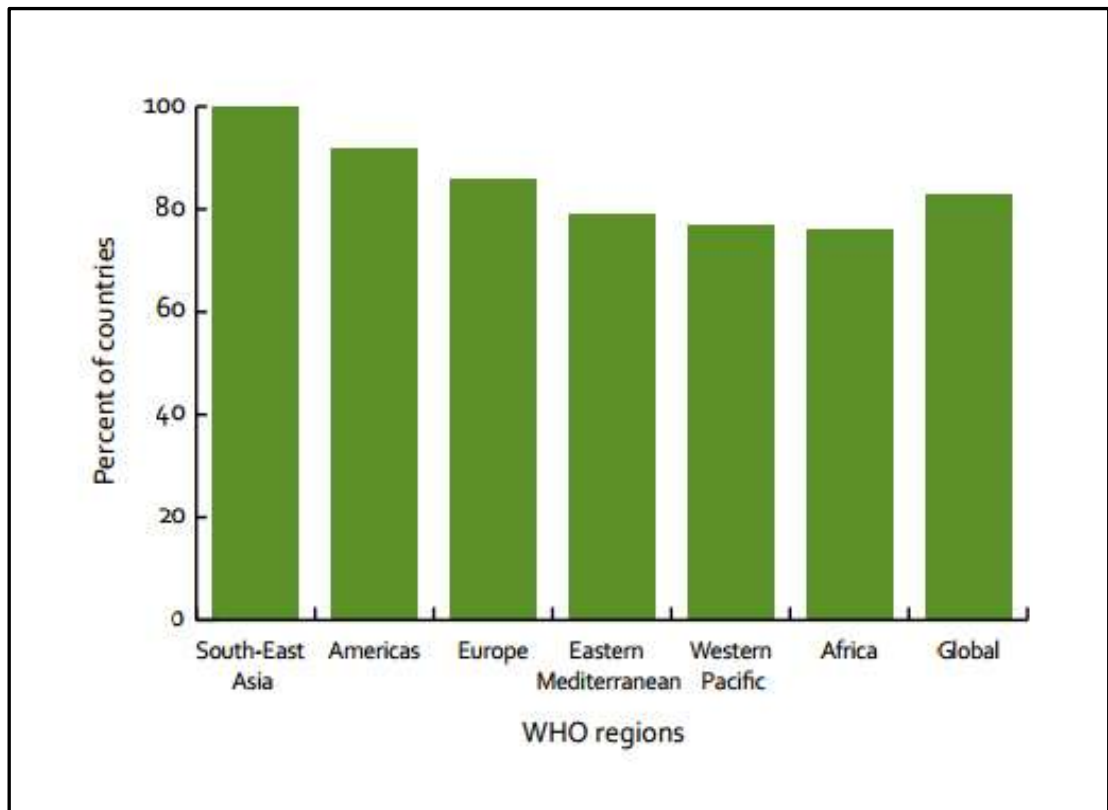
More recently there has been exploration of mobile technology in the medical field. In the medical- technology sector in South Africa initiatives such as a project conducted in a rural community in Graskop in Mpumalanga by the Council for Scientific and Industrial Research (CSIR), used cell phones as a means of communication and assistance between care givers and hospices/clinics to help assist/tend to residents in rural areas with home based healthcare (Council for Scientific and Industrial Research, 2009:59).

Another study conducted in rural areas in South Africa focused on efficient lightweight mobile records (ELMRs), in which emphasis was placed on creating, appending, updating, destroying and retrieval of mobile health records under extreme bandwidth and cost-constrained short messaging service (SMS) on low end cell phones (Chen *et al.*, 2009). Handygo (2009) an Indian innovative mobile service provider uses the mobile phone to deliver services ranging from e-agriculture services which educate rural farmers on innovative practices for cultivation. Other services provided are sex education, health and wellness education to mobile phone users throughout India. The mobile phones used for the Handygo initiatives range from low cost handsets to smartphones (basic applications for low cost handsets and more interactive applications for smartphones).

Smartphones are the next generation of mobile phones which have transformed the way people use phones. Buhari *et al.* (2012:73) describes the smartphone as a phone which has advanced features such as internet access as well as other computer processing capabilities, it far exceeds making and receiving calls, it checks/sends emails, play videos and displays photos and much more. Boulos et al. (2011:1-3) mention that smartphones are no longer seen as phones but rather as “handheld computers” because of their on-board operating systems and capabilities, The smartphones physical attributes are also different compared to older generation phones, smartphones have larger displays and tactile and gesture user interfaces.

West (2012:2) notes that 114 countries throughout the world have implemented mHealth (Mobile Health) initiatives. He also mentions that there are more than 40,000 mobile health applications available across many platforms that have been adopted/downloaded by an estimated amount of 247 million people and that this sector is expected to become a multi-billion dollar field by 2017. It is stated by the World Health Organization (WHO) (2011:6) that to this day there is no standardised definition for mHealth. It is defined by the push and pull of information through the utilization of the mobile phones core functionality.

In a global survey done by WHO 83 percent of the 112 participating Member States reported the presence of at least one mHealth initiative in a country (World Health Organization, 2011:10) See figure 2.1.



**Figure 2.1: Survey results for mHealth initiatives in participating countries (WHO, 2011)**

Mobile Monday (2011:12) notes that by 2015 mobile devices such as smartphones and tablets will be the 87 percent driving force behind the global mobile traffic. The reason for this boom within the industry is the availability of mobile devices and content for such devices. The three smartphones which show an increase in mobile health applications are iPhone, Google android and then Blackberry (Boulos *et al.*, 2011).

The advantages towards work productivity by using mobile devices especially wireless technology it that improves productivity in 4 major ways; unproductive travel times are reduced, logistics are improved, decision-making is faster and small businesses are empowered which also improves communication (West, 2012).

Smartphone applications are quite diverse. A software company such as Skyscape has been using the mobile device as a platform where physicians, nurses and students can access resources (information on thousands of brands and generics, pill images and interaction checker) when needed (Skyscape, 2012). Buhari *et al.* (2012:73) mentions the application named Epocrates which is a reference resource for drug dosages and reactions developed for smartphones such as android, iPhone and windows mobile.

In the medical field accessing of medical records is an advancement. Nuesoft is a company that has developed software ranging from medical billing software and services, practise management software as well as health record software that has been developed for the mobile platform, allowing the user to access patient charts, documents and appointments (Nuesoft, 2011).

Accusoft Corporation (2011) has developed an application which allows the accessing of medical records on the Android platform known as the Barcode Xpress Mobile. This allows the patient to be identified by taking a picture of a patient bracelet which contains the patient ID which identifies the patient and displays the medical record.



**Figure 2.2: Images of patient ID tag being photographed by android device, mHealth initiative example (Accusoft Corporation, 2011)**

A publication by the South African department of health note that currently there are hurdles which face the implementation of mHealth initiatives such as low broadband penetration, expensive bandwidth, standards and policies. Despite the hurdles growth

of mobile technology within the country has reached a percentage of 90 and this not only provides an opportunity to revolutionize the health sector, but it also provides ICT (Information and communications technologies) within South Africa to be seen as an investment which would contribute to the improvements and changes within the health sector (South Africa. Department of Health, 2012:15-21).

With all of these advancements in the mobile health sector, challenges should also be taken into consideration, challenges such as mobile power consumption, connectivity for applications, and security of health data on different mobile software platforms, mHealth policies and laws. For this research study the challenges such as connectivity, security are not the focus although the researcher notes that these aspects are very important for the development of any mobile application. This study however focuses on a possible solution for GPs to access their patient data when they are not in the office.

## **2.4 Summary**

Chapter 2 describes the aspects which the researcher had to become familiar with before starting her study.

- The patient consultation is explored to understand which information is needed by the GP when they should need to check patients' data. The information is needed to understand how to design the layout/structure of the application. Although the literature review is of a general nature, it forms the foundation to understand what the application would consist of. In order to get a clearer understanding of what was needed to design the application; data collection methods such as interview questions and diaries were used to get a clearer indication from the GPs as to how they would want the application to be designed.
- Understanding the working realities informed the researcher that not all general practices operate in the same manner. This encouraged a case study approach for the general practice based in Durbanville, Cape Town. A deeper understanding of the GP's and general practice needed to be developed. This placed the research study within a qualitative research paradigm. In order to gain a deeper understanding, data collection methods such as interviews and diaries were used to gather information about the GP's and their needs/design requirements for the application. To generate research through the designing of the patient file application, the framework known as Research through

design will be used. This allows knowledge contribution to be gathered through the design process of the application.

- Through the design process of the application, design tools such as personas, storyboards, interface sketches, paper and digital prototypes were used to design, communicate and develop the application with the participating GP's of the Durbanville practice.
- Mobile technology is explored to see what is being done globally and locally (South African context) in regards to mobile health technology. Mobile technology is expected to grow within the African continent; this opportunity could result in various health initiatives whereby the mobile phone, whether low end or smartphone could help with the care giving of the country.

Chapter 2 explores the different aspects used to create an understanding of the context for which the application would be designed for and what it might consist of. In chapter 3 the research study approach is explored.

## **CHAPTER THREE METHODOLOGY**

“Real research is often confusing, messy, intensely frustrating, and fundamentally nonlinear.” - Marshall and Rossman (1999:21)

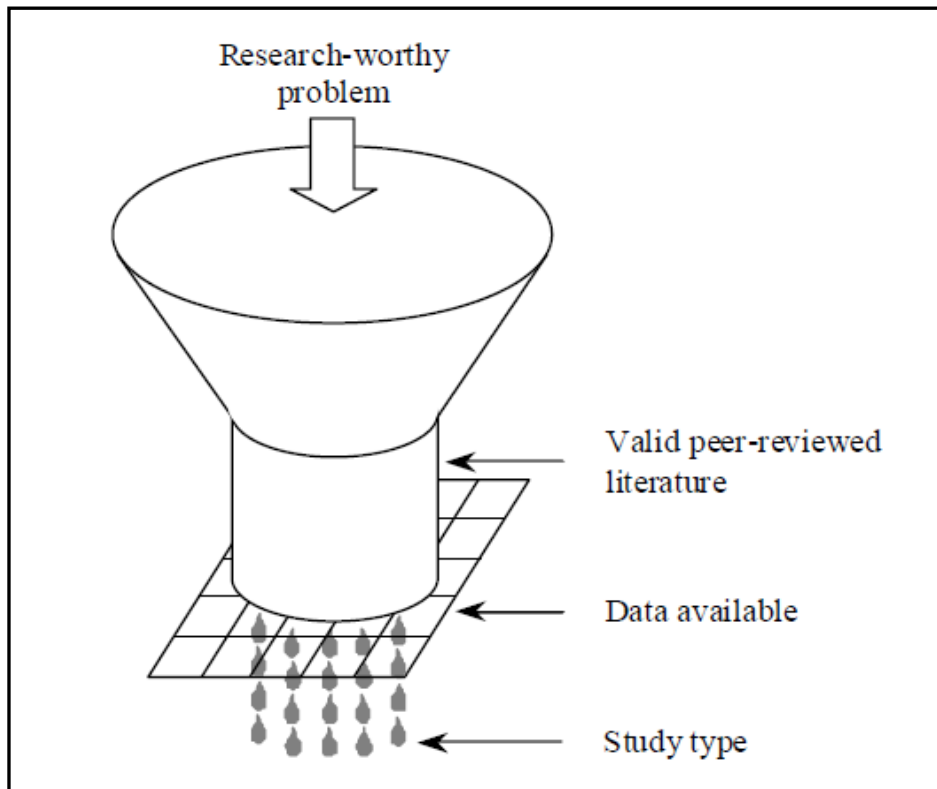
### **3.0 Introduction**

In this chapter the research methodology will be explored. The chapter explores

- Understanding what research is.
- Interaction design is explored.
- Research through design influence in the study.
- The epistemological viewpoint of the study is explored.
- The qualitative approach of the study.
- The ontological viewpoint of the study.
- The research methodology for the study explores the case study approach, relationships between the researcher and the research participants, sampling, ethics within the study, data collection methods, design tools, constraints, analysis and validation of the study.

### **3.1 Understanding research**

Being a novice to the field of research I was faced with the daunting task to comprehend how my research could generate knowledge in the field of Interaction design. Ellis & Levy (2009:323) note that the type of study that the researcher conducts depends on three related aspects, the problem which is driving the study, the body of knowledge and the nature of the data available also known as the PLD model (Problem, Literature and Data Model). Below is the PLD model in which Ellis & Levy (2009:325) introduces the approach to the conceptualization of a research study.



**Figure 3.0: PLD model for deriving study type (Ellis & Levy, 2009)**

**Table 3.0: PLD model (Ellis & Levy, 2009)**

PLD model		
<b>P</b>	Research- worthy problem	This is the point of departure for the study. This section starts to define the nature of the research problem as well as the domain in which the research will be conducted.
<b>L</b>	The existing body of knowledge acknowledged in peer reviewed literature	This is the foundation on which the study is based. This section serves as a funnel which channels the research into the direction of the study and also provides the appropriate methods to be used for the specific study being conducted.
<b>D</b>	The available data to the researcher	This section forms the final filter in deciding which type of study to perform.

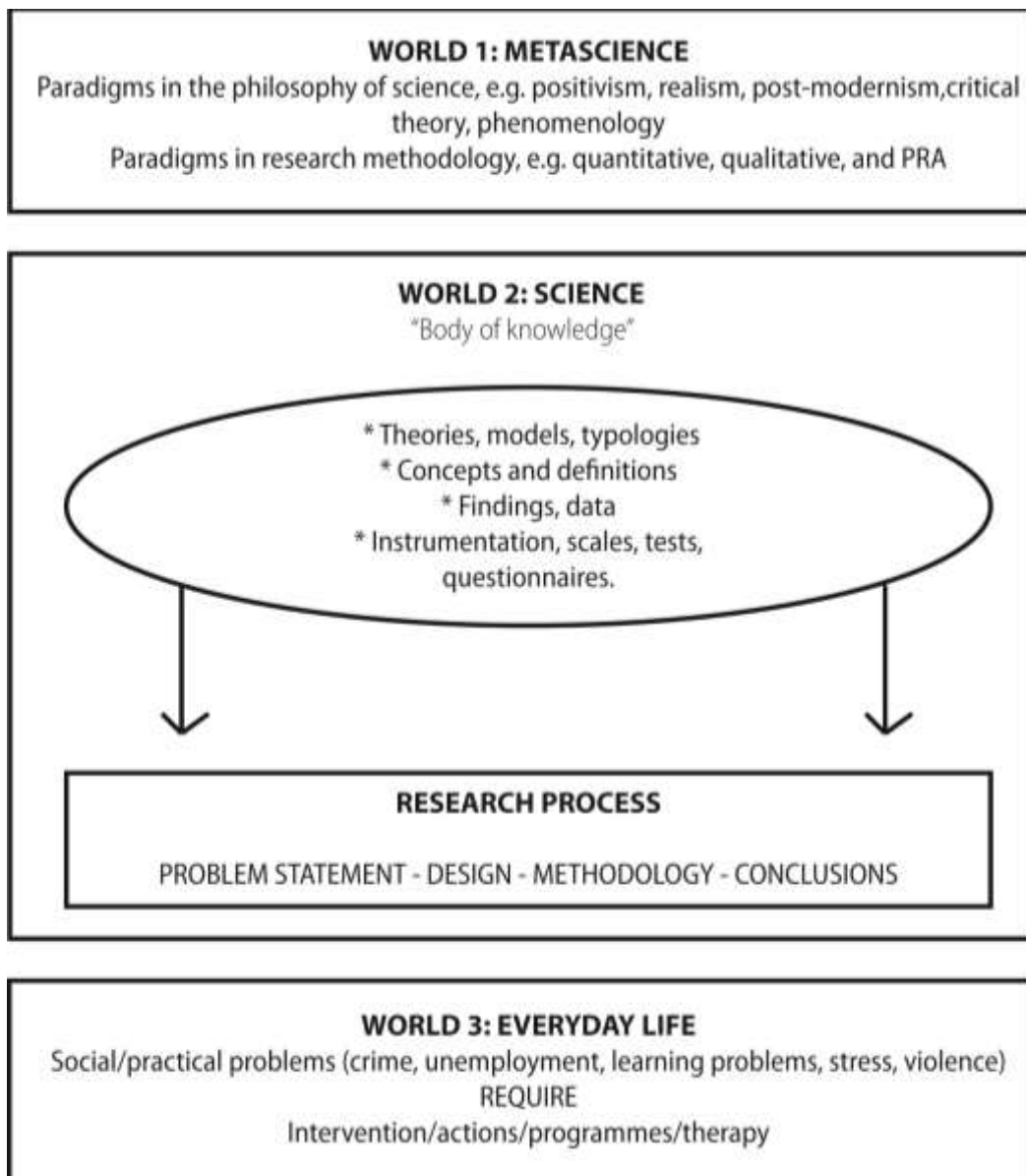
Another research model used in the study is the Three World's model by Babbie & Mouton (2001:15) it explains the nature in which a research study develops, shown in the figure 3.1.

- World three consist of the everyday life and the lay knowledge which human beings acquire through learning, experience and self – reflection; this is where the research problem spawns.
- World two is the world of science and the search for truth. This is where the area under discussion/research, which comes from world three, is exposed to



rigorous and systematic methods of investigation which in turn generates fit knowledge (evidence) which is accepted by the scientific community.

- The last world is known as the world of Meta science, world one. Meta science is where the scientific accomplishments are continuously reflected upon in a critical manner in order to improve the nature of the scientific investigation, in other words Babbie & Mouton (2001:14) describe it as follows “Meta scientific reflection is to make sense of science, to contribute to a more informed practice, and to make contributions which might lead to better science.”



**Figure 3.1: Three World's model (Babbie & Mouton, 2001)**

Both the PLD and the Three World's model were used to comprehend which forms of action would take place in the study.

**Table 3.1: Researcher's study within the PLD model (Ellis & Levy, 2009) and the three world's model (Babbie & Mouton, 2001)**

<b>PLD MODEL</b>	<b>RESEARCHER'S STUDY</b>	<b>THREE WORLDS MODEL</b>
<b><i>Research- worthy problem (P)</i></b>	<b><i>Main research question</i></b>	<b><i>World Three</i></b>
This is the point of departure for the study. This section starts to define the nature of the research problem as well as the domain in which the research will be conducted.	How can mobile access contribute to a possible solution that could support general practitioners with the accessing of patient information when not at the office?	World three consist of the everyday life and the lay knowledge which human beings acquire through learning, experience and self – reflection; this is where the research problem spawns.
<b><i>The existing body of knowledge acknowledged in peer – reviewed literature (L)</i></b>	<b><i>Sub research questions</i></b>	<b><i>World Two</i></b>
This is the foundation on which the study is based. This section serves as a funnel which channels the research into the direction of the study and also provides the appropriate methods to be used for the specific study being conducted.	<p>What characterises the work practice of general practitioners in Cape Town, South Africa?</p> <p>What characterises the use situations where general practitioners need access to patient information?</p> <p>How can a smartphone application support access to patient information for general practitioners when not at the office?</p>	This is where the area under discussion / research, which comes from world three, is exposed to rigorous and systematic methods of investigation which in turn generates fit knowledge (evidence) which is accepted by the scientific community.
<b><i>The available data to the researcher (D)</i></b>		
This section forms the final filter in deciding which type of study to perform.		
		<b><i>World One</i></b>
	Theoretical accomplishments which is arrived at the end of the research study. Which will be reviewed by the academic World.	Meta science is where the scientific accomplishments are continuously reflected upon in a critical manner in order to improve the nature of the scientific investigation.

### 3.2 Interaction design

With interaction design as the thesis main theme it would be informative to provide a brief understanding of the term.

In the book by Moggridge (2007) entitled “Designing Interactions” an interview was conducted with Gillian Crampton Smith who is a designer, educator and founder of the graphics and computers graduate program at the London’s St Martin School of Art as well as the founder of the Interaction Design Institute Ivrea in Italy, was asked to define interaction design and she replied as follows:

In the same way industrial designers have shaped our everyday life through objects that they design for our offices and for our homes, interaction design is shaping our life with interactive technologies – computers, telecommunications, mobile phones, and so on. If I were to sum up interaction design in a sentence, I would say that it’s about shaping our everyday life through digital artefacts – for Work, for play, and for entertainment.

The book entitled Interaction Design: Beyond Human – Computer Interaction (Preece et al., 2002) mentions that interaction design is “In essence, it is about developing interactive products that are easy to use, effective, and enjoyable to use from the user’s perspective.” Interaction design is an act for shaping products and services of a digital nature and is reflected as design work notes Lowgren (2007:1), he also elaborates further that this design work has distinguished characteristics such as:

- Exploring possible futures, starting with context at hand.
- Intending to change the situation for the better by developing and introducing a product or service of some sort.
- That the technical, practical, aesthetic and ethical aspects should be considered.
- That an understanding and developing of the task should be parallel with the design work and the possible solutions.
- That thinking should be done by forms of sketching, model building and other tangible forms.

Interaction design today has evolved from designing for a single machined task to “the exploration of new forms of living with and through technologies that give primacy to human actors, their values, and their activities” (Bannon, 2011:50). Bannon (2011:50) not only mentions the shift from designing for automation to complex social spaces but also makes mention that these spaces “encompasses a

much more challenging territory that includes the goals and activities of people, their values, and the tools and environments that help shape their everyday lives”, these spaces should not only be approached by applying IxD as a tool or method but should be looked at with an interaction design lens or perspective.

By using IxD as a lens opens up new and interesting ways of approaching a design situation. Bannon (2011:53) notes that “new forms of inquiry, new questions, and new methods of investigation” could be the result of changing the perspective as to how design challenges are approached which potentially open new possibilities through interaction design.

### **3.3 Research through design as an underlining framework**

Gaver (2012:940) notes that design is often used to approach “wicked problems”. Rittel & Webber (1973) elaborate further that wicked problems are of a social nature; these problems cannot be solved by any prior knowledge before an understanding is reached of where the problem lies within a social complex network.

The study being conducted is seen as a wicked problem. The study takes place within the working environment of the Durbanville GPs practice and outside of the GPs practice. In chapter 2 a general understanding of various aspects relating to the study were explored such as the general practice operations, the management structure of general practices, the staffing structure within general practices are very different where some practices use nurses and secretaries and others not, the social dynamics are very unique to each situation, the medical record is explored and the consultation, all of which contribute to social space of the study.

Gaver (2012:940) explains that design “is an activity that involves many different decisions, dealing with many different and potentially independent factors of an artefact, all situated within the specific circumstances of production and use.”

Forlizzi et al. (2010:313) mentions in the paper titled “*An Analysis and Critique of Research through Design: towards a formalization of a research approach*” that “research through design” is the activity within design research that focusses on “the process of iteratively designing artefacts as a creative way of investigating what a potential future might be.”

RtD as noted by Boess (2009:1) is where the researcher is a part of the design process, usually as the designer in a project, she further mentions that because these

problems are generated on the spot, the only way to approach the problem is by “the course of a design process and through it”.

For research purposes it was decided to use RtD in this study. Chapter 2 provides certain aspects of a general nature in the general practice setting, but it would not be enough to understand the social dynamic of the Durbanville practice. This is where Inductive reasoning forms part of the research study. Inductive reasoning mentioned by Trochim (2006) is when a research area is approached with no hypothesis, specific observations within the research area is first made and then measured, then through the research process tentative hypotheses are explored and then finally conclusions and theories are arrived at, this type of reasoning is open ended and exploratory by nature. In order to gather a deeper understanding for the research problem, the researcher is the designer within the project for the research study. The project group consists of an interaction designer (the researcher), a project manager, IT programmers and a business analyst.

Because social problems or wicked problems are very intricate, to simply look at a problem at surface value will not provide a solution for it at all, this is why the research process is of a generative and iterative nature. IxD and RtD are iterative and generative processes respectively. Methods for gathering data are revealed once the research problem is understood and then actions are taken which are of an ethical nature to continue conducting research. To put it simply what was learnt at the beginning of the study provides the foundation and once data is gathered iteratively, it builds on one another.

Rittel and Webber (1973:161) mention that once an understanding is gathered of where the problem lies, the next task is to identify the methods/actions that would effectively shrink the gap between the current situation of the problem to the would be desired outcome.

### **3.4 Epistemological viewpoint**

IxD is the construction of an interactive system from the users' perspective in a way which will add value to the users' life. Its core method is that of UCD (User Centered Design) which involves users in a design process where design and evaluation is conducted until an interactive system is delivered. The aim is to better understand the users and the design situation in order to better develop an interactive system that would cater to their particular needs.

The objective of the study is to determine how mobile access can contribute to the development of a possible solution that would assist the GP with access to patient information when not at the office. With the understanding of IxD the research study has an epistemological viewpoint which adopts an interpretive research paradigm. The purpose of this paradigm is to inquire in order to understand a particular phenomenon. The research aim is to explore, discover and understand the events of the individuals who are being studied to better develop an interactive system (Tuli, 2011:100). Relating this to the research study, the researcher will have to understand, explore and discover how the general practice and general practitioners operates within their practice environment in order to design a possible solution which could support the accessing of patient data when the GP is not physically in the office.

### **3.5 Qualitative approach**

A Qualitative approach takes place with the gathering of observations whereby hypothesis or conclusions can be made with. Interpretivism uses qualitative methods in order to gather information of a more detailed nature than that of a quantitative nature (Babbie, 2007). Marshall & Rossman (1999:33) mention that qualitative research is used to inquire about groups, processes, individuals and organizations. In relation to IxD, when designers approach the situation there should be no concrete ideas. Lowgren & Stolterman (2004:18) mention that if designers have ideas these preliminary solutions are very vague at the least. The next step would be that of gathering a deeper understanding of the design situation and users before any concrete solution could be made.

For this study an interpretive paradigm is used to explore and describe the topic area that is being researched, qualitative methods are used to gain a deeper understanding of the GPs and general practice as well outside of the office for which the interactive system would be designed for. Neuman (2011) explains that interpretive social research facts and evidence are context specific, there is no way that one can isolate evidence of a social nature from the combination of events and its settings, social research techniques are very much context sensitive which achieves an empathic understanding of situations. This is why the interpretive paradigm is used along with qualitative methods in the researcher's study because a deeper understanding is needed of the design situation before any designing can take place. The research methods for the study will be described at the end of chapter 3. Below are the steps followed in the qualitative approach.

**Table 3.2: Steps in qualitative approach to social research (Neuman, 2011)**

<b>1. Acknowledge self and context</b>
Identifying a topic of interest and situating it into the socio historical context.
<b>2. Adopt a perspective</b>
Pondering the positioning of the research into a specific paradigm or situating it into a context of on-going discussions with fellow researchers.
<b>3 – 6 Design study, collect data, analyse it and interpret it</b>
Researcher designs study, collects data, analyses it and then interprets it. This is a fluid process and these steps are often done simultaneously, the process is of a back and forth motion among the steps and at multiple times. New theory can be developed and testing old theory can take place as well as using past theories.
<b>7. Inform others</b>
This is styling of report.

### 3.6 Ontological viewpoint

Ontology according to Burrell & Morgan (1979:4) has two viewpoints, one being if the reality that is being investigated is being imposed from the external onto the individual's consciousness or if the reality is a product of the individual's consciousness, ontology is the way reality is viewed. The research studies viewpoint on ontology is that of the latter where the individuals who are being studied make sense of their own realities (reality is a product of the individual's consciousness). Interpretive paradigm and methods are used to describe, explore and interpret (the GPs social realities, where the individuals that are being studied are treated as research participants in the study (Tuli, 2011:101). This coincides with IxD where users are incorporated into the design process to be better understood in order to reach an interactive system that would help with the particular situation that it is being designed for from the user's perspective.

By adopting the interpretive paradigm for this research study requires qualitative methods to be used in order to gather a deeper understanding of the GPs and the design situation. This is why the ontological viewpoint for the study is that reality is a product of the individual's consciousness; the individuals being the GPs in the study and in order to design a potential solution would require the researcher to understand the GP's perspective of their general practice realities.

The influences will be explained (in point form) in the left side of the table and how it fits into the researcher's study will be placed in the right in the table which follows.

**Table 3.3: Influences and how it fits into the researcher's study**

Influences in study	How it fits into the researcher's study
<p>Wicked problems</p> <ul style="list-style-type: none"> <li>• Are of a social nature which cannot be solved with prior knowledge.</li> <li>• Understanding needs to be reached of the situation before any solution can be applied.</li> <li>• Design is often used to approach these types of problems.</li> </ul>	<p>The research topic is within the social space of general practitioners, their general practice and technology. The suggested solution (mobile access/ mobile technology) cannot be introduced without firstly gathering a deeper understanding for the research area and its users.</p>
<p>IxD (Interaction Design)</p> <ul style="list-style-type: none"> <li>• Designing interactive products that are designed from the users' perspective.</li> <li>• It involves hardware and software influences but it also incorporates interactions of people, spaces, objects and behaviours.</li> <li>• It's about exploring future possibilities.</li> <li>• Incorporates users' within the design process.</li> <li>• This process is iterative.</li> </ul>	<p>The general practice is a wicked problem, IxD is used to approach the research area. IxD involves elements from a technology and social nature; it is used to design products for the future. In order to introduce a possible solution, the research area needs to be looked at deeper. IxD involves the research participants within the research process and the design process. By involving the users who will be using the potential solution it gives insight as to what I have to focus on within the general practice environment as well as the social influences from the GPs within the environment. This also includes researching the role and how technology would help with the accessing of patient data when the GP is not in the office. The process of researching and involving the GPs provides data which feeds into the design process and then produces results which can be evaluated by the GPs and then improved upon depending on the feedback (iterative process).</p>
<p>RtD (Research through Design)</p> <ul style="list-style-type: none"> <li>• Iteratively designing possible artefacts for the future.</li> <li>• The researcher is part of the design process, usually as the designer.</li> <li>• Because these social problems are only realized on the spot, the only way to approach it is by a design process and through it. Through the process one discovers.</li> <li>• Enables the researcher to acquire research knowledge.</li> </ul>	<p>RtD was introduced to gather richer data. IxD involves the GPs in the design process, RtD puts the researcher in the design process as well; this provides a gateway where rich data from the GPs are gathered by the researcher who is often the designer in the project. Both RtD and IxD is iterative and generates information from one phase to another, to put the researcher within that developing process not only exposes myself to rich data but also keeps me up to date with every development, piece of data and every thought that the GPs might have in the study, by going through this process and being involved every step of the way really provides information that I would need to develop an artefact that could possibly be used.</p>
<p>Inductive reasoning</p> <ul style="list-style-type: none"> <li>• There are no hypotheses, specific observations needs to be made first and measured, through the process tentative hypothesis are explored and then conclusions/ theories are arrived at.</li> <li>• This type of reasoning is usually</li> </ul>	<p>This form of reasoning is used in the researcher's study because in order to arrive at a hypothesis for the study, the GPs, the general practice and the mobile technology influence needs to be understood and because this research study takes place through the lens of IxD, an understanding for the research/design situation (which is a wicked problem as well) needs to be</p>

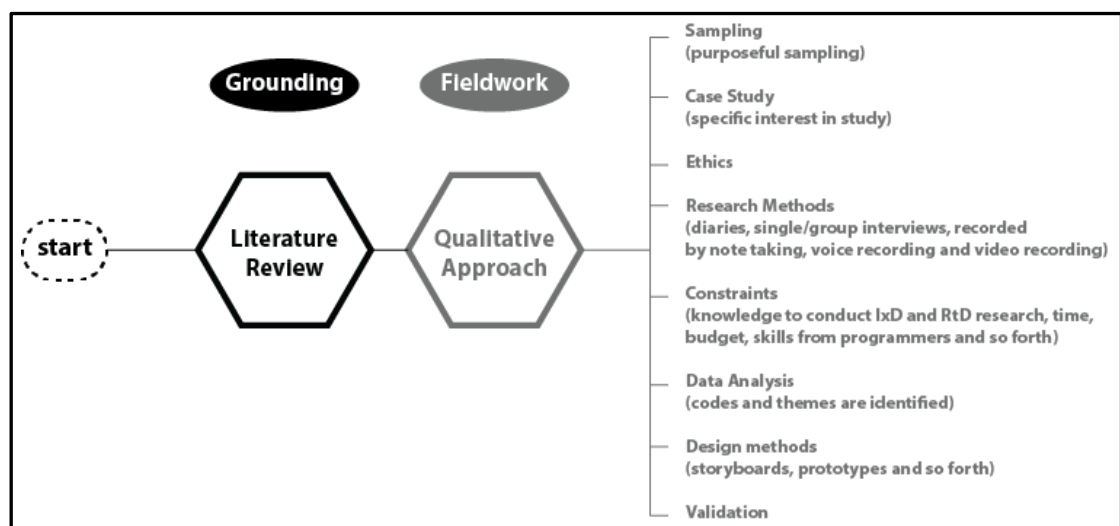


open ended and exploratory.	understood before a possible solution can be applied.
<p>Interpretive research paradigm</p> <ul style="list-style-type: none"> <li>• Is used to inquire about a phenomenon.</li> <li>• To explore, discover and understand events of the individuals who are being studied to better develop an interactive system.</li> </ul>	<p>IxD, RtD and inductive reasoning all have the similar characteristic which is to understand the user/research participant and the environment. These perspectives and frameworks involve the users in the design process therefore the interpretive paradigm is incorporated. So the GP's perspective about their practice, practice structure, practice social aspects and their technology exposure needs to be understood by the researcher in order to produce a possible solution.</p>
<p>Qualitative approach /methods</p> <ul style="list-style-type: none"> <li>• Qualitative methods are used to gather data whereby hypothesis can be made with.</li> <li>• Interpretive paradigm uses qualitative methods to gather deeper information.</li> <li>• To inquire about groups, processes, individuals and organizations.</li> <li>• Qualitative steps: <ol style="list-style-type: none"> <li>1. Identify topic</li> <li>2. Adopt a perspective</li> <li>3. -6. Design study, collect data, analyse it and interpret it</li> <li>7. Inform others</li> </ol> </li> </ul>	<p>As mentioned above the interpretive paradigm is to understand the perspectives of the research participants, this means that the GPs perspectives are subjective in nature. Qualitative methods are different forms of data collection methods that are designed to extract data of a richer nature. These methods are ideal for gathering data from individuals and organizations such as the GPs and the general practice. Within the qualitative approach there are steps which are taken. As it shows on the left number one is to identify the topic or research area of study which is the general practice, the GPs and the influence of mobile technology. Number two is adopting a perspective which is IxD, RtD and the interpretive research paradigm. Number three to six involves the design of the research study. It also includes the methods for data gathering, how the data will analysed and how to interpret it and then lastly is to inform others of the study which would be the thesis. Qualitative methods are used to gather data and then a hypothesis or theory can be developed from the subjective data.</p>
<p>Ontology</p> <ul style="list-style-type: none"> <li>• Reality is viewed in two forms where the reality being investigated is imposed from the external onto the individuals consciousness and secondly if reality is the product of the individuals consciousness.</li> </ul>	<p>The view of reality needed to be understood by the researcher because this is a contributing factor in choosing which kind of research study the researcher would conduct. Because IxD involves the users in the design process and relies on their feedback for input into the design of the possible solution, it is the research participant's reality, so to say, that needs to be understood. In other words the GP in the study has their point of view on the type of reality that they encounter within their general practice, the way they would interact with mobile phones, the way they handle out office scenarios and so forth. These realities cannot be assumed or "made up" by the researcher.</p>

In summary all the lenses/ perspectives, paradigms, approaches, methods, views on reality intertwine with another and build onto one another to create a research study that can be conducted within the sphere of IxD. In sections to follow the research methodology and design methods for the study will be introduced.

### 3.7 Research methodology

In this section the methodology behind the researcher’s study will be explained. What is being researched is whether patient information can be accessed through mobile access by a GP while after office hours. As IxD and RtD requires that inquiries should be made within the design situation before any possible solution can be made, the research methodology of the study starts with literature reviews. The literature review “kick starts” the investigation process of the study. This process is to see what is being done in regards to mobile technology within the health sector on a local and global level, but the literature review does not only look at the mobile technology section, it also looks at the general operations of the general practice, the consultation process and what the patient folder is, all of the aspects within the study which are involved in the researching of the Durbanville GP general practice. The literature review is used as a point of departure for the study and the researcher notes that a possible solution cannot be arrived at on these findings alone (relating back to the L of the PLD model).

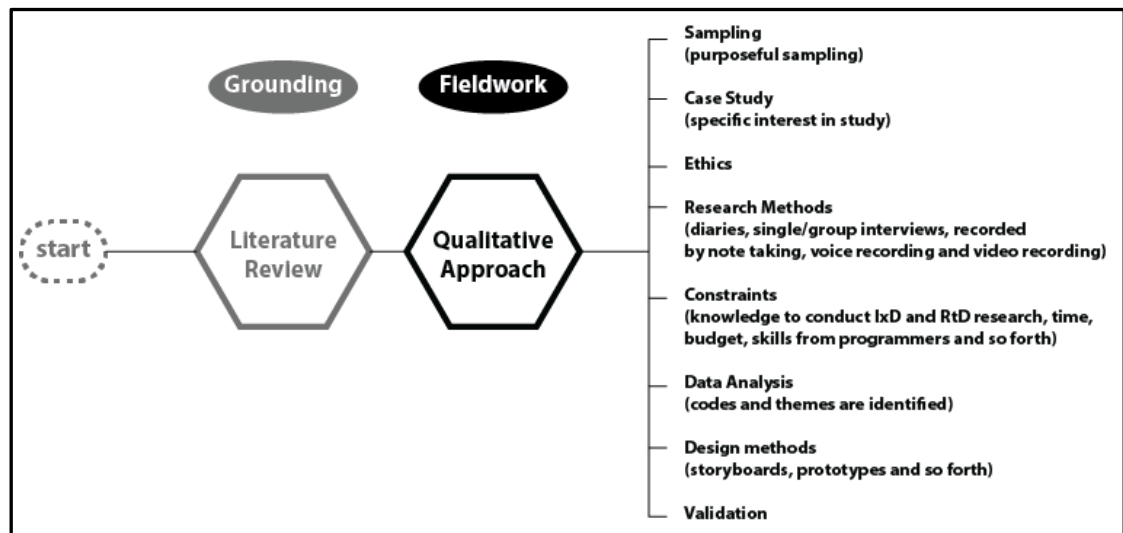


**Figure 3.2: Literature review within the study (Author’s construct, 2013)**

Once the literature has been looked at, the researcher has a vague grounding or understanding of the design situation and then proceeds by doing field work. IxD and RtD places emphasis on understanding the user in regards to designing what they would want and need in a situation. Thus it’s important for the researcher to

understand what the GPs experiences are within their day to day activities. To understand these experiences of the GPs qualitative methods of inquiry is used.

Qualitative methods are used to gain a richer insight into the design situation, as the interpretive research paradigm is used to enquire about a phenomenon. Seeing that these experiences are derived from the GPs, this approach sets the ontological view point of the study as well.



**Figure 3.3: Qualitative approach within the study (Author’s construct, 2013)**

The research study adopts the qualitative method approach when it comes to doing the fieldwork within the study. Maxwell (1996:63) notes that “there is no cookbook for doing qualitative research” and that the use of qualitative methods depends on the situation and phenomenon that is being studied. Qualitative research has four main components, these being:

- Relationship between the researcher and those being studied.
- The sampling of the study.
- Data collection methods for the study.
- Data analysis methods for the study.

The above mentioned components of the qualitative research approach will be related to the research study along with additional components in the sections to follow.

### 3.8 Sampling

Sampling is concerned with the what, when, who and where it’s going to be studied. Maxwell (1996:69) mentions the following about sampling

If you are talking with one kind of informant, you need to consider why this kind of informant is important and from there, which other people should be interviewed...Remember that you are not only sampling people, but also settings, events, and processes.

The researcher was uncertain as to whether two practitioners were enough for the study, but then found a passage by Patton (1990:184) which states:

There are no rules for sample sizes in qualitative inquiry. Sample size depends on what you want to know, the purpose of the inquiry... I repeat the size of the sample depends on what you find out, why you want to find it out, how the findings will be used, and what resources (including time) you have for the study.

The research study conducts purposeful sampling. Purposeful sampling as mentioned by Patton (1990:169) lies within the selection of a case that has a rich amount of information within it, he mentions this is where the power and the logic lies, when it comes to studying in depth.

To answer Maxwell and Patton's guidance as to why the researcher had chosen purposeful sampling, the "what" of the study is the development of an application which could grant access to GPs patient folders when they are not in the office, the "when" is to look at when the Durbanville GP's needed to access this information, the "who" of the project are the Durbanville general practitioners of the general practice and the "where" is the operations of the general practice and outside of the environment.

The sample for the study consists of a general practice within the Durbanville area within Western Cape, South Africa; the practice consists of two practising general practitioners who work in partnership with one another. The reason for sampling the GPs is that the application is being developed for this target market and that these GPs were willing to participate in the study. The setting in which the GPs operate relates directly to the application which is to be designed, the researcher needs to understand how the GPs operate with their patient folders in the general practice as well as when they are away from the practice.

### **3.9 Case study approach**

The research study adopts a case study approach. Thomas (2011:6) notes that in order for a study to be considered as a case study there needs to be an interest within the study which is often real life situations. Using this study as an example what he means is that the general practice and the GPs cannot be studied purely of it being a general practice and having GPs working within that environment, there needs to be a purpose to the study like the studying of whether mobile access can contribute a possible solution for the access of patient information when GPs are not in the office. The research study falls within the exploratory purpose, Thomas (2011:104) elaborates on why studies are exploratory by saying the following:

An exploratory case study will be done where you are faced with a problem or an issue that perplexes you. You need to know more: what is happening and why? You may have little preliminary knowledge of the issue or at least, little rounded knowledge of it.

The case study focuses on the design process for the development of an smartphone application which could allow general practitioners in the private sector to access their patient information when they are not in the office, for example after office hours if the need arises. In order for the continuous development of the study the GPs and other participants (public doctor, pathology company and general practice staff) involvement in the research process was entirely voluntary and intentions of the study was made transparent unto them. Sessions were accommodated according to their (the research participants) availability and precautions were taken to not impose any inconveniences or harm onto them in any form or manner.

A case study approach is used to focus entirely on this particular environment being the Durbanville general practice of these two general practitioners within the Western Cape. Thomas (2011:3-4) notes that a case study is focusing entirely on the case in its entirety. He elaborates further that the case study is “about understanding how and why something might have happened or why it might be the case.”

### **3.10 Relationship between researcher and research participants**

Maxwell (1996) mentions that what the researcher should strive for is to learn what they can from their study in an ethical manner which would answer their research questions and that a researchers relationship with those being studied changes continuously and is a complex aspect. Before the study started, an agreement was

arrived at between the researcher and the research participants that a study could be conducted on the process of designing an application.

Maxwell (1996:66) mentions that the relationship between the researcher and the participants is often conceptualized as the “gaining entry to the setting, or establishing rapport”, he elaborates further that this section of the research study is not a once off agreement. This proved to be evident within my study. Throughout the process of the study I had to receive confirmation from the participants if certain methods of the qualitative approach and design process they, the General Practitioners, were willing to partake in. Although the GPs agreed to partake in the study the researcher felt she needed to confirm with the GPs whether they were comfortable with certain qualitative methods used in the study as well with the design methods used. What I had to think about was that even though the situations may change within the study I would have to be able to adapt with these situations and conduct research that didn't hinder any ethical issues. When it comes to research within the healthcare sector precautions are taken especially when studies focus on improving the industry, what has to be thought about are the ethical considerations within the healthcare sector. Not only is it important as a researcher to uphold ethical codes for research purposes, it is also important to know what the society which is being researched considers ethical or unethical (Babbie, 2007:62).

### **3.11 Ethics**

According to the definition of the oxford dictionary ethics is defined as follows: “moral principles that govern a person's behaviour or the conducting of an activity” and “the branch of knowledge that deals with moral principles” (Oxford Dictionaries, 2012). As a researcher and more specifically a social researcher there are ethical considerations to take into account when doing research. Ultimately the research should be conducted in a manner that searches for the truth but not at the expense of the rights of the individuals involved in a society (Babbie & Mouton, 2001:520).

For the progress of the study a proposal was issued to the Cape Peninsula University of Technology research ethics committee, which was reviewed along with an ethics checklist. In order to up hold the ethics of the research from a researcher's perspective and to protect the general practitioners and the other participant's interest and well-being, an “informed consent form” shown in appendix A was drawn up. The informed consent form is a form that stipulates all aspects that are involved with the study (Babbie & Mouton, 2001: 522).

The research conducted is focused on understanding the working environment and the general practitioners working in the private sector within the study and will not hinder with the GPs and doctor's patients or physical patient information e.g. the patient folder/patient consultations. The medical society has strict ethical issues surrounding confidentiality and privacy of patient information (The South African Medical Association, 2012) which practitioners should uphold, thus a large effort has been made to adhere to this, from the researcher and general practitioner's/doctor's perspective. In regards to the confidentiality and privacy between the practitioner and patient, it has also been added to the informed consent form for the general practitioners and doctors, that this will be up held by the researcher and the participants within the study.

In regards to patient information it must be noted that this research focuses on interface and user experience designing for a mobile health application. The data elements being used for the interfaces will represent the definitions and scope of possible values and will not contain any specific data values. The patient data will be simulated data which represents possible patients based on the profile of typical patients. No patients will be interviewed and no actual patient data will be considered or used. The methods used for compiling patient data are concrete scenarios and personas which are methods used in design for generic representative users and not specific real users (Miettinen & Koivisto, 2009). Design methods/tools are introduced in section 3.13.

It has to be noted that the researcher is part of a team that had decided to research this particular design situation/phenomenon. The team is a multidisciplinary group which consists of a business analyst, project manager, I.T programmers and a designer. Team was formed in the setting of the Kujali Living Lab; this is a place where students are interning as researchers within their particular academic faculty. The Kujali Living Lab also provides an environment whereby a working environment is provided that accommodates for the research projects which are initiated by the students. The project was initiated due to my interest within the field of IxD, coming from an industrial design background where emphasis is placed on the designing of physical objects which has to adhere to aspects such as ergonomics, manufacturing processes and materials there was an interest and curiosity to understand how IxD was used to develop products of a software nature as opposed to physical objects. Just to recap on this section, literature reviews are used as a point of departure for the research study, this is mainly to gain a grounding of the research area which is being studied. The study has a specific interest within a real world situation which

frames it as a case study. The sampling of the study is purposeful due to the specific area which is being researched. Due to the nature of the study because it deals with the medical sector, ethics is upheld from the researcher's side as well as adhering to the ethics of the medical sector. No actual data values for the study is used in regards to the patient information, these are generated by using design methods. The researcher forms part of the design team that are investigating this phenomenon.

### **3.12 Data collection methods**

The data collection methods which are used in the study are

- Diaries,
- Single/group interviews which were unstructured, semi-structured,
- Structured interviews were either recorded with a voice recorder and/or video recording and/or note taking with the consent of the participants.

Maxwell (1996:74) notes that the choice of methods, are used to answer the research questions, he elaborates further " Their selection depends not only on your research questions but on the actual research situation and what will work most effectively in that situation to give you the data you need."

- Diaries as noted by Thomas (2011:164) as recordings of activities which are usually structured; these diaries contain information such as thoughts, ideas, reflections, actions, reactions and emotions. In the study general practitioners used diaries to record activities throughout certain periods in the study; this will be presented in Chapter 4. One of the reasons why diaries are used in the study was due to ethical reasons, it was not advisable for the researcher to be able to observe the GPs within their natural setting because the possibility of being exposed to patients as well as patient data was very likely to happen. Another reason for the usage of the diaries was for feedback purposes when the GPs tested the application which will be presented in Chapter 4.

Although diaries were used in certain sections within the study, once the time was completed for its usage and the diaries were collected and feedback sessions were held with the GPs to reflect upon the period, these feedback sessions were either voice recorded or videotaped. Diaries were only used for data gathering from the Durbanville GPs in the study.

- Interviews were conducted with all the research participants in the case study either in groups or on a "one on one" basis. These informants consisted of another GP (external to the Durbanville general practice in the case study), a



company within the diagnostic pathology industry, a doctor which works within the public health sector and the Durbanville secretary. These interviews were of a semi-structured and unstructured nature, Thomas (2011:163) notes that this is the most common form of interviewing done within small social research studies, which allows the researcher much freedom to probe or follow up on issues which are important or necessary for the study.

- Group interviews were used with the GPs of the general practice under study. The reason for group interviews was due to the availability of both GPs. Interviews were conducted within normal working hours, the interviews were held at the general practice of the GPs. Reason why the interviews were held during working hours was due to the availability of the GPs and the researcher did not want to impose, inconvenience or take advantage of the GPs with after working hour interviews or interviews on the weekends which is used by the GP's as family time and social time.
- Diaries were used as another means of data gathering in situations where the researcher could not do interviews e.g. after office hours situations, when the GPs were at home and on weekends when testing the beta application.

Reason why interviews were conducted within the general practice was due to availability of the GPs, but the setting provided the necessary stimuli for both the researcher and GPs when information needed to be gathered for the understanding of how the general practice and GPs operated. These group interviews with the GPs of the study being researched were semi-structured and unstructured in nature. An unstructured interview mentioned by Thomas (2011:163) is that there is no structure to these interviews; ideally the interviewee sets the tone (agenda) of the interview. The researcher in these situations enters the interview with an open mind and really just listens and facilitates. All interviews were conducted by the research team with the exception of the public health doctor interview.

It's also noted that the researcher made notes within the study; feedback sessions with team members were also recorded in the form of note taking as well as video recording and meetings were held with team members to record progress.

The methods of recording for the interviews were either done by note taking (journals recordings by the entire research team) and or voice recording and or video recording. Researcher felt that interviews recorded with either the voice recorder and video recorder proved to be helpful, the recordings were accessible whenever the researcher needed to go back to certain interviews in the past.

### **3.13 Design methods (Tools)**

The incorporation of Interaction design which involves the users in the design process within the study will produce a design artefact, but does not produce knowledge. This is why Research through design (RtD) is used as a framework within the research study. RtD uses the portals of interaction between the user and the researcher as moments of knowledge generation. These moments of interaction are the design tools that are used by the researcher and the user to develop not only a design but knowledge from a research point of view. The following design tools are introduced which are used in the research study. Examples of the design methods (tools) are attached as appendices for clarity purposes.

#### **3.13.1 Contextual inquiry (Design tool)**

The goal for contextual inquiry is to construct a well-developed picture of the actual working environment, this involves the understanding of the roles, responsibilities and problems within the current working situation and this is normally conducted through interviews and observations (Lowgren & Stolterman, 2004:66). This tool will enable the researcher to understand the problems within the working environment of the general practice. To gather information about the context the researcher had conducted interviews in the researching of the Durbanville general practice GPs as well as the other participating health operatives (Athlone GP and public health doctor). Interviews were used as opposed to observations because of the ethical considerations between the doctor and the patient. The interviews were initiated at the start of the research study. The interview questions were of a contextual nature, these questions tried to uncover how the practitioner would welcome and treat their patients for their consultations, when the practitioner would need to access their patient data and so forth. See appendix B for the questions used to interview the Durbanville GPs as well as the participating health operatives.

#### **3.13.2 Personas (Design tool)**

These are fictional profiles of users that are based on research data that has been collected. The profiles include behaviours, names, personalities and goals that are specific to a certain group of people. This tool is used to better understand people (Miettinen & Koivisto, 2009:21). For the research study the Durbanville GPs were interviewed to generate personas. These personas were used to understand the users in order to design the smartphone application that was to be understood and used by them. The personas used in the research study which was made by the author (researcher) is attached as appendix D.

### **3.13.3 Storyboard and scenarios (Design tools)**

The storyboard was a design tool which was used to help the research team and the research participants to understand how the application could be used. Storyboards are a series of interface sketches combined with some scenario sketches which aims at showing a sequence for a certain section within the system. It's a tool for generating possibilities that shape the intended dynamics of an interactive design system (Lowgren & Stolterman, 2004:83). Lowgren & Stolterman (2004:80) note that scenarios are stories which show how the anticipated system would be used. This is another communication tool which helps the shaping of the interactive system. Within the study scenarios were used by the design team to map out how the GP would want to access their patient file information. It also proved to be helpful when the team mapped out two scenarios whereby the GP would answer a call and "quick search" for patient information while the patient was on the line and the other scenario would be were the GP ends the call, searches for the patient information and then contacts the patient again. For the storyboard/ scenarios used in the study see appendix E.

### **3.13.4 Interface sketch and sketching (Design tools)**

These communication tools which conveys ideas through the entire design process for designers or teams who want to display their ideas to the users other than in word format. Hand drawn sketches are used as a quick mode of idea interpretation for the designer as well as acting as a strong stimuli for dialogue as opposed to refined visual representation that gives the impression to users that a design is a final product and can no longer be changed or improved upon (Lowgren & Stolterman, 2004:80). Both tools are used to show what the projected system would look like. It shows not only the outlines of basic functions but also a more detailed view of it. This method is flexible when used in designing how user interfaces would be used for specific scenarios (Lowgren & Stolterman, 2004:82). For the research study both tools helped with the revising of user interfaces for a far easier and faster reproduction of interfaces which saves time and which also spurs faster development for idea generation.

### **3.13.5 Dynamic paper prototype (Design tool)**

This is a tool that demonstrates the interactive quality of the system. The prototype is a preparation of different interface sketches, the person using the prototype will select an action for example a button, the button is pushed and the facilitator of the prototype which at times is the designer will present the user with the next result after pressing a specific button. The benefit of a communication tool such as this is that there is a clear sense of what the intended system should do (Lowgren & Stolterman, 2004:85). Within the design workshops the dynamic paper prototyping used by the research team and designer acted as a good communication tool between the

research team and the GPs. It made the research team display the access of patient information easier by providing images rather than using simple words.

### 3.13.6 Dynamic digital prototype (Design tool)

The digital tool is a representation of what the intended system would interact like but not to the full extent. The interactive tool presents a more realistic representation of the system in which the researcher can still examine if this is still what the user wants or needs (Lowgren & Stolterman, 2004:89). Within the research study the research team had developed a digital prototype whereby the Durbanville GPs could evaluate if the application could be understood and used by them. See appendix F.

In table format the design methods/tools will be listed and how the methods were secured in the study and the type of data generated from the method.

**Table 3.4: Design tools, method secured and data derived in study**

<b>Design tool</b>	<b>Method secured</b>	<b>Data generated</b>
Contextual inquiry	This was done through interviews which were conducted with the Durbanville GPs and participating health operatives. The interviews were captured via video and voice recording with the consent of the research participants in the interviews.	The data generated was used to develop a certain user type for the application in order to design to their specific needs. This data aided in generating personas, storyboards, scenarios.
Personas	From the information which was gathered in the interviews about the participating GPs, fictitious GP characters were generated in order to develop a user with certain qualities which would have certain expectations when using a smartphone application to access patient information when not in the office. Personas were developed in Microsoft word, fictitious names, pictures and information was developed which were in relation to the study being conducted.	GP characters were generated which were used by the research team to develop scenarios and interfaces. These characters were used as gateways to discuss situations which the research team had to develop for.

Storyboard and scenarios	From the information gathered from the interviews about the context, the persona's, scenarios, storyboards and possible interfaces were developed via sketching by research team.	The storyboards and scenarios with the interface sketches were shown to the Durbanville GPs in the research study during the design workshops (chapter 4). This provided a gateway into discussion as to how the GPs had envisioned using the application.
Interface sketching and sketching	Interface sketches and sketching was done through the design process with the Durbanville GPs of the research study. This was used in the design workshops shown in chapter 4. The interfaces acted as the stimuli's in which the participating GPs also contributed by explaining and by interacting with interfaces in order to show what the next interface or step would be in the application. These moments with the GPs were the interfaces are being used are captured via video recording and note taking.	Data generated from the interface sketches resulted in the form of new interfaces and scenarios in which the GPs could imagine themselves using the application.
Dynamic paper prototype	The paper prototypes were used once there was a more refined idea as to how the application would be used, this method of discovering what the GPs wanted the application to operate like aided in the development of new interfaces. Using the paper prototypes was an easier method of displaying what the application could do rather than just discussing it. This method was used in the design workshops which are shown in chapter 4. The paper prototypes used by the GPs and the research team were video recorded.	Data generated from this method is in the form of new and more refined interfaces which were discussed and agreed upon by the GPs in the research study.
Dynamic digital prototype	The digital prototype was developed by the research team when the participating GPs in the research study had decided on the design of the application. The prototype was evaluated by the GPs as well.	The digital prototype was kept over a time period and evaluated by the participating Durbanville GPs in the research study. Due to ethical reasons the data was recorded in diaries whereby the GPs had to record their experiences whilst using the digital prototype

When looking at the different design tools in the research study, these methods had generated a next step in the evolution of the application which could support GPs with the accessing of patient information. But looking deeper at the tools each of these methods acted as a portal where information and ideas were captured and which generated information/data in the development of the patient file smartphone application. This is where the research knowledge contribution on the research study takes place.

### **3.14 Constraints of the research study**

Constraints which the researcher experienced through the process of the study was the knowledge gap between knowing how to conduct research within IxD and RtD and learning about it, being a novice researcher, I had to learn about conducting research as the study progressed. Another is about learning the guidelines and standards which are used within the android platform for designing interfaces and user experiences as the study progressed. The knowledge of the programmers for this particular software platform was also new to them; they had to learn as the study progressed as well. Another constraint is the budget for the purchasing of equipment that was used for testing by the GPs, this restricted the acquisition of the latest technology (or version) and the number of products. The time constraint with regards to the visits with the GP's of the study. The researcher would just like to note that all of the above constraints affected one another within the study.

### **3.15 Analysis for the research study**

Data analysis is described by Thomas (2011:171) as the studying of the meaning that people construct for themselves through the situations they find themselves in and these meanings are used to understand the social world. Patton (2002:432) mentions that:

Qualitative analysis transforms data into findings. No formula exists for that transformation. Guidance, yes. But no recipe. Direction can and will be offered, but the final destination remains unique for each inquirer, known only when-and if-arrived at.

Patton (2002:432) mentions that qualitative analysis is about 'making sense' of large amounts of collected data with the following:

Reducing the volume of raw information, sifting trivia from significance, identifying significant problems, and constructing a framework for communicating the essence of what the data reveal. When data is

collected in the different methods within the research study the next step is to analysing it.

Patton (2002), Preece et al. (2002), and Thomas (2001) mention the results of analysing, these being patterns, themes, categories and content analysis. Thomas (2011) notes once data starts to be analysed themes and categories start to emerge within the data collected, the aim of this process is to identify the meanings that are constructed by the participants as well as the researcher within a situation.

Patton (2002) mentions the term 'Inductive analysis' where themes, patterns and categories emerge or are discovered as the analyst interacts with the data collected, these are seen as the building blocks for the case study where the goals and research questions are answered to create the overall picture of the research study. The researcher will be conducting qualitative analysis in which themes have developed through the data will be identified and presented in aiding of the study. The analysis will be presented in chapter 5.

### **3.16 Validation for the research study**

Validation for the study has been quite a task for the novice researcher, by reading through a number of qualitative research textbooks which seems to have no end and trying to understand what validates a study, Patton (2002:553) sheds some light by mentioning three elements which the researcher has to take into account, these are 'rigorous methods' which pertains to the fieldwork where the quality of data is of a high nature is analysed with attention to credibility issues, 'credibility of the researcher' this is regards to the training, experience, presentation of self with regards to the researcher and the 'philosophical belief in the value of qualitative inquiry' which is the "fundamental appreciation of the naturalistic inquiry, qualitative methods, inductive analysis, purposeful sampling, and holistic thinking."

Maxwell (1996:86) mentions that validity is "rather a goal than a product", that it's rather relative between the purpose and the circumstances of the research study and that the methods are really just methods in obtaining evidence that would make validity threats implausible.

The methods which the researcher used within the study had to be thought of, as mentioned above the use of these methods were due to the sensitive nature of the topic which was being studied. Through the study the researcher was also aware of the limitations that these methods had, for instance when it came to understanding

the operations of the GP's and the general practice, naturally the idea was to observe these operations, but ethical constraints had to be taken into account and therefore diaries and interviews had to be used, Maxwell (1996:76) mentions that one assumption about obtaining immediate descriptions of behaviour and events is mainly obtainable by using observation, although this is true, interviewing is most capable of obtaining the results as well. Maxwell (1996:76) mentions the following about using the method, interviewing, as follows:

The latter (being interviews) gives you a description of what the informant *said*, not a direct understanding of their perspective. Generating an interpretation of someone's perspective is inherently a matter of inference from descriptions of his or her behaviour (including verbal behaviour), whether the data are derived from observations, interviews, or some other source such as written documents.

When it came to biases the researcher tried to keep these at minimum by including the entire team in the collection of data thus to reduce the researchers bias when it came to understanding the design situation, e.g. There were always team members in the interviewing session who asked questions other than the researcher and they also done probing on issues that were important for the study, interview questions were set up by the team members as well. Diaries on the other hand were really dependant on the reliability of the research participants for the recording of information. In the study there were situations when the researcher had to conduct interviews alone but these interviews were semi-structured and questions were assembled by the team, which includes the researcher.

Maxwell (1996) and Patton (2002) mention triangulation as another strategy for validity. Triangulation as understood by the researcher is the harnessing of different data collection methods, a variety of data sources, settings as well as theories that prevents the bias of a single viewpoint study.

Feedback as mentioned by Maxwell (1996:94) which is getting "feedback from a variety of people, both those familiar with the phenomena or settings you're studying and those who are strangers to this situation." These comments will differ but they are valuable. The researcher notes that during the study she presented her project at showcases within the Kujali Living Lab, these showcases are to display to industry and other universities what the student interns are working on. The feedback proved to be most helpful and interesting. Other elements which Patton (2002) mentions are



the credibility of the researcher and the intellectual rigor of the study. The credibility of the researcher has been noted in previous paragraphs. The intellectual rigor refers to the paradigms that the researcher is using within the study e.g. Ontology, epistemology, IxD, RtD and so forth. All of which have been mentioned in the previous sections within the researcher's study.

### **3.17 Summary**

In this chapter the methodology for the research study is explained. The methodology for the study incorporates the lens and framework of interaction design and research through design both which places the understanding of the GPs as an important aspect within the study. The only difference is that RtD allows the researcher to partake as the designer within the research project which physically allows the researcher to gather data. Due to the importance of understanding the GP's, the emphasis is placed on understanding their experiences which places the study's ontological viewpoint as whatever the GP experiences, that is their truth and it's important for the researcher to understand this to better design a solution which would be a right fit. Because the GPs perspective needs to be understood this places the study within an interpretive paradigm which focuses on understanding the user whereby a qualitative approach and methods are used to gain richer data from the GP's. In relation to the setup of the study the relationship between the researcher and GPs and other research participants are touched upon. Also in which category the sampling of the research participants are mentioned and how ethics are viewed within the study. Data collection methods and design methods were touched upon as well as the constraints, analysis of the data collected and validation within the research study.

The researcher would just like to mention that the general overviews which were mentioned in chapter 2 had guided the researcher in choosing methods which could be used to gather data. For instance ethical issues which were discovered whilst researching General practitioners aided in the choosing of design methods and data capturing methods which did not infringe on the medical society laws e.g. doctor and patient confidentiality and the usage of interviews rather than observations within the general practice to generate personas and sketches to develop ideas in the development an application.

## CHAPTER FOUR THE DESIGN PROCESS

### 4.0 Introduction

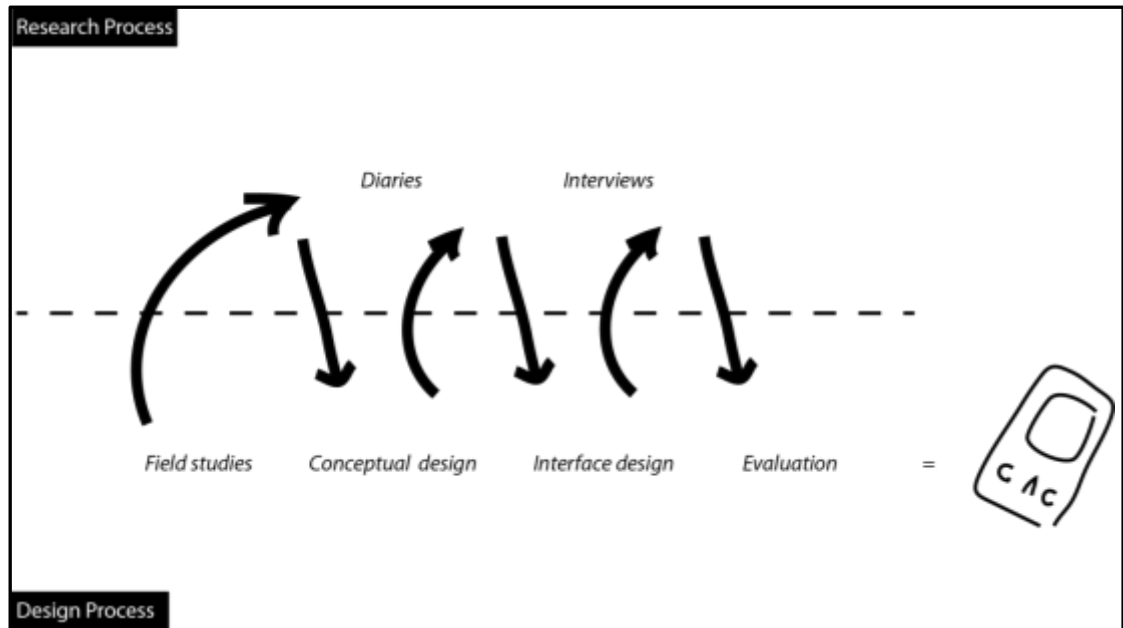
In this chapter the focus is on the design project. To set the stage for the design project. As mentioned in chapter 1, the project was initiated within the Kujali Living Lab. The Kujali Living Lab is an organization where student researchers, research and develop innovative projects in the field of ICT. I was interested in the field of information technology (IT) which is the labs focus. I thus saw an opportunity to initiate a project which incorporates mobile phone applications and the health industry. The research team consisted of an IT project manager, business analysts, IT programmers and myself as the Interaction designer and lead researcher.

**Table 4.0: Team members of research study**

<b>Role</b>	<b>Team members</b>
IxD designer	Shaeema Boer
IT project manager	Roeghshana Mukaddam
Business analysts	Siviwe Henda, Mxoleli Cwati
IT programmers	Chantell Witbooi, Mlindisi Khoza, Cecil van der Watt

The primary participants of the study were the two GPs situated within the Durbanville area in the northern suburb area of Cape Town (South Africa). Other participants were the secretary in the Durbanville general practice, a third GP, a pathology company and a public doctor, all of who are based within the vicinity of Cape Town.

The way in which the project is presented fits within a chronological timeline. The reason for this choice is that data that was gathered in the early stages form the foundation for the data collected in the later stages of the study. The early data leads to the development of further data in the design project building a story of the project from its inception depicting the natural flow of the design process.



**Figure 4.0: Research process feeding into the design process and vice versa within the study**  
(Author's construct, 2013)

The entire process of the project is presented because the research developed around the interactions during the design process. The research and design methods which were used are presented in the timeline as they occurred. As figure 4.0 shows both research processes, diaries and interviews are used to gather information. The information from the diaries and interviews is then fed into the design process and once data is gathered from the design process the data feeds into the research process again, forming a reciprocal cycle until an evaluation and a possible solution are reached.

#### 4.1 Overview of the research project

An overview of the research project will be shown to highlight what the reader can expect. Each stage of the design process is presented with a heading, the methods that were used, the participants, the location, the date, aim of the visit, overview and the findings. Findings are separated into design findings and research findings were applicable.

The stages in the design process are organised as follows;

- Interview study (which includes all interviews)
- Self-reporting with diaries done by the Durbanville GPs
- Design workshop 1
- SAFIPA- CSIR showcase event

- Design workshop 2
- Design workshop 3
- Self-reporting prototype given to the participating GPs
- Feedback session with the participating GPs

#### **4.1.1 Interview study**

The Interview questions (see appendix B) were created by the research team. The interview questions used for the GPs practices, the public health sector doctor and the pathology company are similar for the investigating interviews as the purpose of the interviews are to understand the operational function of these work environments as well as investigating whether incorporating mobile technology would be seen as beneficial to these health sector environments.

My task as researcher in the interview study was to assist with the development of the interview questions for the research participants (the GPs practices, the public health sector doctor and the pathology company) in the study.



**Figure 4.1: Durbanville GPs in an interview  
(Author's construct, 2011)**

#### **4.1.2 SAFIPA - CSIR Conference showcase event**

The SAFIPA - CISR Conference showcase event held on the 19-20 October 2011 which showcased ICT Innovation in South Africa was held in Pretoria at which the patient file smartphone application project was presented. The feedback from the showcase was useful with regard to storage, internet security and technical background. Although it did not directly influence the design of the interfaces, it

showed that the project had been introduced to higher level academic institutions and the public who were familiar to the area of study and who were not.

In presenting the different sessions of the study the SAFIPA – CSIR Conference showcase event will be moved after the three design workshops to maintain the current numbering system in the thesis.

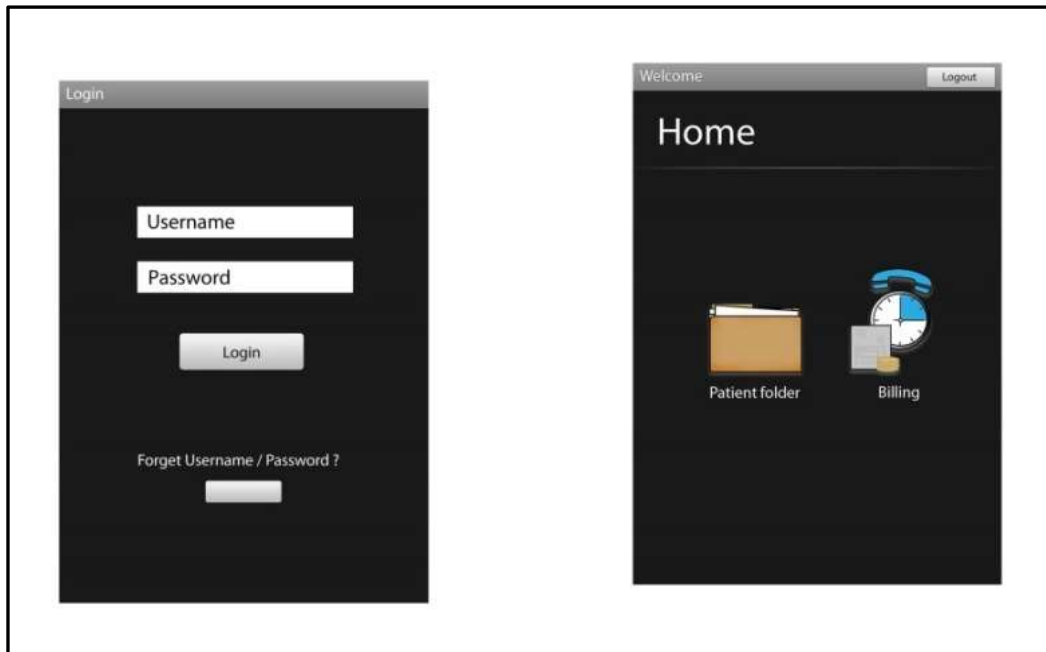
#### **4.1.3 Design workshops**

The design workshops are sessions in the research study in which the research team collaborated with the Durbanville GPs for whom the application was designed for. The design methods are used to generate designs in these sessions.

My tasks in the first design workshop were to create the interface sketches, scenario storyboard, persona's (characters in the storyboard) used in Design Workshop one. The designing of the refined interface sketches done in Design Workshop two. I took the GPs through the design process with the assistance of the rest of the research team as follows; I presented the storyboard, persona's and interface sketches to the GPs in Design Workshop one with the assistance of the research team; requirements were identified then refined and presented in Design Workshop two with the assistance of the research team; confirmed requirements were then developed by the IT programmers and the process was supervised by me.



**Figure 4.2: Image of research team member in design workshop with Durbanville GP (Author's construct, 2011)**



**Figure 4.3: Interface sketches done in design workshops (Author's construct, 2011)**

#### 4.1.4 Self – reporting diaries

The self-reporting stage in the research study was when the Durbanville GPs took diaries home which were used to simulate the application for data collection purposes and for the testing and evaluation for the completed digital beta application. There was a feedback session after the participating GPs tested the application.

My task in the self- reporting stage was to design the diaries used by the GP's for data collection purposes and the digital beta application was developed by the research team IT programmers.

**Table 4.1: Timeline of the different sessions in research study**

No.	Date	Sessions
1	16 August 2011	Case study: Durbanville GPs interview
2	10 September 2011	Public doctor interview
3	21 September 2011	Athlone GP interview
4	29 September 2011	Pathology company interview
5	03 November 2011	Design workshop 1
6	18/19 October 2011	SAFIPA - CSIR showcase event
7	06 December 2011	Design workshop 2
8	27 March 2012	Design workshop 3
9	04 October 2012	Proof of concept digital prototype given to case study GPs
10	09 October 2012	Durbanville secretary interview
11	18 October 2012	Feedback session

## 4.2 The interview study

The interview study consists of all the interviews which were conducted. The interviews consisted of the Durbanville GPs and their secretary, the Athlone GP, a pathology company and a public hospital doctor. The interviews were conducted to gain an understanding of the working environments in which the GPs function and to investigate if mobile technology would benefit these working health environments.

### 4.2.1 Interview with the GPs based in Durbanville

**Methods:** Semi-structured and unstructured interview, assumptions, research team journal notes.

**Participants:** Two designers (Shaeema Boer and Anton Delen who participated for this specific interview), two IT programmers (Chantell Witbooi and Cecil van der Watt), one IT project manager (Roeghshana Mukaddam) and two GPs.

**Location:** Durbanville practice (Northern suburb of Cape Town).

**Date:** 16 August 2011.

**Aim:** To establish rapport with the GPs, to investigate the procedures that they use to capture their patients data and to explore if there is a need for an application whereby GPs can access their patient data.

**Overview:** The interview mainly tries to discover whether there are situations that GPs would use a smartphone application to access patient data, as well as trying to understand the process of a consultation and the sections in which information is captured in the patient folder.

#### Key research findings:

- The two GPs are female and are between the ages of 35 and 50.
- Their current system used in their practice is paper based, white sheets of paper are used to manually capture data and patient history is given verbally by the patient during the consultation and then recorded by the GP, a folder is made if the patient is new. The patient's information gets recorded chronologically as per consultation and has a summary page which has the most important information on it which the GP updates regularly.
- The general practice is in the process on implementing an electronic health record system.
- The GPs do experience instances where patients contact them after office hours for assistance.

- The GPs use of technology (cell phones, computers and so forth) are from an intermediate level in regards to technology competence, but they do show enthusiasm in regards to learning and implementing technology based skills.
- Through the interview the GPs had a made a wish list of what they would like the application to perform, they would like to have input and edit features, be able to view pathology results via the application and incorporate a reminder system.

**Assumptions:** The research team had some vague assumptions as to what a GP tasks are in a practice. Most team members thought that GPs only deal with cases with minor ailments such as cold or flu and they were very surprised to discover that GPs perform minor surgical procedures and offer basic psychiatry treatment.

### **Summary**

Through the interview process it was found that there are instances in which GPs are contacted after office hours for assistance, and that they would like to have an smartphone application which could assist them at such times.

After the interview with the GPs, I compared the differences and similarities between the operational functions of the general practice and the public hospital environment. This lead to the decision to interview a public doctor who works in the hospital environment.

#### **4.2.2 Interview with public doctor in the health sector hospital environment**

**Methods:** Semi-structured, unstructured interview and my journal notes.

**Participants:** One designer (Shaeema Boer) and one public health sector doctor.

**Location:** Strand (Northern suburb of Cape Town).

**Date:** 10 September 2011.

**Aim:** To investigate the operational functions of the public hospital environment and to explore if a mobile application would be of benefit to the public doctor in the hospital environment.

**Overview:** The interview had provided an overview of the operational functions and the obstacles experienced by a doctor within the particular working environment. The doctor's opinions were mentioned relating to the use of a patient file application in the setting of a public hospital environment.



### **Key research findings:**

- The doctor is female and between the age of 24 and 28.
- A large number of medical and administrative staff deal with a patient's information and as such generally would contribute to a larger volume patient folder.
- The public hospital structure consists of a larger number of different stakeholders (doctors, nurses, cardiologists amongst others) unlike as a general practice which is opened on a 24 hour basis.
- The public hospital does use an electronic system but this is predominately for administration purposes.
- Doctors do use their mobile phones while they work.
- The doctor mention that an smartphone application would be ease of access in the public hospital setting, patient files were couriered from the file room to the doctor which is a lengthy process.
- The doctor had concerns about the reliability and security when came to entering patient data when in the patient folder because mistakes occurred.
- Updating patient folders with the large volume of patient traffic would make the successful use of the mobile application difficult.

### **Summary**

The public hospital setting has a large number of stakeholders who are involved with the patient folder and the patient. The volume of patient traffic is huge compared to a general practice. After my interview with the public doctor who provided some insights into the operational functions of the public hospital setting; I decided that the mobile application for a patient file would not necessarily function in a hospital setting because of the volume and the monitoring of patients in the hospital. Instead the research team had decided it would be more relevant to the study to interview another general practice.

#### **4.2.3 Interview with the GP based in Athlone**

**Methods:** Semi-structured and unstructured interview and research team journal notes.

**Participants:** One designer (Shaeema Boer), two IT programmers (Chantell Witbooi and Cecil van der Watt), one IT project manager (Roeghshana Mukaddam) and one GP.

**Location:** Athlone general practice (Northern suburb of Cape Town).

**Date:** 21 September 2011.

**Aim:** The aim of the interview was to gain another perspective of a general practice and to explore if a smartphone application would be seen as beneficial by another GP.

**Overview:** Different types of general practices, the patient file, the smartphone application for patient file and the billing procedures were discussed.

**Key research findings:**

- The GP is male and between the age bracket of 55 and 70 years.
- GP has two general practices in the Athlone vicinity in which he consults at during different times of the day.
- The GP mentioned that there are different types of general practices. In his practice there are only two staff members, but in other practices there could be three or more people as well as a medicine dispensary section.
- The GP uses a paper based patient folder, which consists of the patient identifiers (name, surname, date of birth, ID number and medical aid information). Dates and times of the patient consultations were identified as being important.
- An electronic system is used in his practice but this is for billing purposes, his secretary manages operational functions of the practice and he consults with patients.
- He stated that he and his secretary have an ethical approach towards the operational functions of the practice and the patient's.
- The GP mentions that he did not receive many calls for after hours assistance; if he received an after hours call it was usually an emergency of a serious nature which he referred to the nearest hospital.
- In his experience he thought there are situations in which it would be useful to have a smartphone application to view patient information. He works on an appointment basis. Hi secretary prepares the patient files. However there are times when patients have to be seen at short notice and in these cases he thought a smartphone application for accessing patient files would be useful.
- Other than the use for the application file the GP thought that the smartphone application could be used interactively with the patient (e.g. patient being able to send an image of a physical condition for the doctor to diagnose).

## Summary

The Athlone general practice provided a different perspective of how a general practice functions. The GP's involvement with his patients is different when compared to the Durbanville GPs when it comes to after hour assistance because the calls are less than the Durbanville practice in the study.

The research team and I noticed that all of the GPs that were interviewed felt that a more efficient system to access a patient test results would facilitate the running of their practices. Based on this I decided it would be useful for the design process of the smartphone application to interview a pathology company that deals with GPs lab tests. Although it was not sure if the application could actually encompass this function it was an avenue which needed to be explored.

### 4.2.4 Interview with Pathology Company

**Methods:** Semi-structured and unstructured interview and research team journal notes.

**Participants:** One designer (Shaeema Boer), two IT programmers (Chantell Witbooi and Cecil van der Watt), one IT project manager (Roeghshana Mukaddam) and two employees of the pathology company.

**Location:** N1 City (Business Park) (Northern suburb of Cape Town).

**Date:** 29 September 2011.

**Aim:** To discover how Pathology Company functions and how their labs results (of a sensitive nature) are sent to doctors. To receive feedback on the smartphone patient files application.

**Overview:** The interview was informative in regards to approaching the application from a commercial viewpoint. The information which was received was mainly in regards to the online security of the application and the back end system designing of the application.

#### Key research findings:

- The pathology company analyses and tests various samples ranging from blood tests to agricultural analyses. A doctor draws a sample of blood from a patient which is sent to a pathologists who perform the necessary tests and analyses. The results are either sent in paper format or electronically by email, internet, fax or telephone.

- Many practitioners would like to receive patient test results via sms, but patient information needs to be encrypted and because confidential patient information would be sent through public domain servers, sms is not a viable option.
- During the interview pathology employees communicated that if the smartphone application was merely for viewing from the smartphone platform it would be acceptable, but if the application became more interactive a device with a larger screen would be needed.
- It was mentioned that the younger generation of doctor's were more open to the use of mobile medical devices.
- It was also mentioned that the operational function of the smartphone application would have to be very simple to operate as most medical practitioners have limited amounts of time during working and also after hours.

### **Summary**

The research team found the interview with the pathology company useful. It was informative to know about the pathology results which were not made available through sms. Although a large amount of the information had dealt with the perspective of launching a commercial product it was still informative for the research team.

All the interviews had focused on the GPs as well as the public health doctor. In the interviews with the GPs they had mentioned instances where the secretary had made contact with the patient file. The researcher team and I thought it would be informative to gain an insight of the operational functions of a general practice from the secretary perspective.

#### **4.2.5 Interview with the secretary from the Durbanville general practice**

**Methods:** Semi-structured and unstructured interview.

**Participants:** One designer (Shaeema Boer), one business analyst (Siviwe Henda) and one general practice secretary.

**Location:** Durbanville (Northern suburb of Cape Town).

**Date:** 09 October 2012.

**Aim:** The aim of the interview with the secretary was to get another perspective of the general practice operational functions and the patient file.

**Overview:** The secretary was asked questions regarding her involvement with the patient file and how the GP's handled certain situations when they were on vacation and if the secretary was involved in after hours situations regarding the patient file.

**Key research findings:**

- The secretary had explained her duties as doing the administration work for the practice; which entails preparing files for the GPs, answering calls, payment of accounts for the practice.
- She mentioned that she was not contacted after hours for patient information.
- She prepared the patient files. Making sure there was extra paper in the file and making them ready for when the GP arrives.
- When test results were received from the pathologist she added the results to the patient file and informs the GP that the results have arrived.
- The filing cabinet for the files is located within the secretary's area of work. The secretary files the folders in alphabetical order where the name and surname of the main member of the medical aid scheme is used as the reference point, the patient folders are grouped within family folders, this is done to make the paper work for the secretary and GP easier to access and handle.
- When one GP is on leave there always needs to be another to take care of the other GPs patients. Secretary observed that the GPs do not find consulting one another patients difficult, as all the necessary information about the patients is kept in the patient file. She mentioned that some patient's prefer to wait for their usual GP to return from their leave, but if necessary they would come for minor ailment consultations and if necessary they would come for major consultations.
- At the end of the year the entire staffs is on holiday and patients are referred to another GP practice.

**Summary**

The secretary was interviewed to gain another perspective of the general practice. The decision to interview the Durbanville secretary was based on my discussion with the Athlone GP regarding his secretary's involvement in the administrative functions and the handling of the patient file.

### 4.3 Self-reporting diaries

The interviews provided an overview of the general practice but I needed to gain a deeper understanding of the operational functions of the patient file and how the Durbanville GPs use it. As such I gave the GPs diaries in which they could record their location, times and the reason why they would need to use patient file.



Figure 4.4: The researcher explaining the use of the diaries to the GP's (Author's construct, 2011)

<p><b>Hello</b> Dear GP.</p> <p>This is your paper <b>mobile health record</b> prototype lets call it</p> <p><b>MOBIHERE</b> ..... :)</p> <p>(<b>mobile health record</b>)</p> <p><b>Important:</b> <i>For research purposes the following documentation is needed.</i></p> <p><b>Instructions:</b> Whenever you are in a situation that requires you to look up information of a patient, you are required to record the :</p> <ul style="list-style-type: none"><li>&gt; <b>time</b> of the situation</li><li>&gt; your <b>location / where</b> you are when you needed to check for information</li><li>&gt; <b>date</b> when the need arised</li></ul> <p>The block below is for any other extra ideas and thoughts as to how MOBIHERE can help you :)))</p> <p>Your <b>MOBIHERE</b> prototype will be collected on the next meeting with the kujali team.</p>	<p>date:</p> <p>time:</p> <p>Location:</p> <div data-bbox="995 1352 1417 1778" style="border: 1px solid black; height: 190px; width: 100%;"></div>
--	--

Figure 4.5: The diaries front cover and the recording sheet (Author's construct, 2011)

The self-reporting diaries were kept for a month. No patient names or actual patient data should be presented in the diaries. Usual feedback for the idea generation for the application was provided by the self-report diaries. Diary finding summary follows.

### 4.3.1 Research findings

- The GPs opinion was that by having the smartphone patient file application they would be granted a wider scope in providing a better service for their patients.
- The frequent use of the diary made the GPs aware of how often they would need to check a patient file. One of the GPs mentioned there were vary times when she would want to view patient data such as when she was driving or when she was at home, she mentioned even when she has a feeling to call a patient or when she remembered that she would want to remind a patient about a check-up, at these times the application would be useful because both the patient data and the patients contact details would be accessible for use at any time.
- The GPs mention that the benefit which they find with the application is that they would not have to travel with a number of patient files.
- For security purposes the GPs see the application as being useful. The patient files won't be exposed or get lost.

The tables that follow show a summary of the main results and functional requirements that were made in the self – reporting diaries by GPs.

**Table 4.2: Major results from in the self-reporting diaries kept by the Durbanville GPs**

<b>Days</b>	Every day (majority on weekends) there was some sort of patient information which the GP wanted to access.
<b>Time</b>	The hours of accessing happened between 09:00 to 21:00, the times show that the most common hours are 11:00, 16:00, 18:00 and 20:00.
<b>Place</b>	Although there was a need to access patient data every day, the places at which information was accessed was as follows at home, in the car, on holiday, in gym, while shopping or when attending lectures.
<b>Reason</b>	The reasons for wanting to access patient information is in point form: <ul style="list-style-type: none"> <li>• To contact the patient, GP needed the patients contact details.</li> <li>• Having access to data to check information.</li> <li>• Taking a file home to call a patient about their pathologist results.</li> <li>• When a patient calls for a script, GP needs their file to check about medication information.</li> <li>• When a patient contacted the GP for advice they would need the patient's information.</li> <li>• When referrals were needed by a patient for a specialist.</li> <li>• GP wanted to link schedule appointments to patient file application.</li> <li>• When the GP needs to check medication and allergies of a patient.</li> <li>• Adding notes to a patient file as required.</li> </ul>

**Table 4.3: Functional Requirement for the patient file application**

Req. no.	Functional Requirement for the patient file application	Description of requirement	Priority
1	System must store the patient's personal and medical details	System must store patient's: <ul style="list-style-type: none"> <li>• Name</li> <li>• Surname</li> <li>• DOB</li> <li>• Medical aid</li> <li>• Dependents</li> <li>• Diagnoses</li> <li>• Allergies</li> <li>• Medication</li> <li>• Notes</li> </ul>	High
2	Patient Diagnosis	Allow the user to record a patient's diagnosis and the diagnosis date.	High
3	Patient allergy recording	Allow the user to record any allergic reaction that the patient might have	High
4	Patient Medication recording	Allow the user to record any medication information that the patient is using	High
5	Writing of notes	Writing notes pertaining to patient condition	High
7	Patient diagnosis editing	Allow the doctor to edit a previous diagnosis entry on the database	High
8	Patient allergy editing	Allow the doctor to edit a previous entry of the patients allergies	High
9	Patient medication editing	Allow the doctor to edit an entry detailing the medication given to a patient	High
10	Patient note editing	Allow the patient to edit a previous note entry	High
11	Patient diagnosis deletion	Allow the doctor to delete a previous entry of a patient's diagnosis	High
13	Patient allergy deletion	Allow the user to delete a previous allergy entry from the database	High
14	Patient note deletion	Allow the user to delete a note entry from a patients notes folder	High
15	Telephonic billing	Allow the user to record the details of a telephonic consultation between the patient and the doctor	Low
16	Script billing	record the details of a script based consultation between the GP and the patient.	Low



### 4.3.2 Summary

The research finding of the diaries gave the research team a better understanding of the requirements which the GPs would want from the patient file application.

The collection of the self-reporting diaries had developed a better understanding of the design situations and reasoning behind the accessing of the patient file by the Durbanville GPs. The research team had taken the user requirements which were identified in the interview study and the self – reporting diaries to design the application interfaces. Interview study and self-reporting diaries were looked at for user requirements (see figure 4.6). The information was interpreted into interface sketches, personas and a storyboard which were shown to Durbanville GPs which were used these to develop the application further in the design workshops. (See figure 4.7)

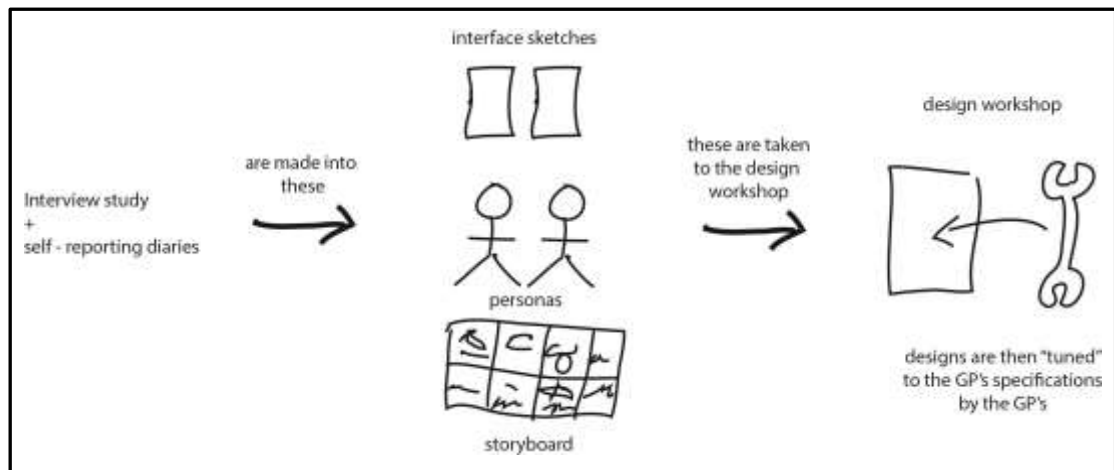


Figure 4.6: How the design tools were generated in the study (Author's construct, 2011)

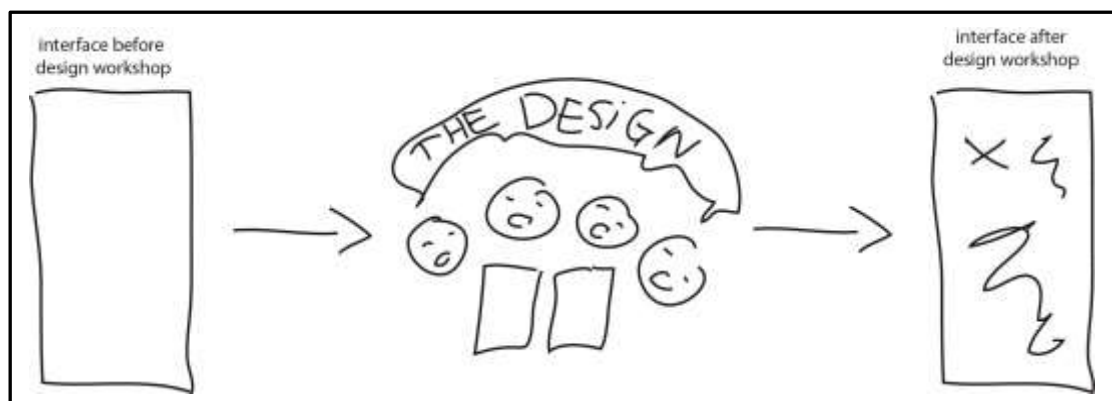


Figure 4.7: How the interfaces take shape in the design process (Author's construct, 2011)

#### 4.4 The design workshops

The way in which the workshops operate is that interface sketches are shown to the GP's. During the workshop the research team and GP's discussed which design elements in the interface sketches should stay and which should go. Through this process the design was refined. After Design Workshop 1 I made the necessary changes to the interface sketches which were then presented to the GPs in the Design Workshop 2 in which the design process was further refined. After Design Workshop 2 I made the necessary changes to the interface sketches and presented these to the GPs in Design Workshop 3 where another set of refinements are made before the digital prototype is developed and given to the GPs for evaluation.

##### 4.4.1 Design Workshop 1

Design Workshop 1 was the design workshop with Durbanville GPs (case study GPs).

**Methods:** Interface sketching, sketching, storyboard, personas, dynamic paper prototyping and research team journal notes.

**Participants:** One designer (Shaeema Boer), two IT programmers (Chantell Witbooi and Cecil van der Watt), one IT project manager (Roeghshana Mukaddam) and two GPs.

**Location:** Durbanville (Northern suburb of Cape Town).

**Date:** 03 November 2011.

**Aim:** To introduce the first set of interface sketches to the GPs and to receive their feedback and design input.

**Overview:** After the interview study and the self – reporting sessions with the diaries, the research team had taken information from those sessions to develop personas, scenario storyboards and interface sketches which were shown to the Durbanville GPs.

The research team presented the scenario storyboard which visually depicted the scenario in which the GP receives a call and needs to help the patient immediately; she would then have to access the application quickly and assist the patient when she has found the information which she is looking for. (See appendix E for detailed scenario storyboard.)

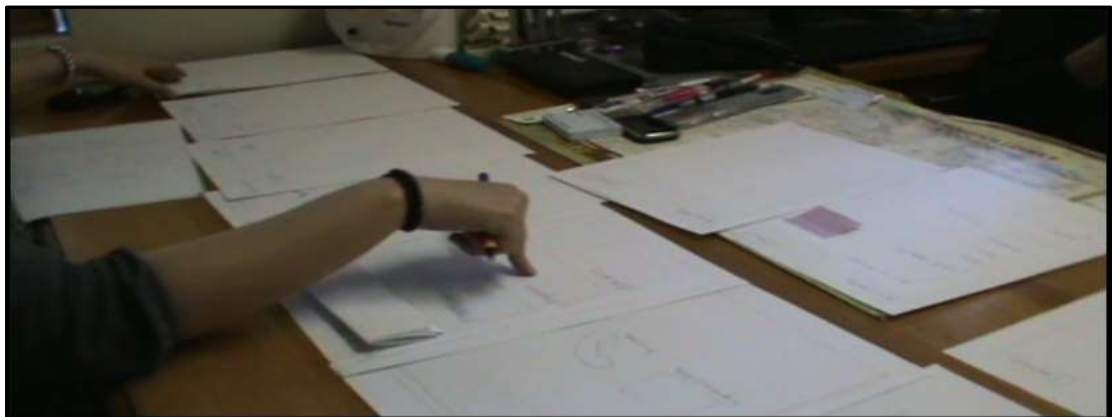


Figure 4.8: Image of scenario storyboard used in Design Workshop 1 (Author's construct, 2011)



**Figure 4.9: Image of scenario storyboard used in Design Workshop 1 (Author's construct, 2011)**

Once the scenario storyboard was explained and viewed by the GPs the interface were shown to the GPs. Below is an image of the interface sketches used in the design workshop.



**Figure 4.10: Image of interface sketches used by research team and GPs in Design Workshop 1 (Author's construct, 2011)**

The presentation of the research findings in all three design workshops will be shown in a table format. The findings will be presented in the left column as research findings and the design actions which had taken place in the workshop will be presented in the right column. Images relating to the design actions in the design workshops will be presented after the table.

#### 4.4.1.1 Design Workshop 1 findings

Research findings and design actions done in Design Workshop 1 are presented.

**Table 4.4: Research findings and design actions done in Design Workshop 1**

Research findings found in workshop	Design actions done in workshop for the research finding
<p>GPs mention that the application was not seen as a detailed patient file as it would be in a paper based file; the idea behind the application is for quick access so the details within the patient file application will be direct but minimal.</p>	<p>The application would be designed to be used for quick access. Design actions are:</p> <ul style="list-style-type: none"> <li>• Patient files to be stored alphabetically for quick access.</li> <li>• Family folders are added to better group patients together when searching for parents and dependents.</li> </ul>
<p>GPs mention that the screen should not be cramped with information.</p>	<p>Agreed by both GPs and research team that information in the application will be shown in a minimal format. Design actions are:</p> <ul style="list-style-type: none"> <li>• Patient identifiers in the application are the name and surname of the patient, the Identity number/ date of birth and medical aid scheme.</li> <li>• The patient information in the patient file is displayed in categories (allergies, diagnosis and medication) these categories will have the most recent diagnosis displayed. It was decided by the GPs that the diagnosis and medication would show the acute and chronic information separately.</li> </ul>
<p>The use of the interface sketches and the dynamic paper prototype worked well to explain and discuss what the GPs wanted the interface to look like.</p>	
<p>The GPs imagined what the application would look like in its ideal state which would be used within their practice as well by other GP's. Some of the ideal scenarios which the GP's had mentioned to the research team was the application would sync with the electronic system that the practice would implement, this would allow billing functionalities to be to updated and sent from the application directly to the medical aid schemes. Another ideal functionality which the GP's would like is a notification function for results from pathology companies which send test results to the practices.</p>	

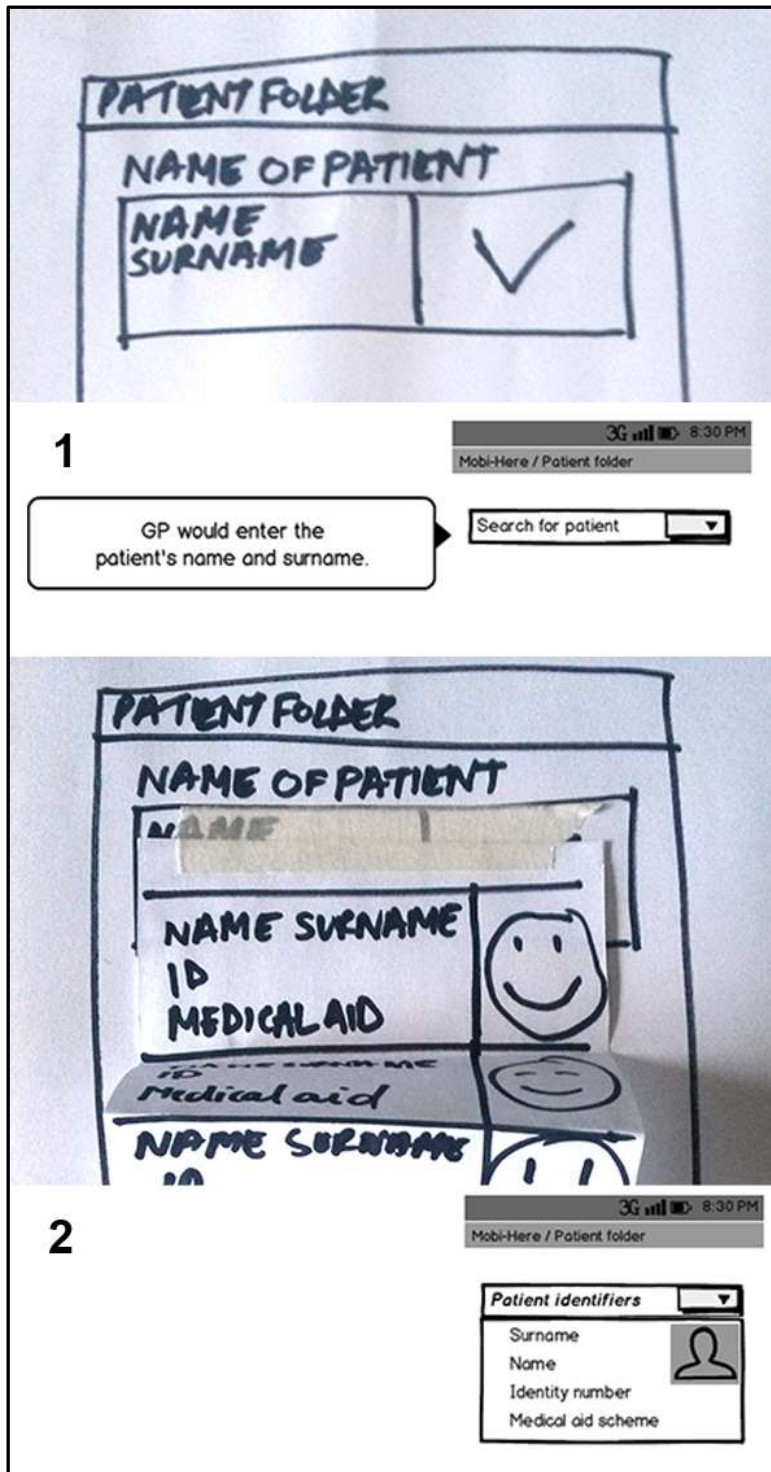


Figure 4.11: Partial image of paper interface sketch (1) (above) with sketch wireframe (bottom) showing the patient search bar where the GP would enter the patient name or surname on the patient file application and partial image of paper prototype (2) displaying a drop down menu showing the patient identifiers which are the patient's surname, name, identity number, the medical aid scheme and a picture of the patient. (Author's construct, 2011)

Figure 4.11 has interface sketches of the application; these show line drawings of the layout of the interface. The paper sketched interface and wireframe at number 1 show where the GP would enter the patients name and surname and the paper prototype interface at number 2 shows a "drop down" menu when the patient's name has been found. The drop down menu shows the patient identifiers for the application this is the name, surname, ID number as well as the medical aid scheme and a photo of the patient.

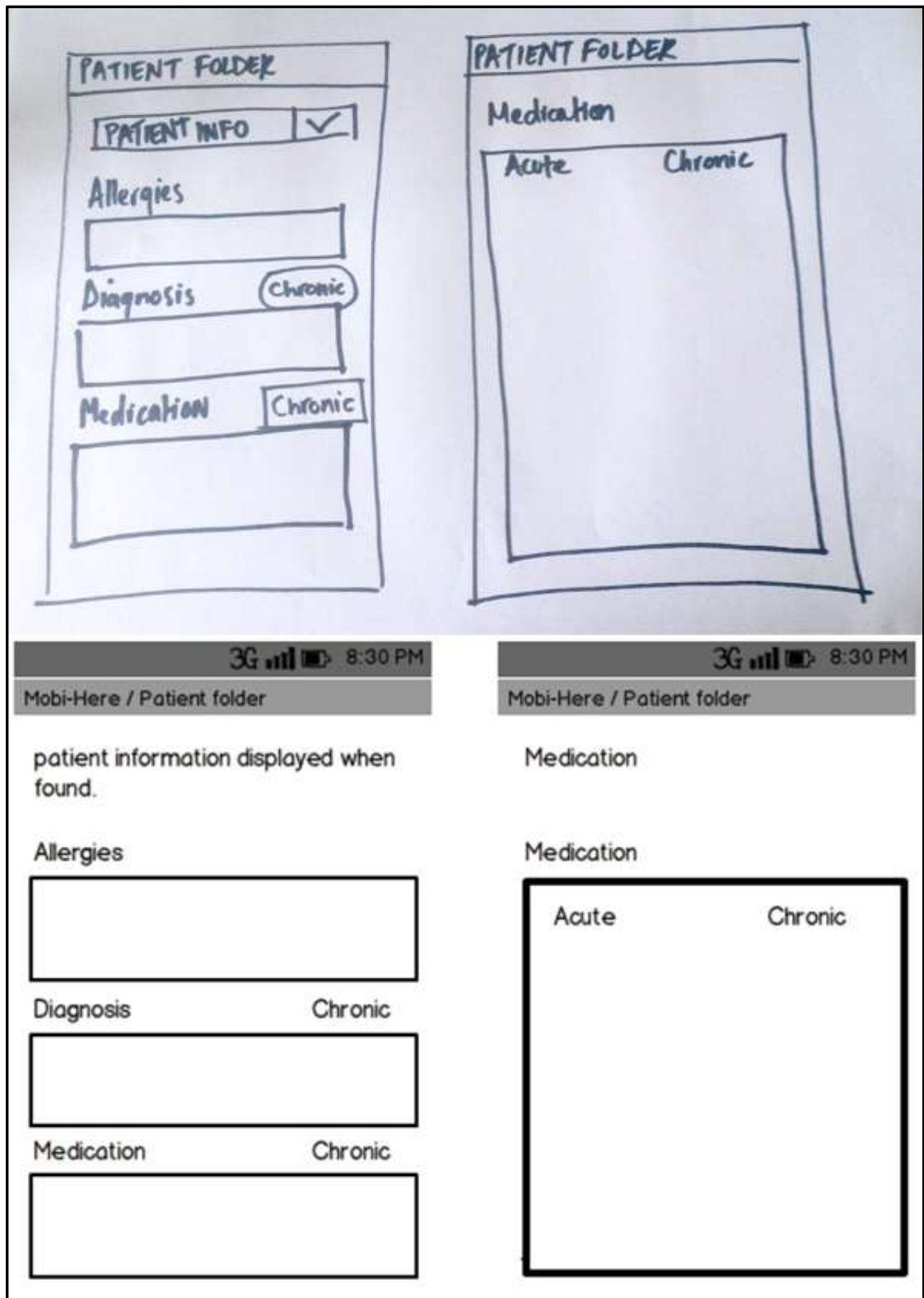


Figure 4.12: Image of paper interface sketch with headings to indicate different sections clearly. Interface wireframe sketches at the bottom show the patient file layout clearer.  
(Author's construct, 2011)

Figure 4.12 shows the interface sketches with the categories allergies, diagnosis and medication and the chronic indicators. The image on the left represents the interface when the patient is found and their patient folder is displayed. On the page the patients name is shown with the categories allergies, diagnosis and medication for easy

identification of specific areas in the file, the file shows the chronic indicators at the categories diagnosis and medication. The image on the right is the interface which appears if the medication section were selected. This screen shows more information in regards to the medication of the patient. The information shown is divided into acute and chronic headings.

The researcher notes that having the aid of the paper prototypes, interface sketches and the storyboard made it easier for the GPs to understand the application which also allowed them to use the design tools to develop the concept further.

#### **4.4.1.2 Summary**

Design Workshop 1 focused on the interface sketches which were designed from the information gathered from the interview study and the self – reporting diaries. The tasks of the research team and the GPs were to develop the designs further and choose which design elements should be focused on. The main issues which were addressed were the patient identifiers (name, surname, date of birth) and the grouping of the patients in the family folders for easy access. The family folder displayed the main member which is the medical aid scheme holder (and his/her dependents).

The other focus was the layout of the patient file interface. The GPs liked the idea of separating the medication, allergies and diagnosis which was where the most recent information would be shown. The GPs wanted the application to show if the patient had chronic illnesses, so that they know which medications the patient could and could not use. When going to the patient folder (diagnosis, medication and allergies), the GPs wanted to be able to access a new screen with more detailed account of diagnosis, medication and allergies.

The research team used the feedback from Design Workshop 1 to refine the interfaces sketches. The sketches were done in design programs to show a more defined layout of what the application interface would look like. To confirm the refined designs, Design Workshop 2 was held with the Durbanville GPs.



#### 4.4.2 Design Workshop 2

Design workshop with Durbanville GPs.

**Methods:** Interface sketches and research team journal notes.

**Participants:** One designer (Shaeema Boer), one IT programmers (Chantell Witbooi), one IT project manager (Roeghshana Mukaddam) and one GP (other GP was on holiday).

**Location:** Durbanville (Northern suburb of Cape Town).

**Date:** 06 December 2011.

**Aim:** To present the interface sketches from Design Workshop 1 with the refined design adjustments and to confirm the design decisions in regard to the interfaces for the application.

**Overview:** The refined interface sketches from Design Workshop 1 were shown to the GPs in Design Workshop 2. It's noted that the one GP was on holiday when the research team had Design Workshop 2. Existing or current decisions which needed to be done in regard to the interface of the application was confirmed. GPs were exposed to rough pencil interface sketches in Design Workshop 1 and in Design Workshop 2 the sketches were refined and done in colour, then presented to the GP. These refined sketches were made by design software as opposed to the drawn sketches which were used in the Design Workshop 1.



**Figure 4.13:** Image of refined interface sketches shown to the GP by the researcher (Author's construct, 2011)

#### 4.4.2.1 Design Workshop 2 findings

Research findings and design actions done in Design Workshop 2 are presented.

**Table 4.5: Research findings and design actions done in Design Workshop 2**

Research findings found in workshop	Design actions done in workshop for the research finding
The layout colours which are chosen are grey, white and black for the application.	Design action: <ul style="list-style-type: none"> <li>The colour scheme of interfaces for application is grey, white and black.</li> </ul>
GP prefers a number set password when logging in.	Design action: <ul style="list-style-type: none"> <li>Number password was incorporated into the login design for the patient file application.</li> </ul>
GP mentions that at times she cannot remember every detail about her patients file so when a patient contacts her after hours, to ensure that she gives the correct information she would like to be able to retrieve a summary page on the application to refresh her memory.	Design actions: <ul style="list-style-type: none"> <li>Summary page is added into the interface design.</li> <li>The summary page is a page with the patients information summarized, this consists of a: <ul style="list-style-type: none"> <li>Medication list (chronic),</li> <li>Diagnosis (acute/chronic),</li> <li>Allergies (acute/chronic), along with a number of other notes such as how many dependents the patient has, what operations they had gone for, which are all displayed in minimal detail.</li> </ul> </li> </ul>
GPs wanted a clearer indicator that would show whether a patient has a chronic illness.	Design action: <ul style="list-style-type: none"> <li>The research team had decided to add a colour with the chronic indicator text to help the GPs identify if a patient has any chronic information in the patient file screen. (See figure 4.16 for an example of the patient file screen)</li> </ul>
It was mentioned by the research team that the application should not introduce another form of data capturing but try to develop familiar methods of capturing patient information in the application that GPs can understand.	Design actions: <ul style="list-style-type: none"> <li>Family folders were introduced into the system because this way of searching for a patient was familiar to the GPs.</li> <li>When a patient's name is entered in, the application presents the name and/or if the patient is part of a family folder, the entire family list is then shown.</li> </ul>
The GPs make mention that they come from a generation where electronics was not as available as it is now and therefore they feel more comfortable with paper.	
GPs mention that their paper files will always be within their practice. They mention that in case electronics fail there	

<p>is another format of data which will be available. The reason why the GPs use paper is that when they want to explain things or remind themselves of certain things concerning a patient, they can draw images or develop their own codes on paper which they cannot be able to do on an application.</p>	
<p>GPs mention that in today's technological age, information is easily accessible and it does have its advantages for delivering a good service.</p>	
<p>Even though the application is being developed from a conceptual perspective the GP does not allow her imagination to be limited. Her suggestions of the integrations of the application and their future electronic system generates different scenarios as to how the application could contribute to her general practice operations e.g. By a push of a button the GP would be able to update her electronic system by using the application.</p>	
<p>Patient information is privileged information; the GP mentions that all doctors are bound by an oath whereby they are obligated to protect the patient to the best of their ability.</p>	
<p>She sees no danger with having the application on her phone. She is more concerned with the efficient and fast access of patient information via the application. Although if her cell phone were stolen she wants a security measures to be developed to handle such a scenario when it comes to the application.</p>	
<p>The refined interface sketches have had a positive influence in stimulating ideas around the development of the application.</p>	

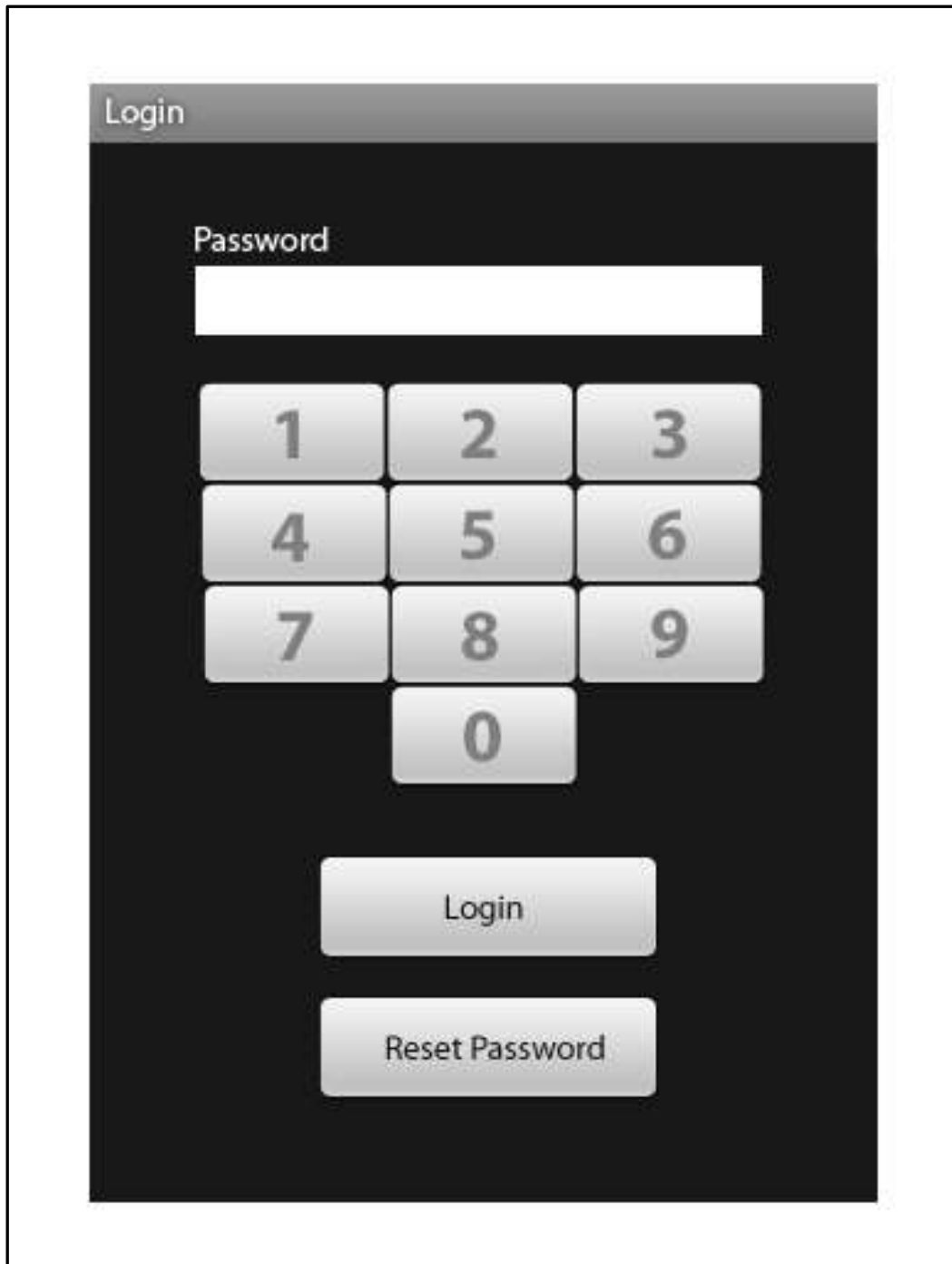


Figure 4.14: Refined interface sketch showing numbered password for logging into the application  
(Author's construct, 2011)

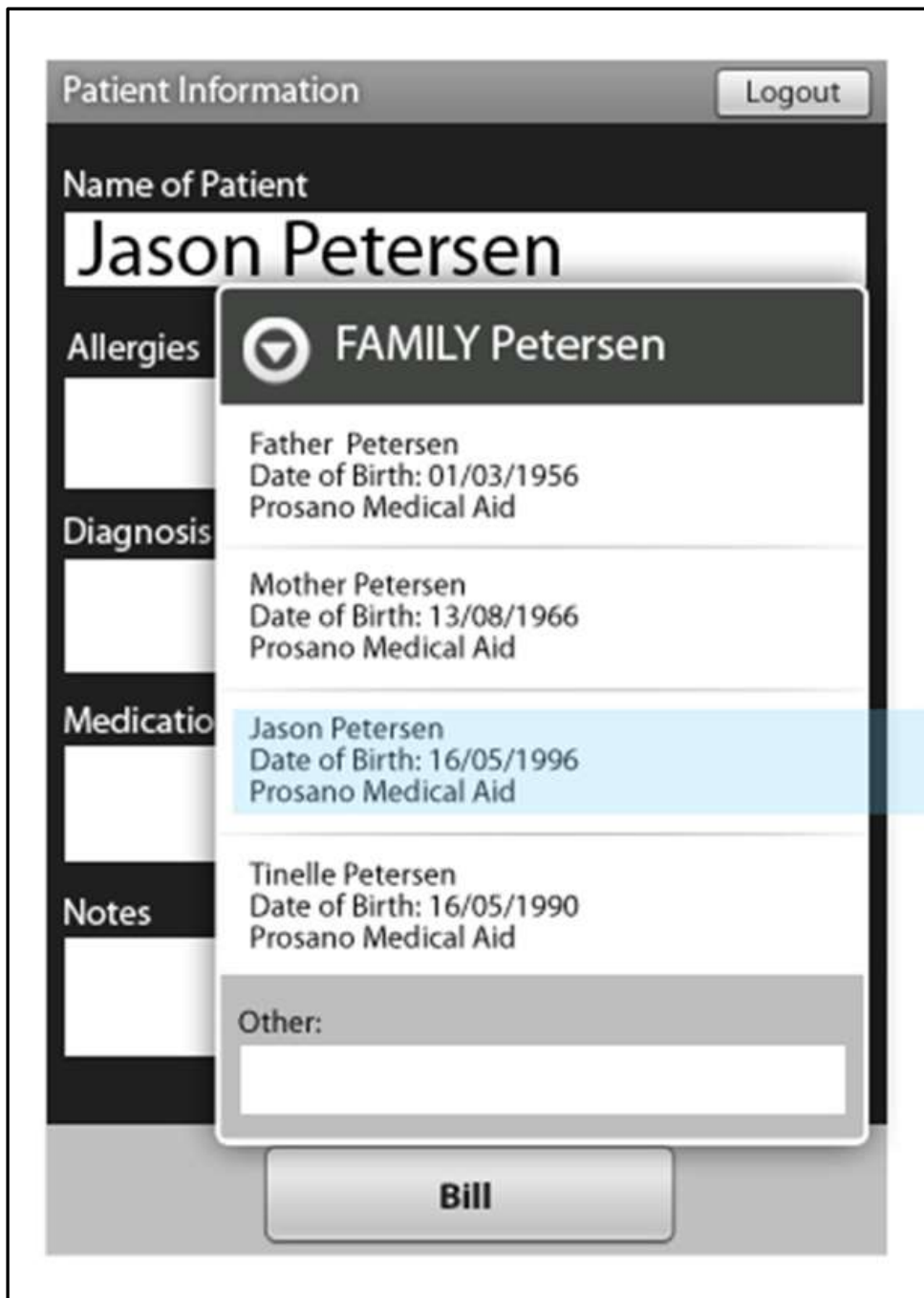


Figure 4.15: Refined interface sketch showing the patient, Jason Peterson’s family folder when searching for his patient folder (Author’s construct, 2011)

Figure 4.15 shows the refined interface sketch when searching for a patient. When searching for the patient’s name the GP would enter the name in the text box named “Name of Patient”, in this example the patient’s name is Jason Peterson. When Jason’s name is identified his family folder is shown. This is to quickly identify who is linked to Jason’s profile. His family member’s files can also be accessed from this family folder screen for quick access. Jason’s name is then selected (indicated with a light blue highlight) because the GP wants to view his patient file.

The image shows a refined interface sketch for a patient's information. At the top, there is a header bar with the text "Patient Information" on the left and a "Logout" button on the right. Below this, the patient's name "Jason Petersen" is displayed in a large white box. The information is organized into several sections, each with a black header bar and a white content area. The sections are: "Allergies" with the text "16/08/2011: Penicillin." and a "Sensitivities NO" indicator; "Diagnosis" with the text "18/04/2011: Broke left leg in a rugby match." and a "Chronic NO" indicator; "Medication" with the text "19/04/2011: Pain tablets." and a "Chronic NO" indicator; and "Notes" which is currently empty. At the bottom of the interface is a large, rounded rectangular button labeled "Bill".

Figure 4.16: Refined interface sketch showing the patient, Jason Peterson's patient folder once he was selected (Author's construct, 2011)

Figure 4.16 shows the refined interface sketch when a patient has been selected. In this example the patient Jason Peterson is selected. His patient information is separated into the categories "allergies, diagnosis, medication and notes", these categories have the most recent diagnosis displayed. In this example the patient has indicators which show if he has chronic patient information in the different categories.



Figure 4.17: Refined interface sketch showing a detailed diagnosis screen (Author's construct, 2011)

Figure 4.17 shows the refined interface sketch of Jason's Diagnosis category. The screen is accessed on figure 4.16. The GP would touch on the Diagnosis window which would open the screen in figure 4.17. Figure 4.17 is a screen which shows the most recent and previous entries made in the diagnosis category.

#### 4.4.2.2 Summary

In Design Workshop 2, new elements had been introduced but some design elements had been consistent for instance the patient search functionality by incorporating the family folder was confirmed to stay. New key elements is using only a numbered password because remembering a username name and password would be time consuming, the GP's no longer wanted the patient information to be split into chronic and acute sections all information will be displayed on one screen. The summary page is introduced because the GP's would like an overview page of the patient before entering the patient file on the application, these are for situations where they could quickly view a patient without going into the patient file entirely.

The third design workshop was aimed at focusing on the design elements which had been mentioned in previous workshops and to evaluate the incorporated design elements on the digital prototype which the research team had developed for this workshop.

#### 4.4.3 Design Workshop 3

Design Workshop with Durbanville GPs.

**Methods:** Dynamic digital prototype and research team journal notes.

**Participants:** One designer (Shaeema Boer), one IT programmers (Chantell Witbooi), one IT project manager (Roeghshana Mukaddam) and two GPs.

**Area:** Durbanville (Northern suburb of Cape Town).

**Date:** 27 March 2012.

**Aim:** The workshop was aimed at evaluating whether the layout and user experience of the dynamic digital prototype was understood by the GPs.

**Overview:** The dynamic digital prototype was shown to the GPs and they were asked to experiment with the digital prototype within the session and provide feedback.

At this point within the design project the research team had want to confirm if the layout of the prototype application was user friendly and understood by the GPs and if the GPs were able to use the touch smartphone technology. Figure's 4.18 and 4.19 show the GPs using the digital prototype and discussing design elements, functionality and user experience on the digital prototype which the research team had developed. This particular workshop was used to evaluate any issues which were mentioned in the previous design workshops and to further develop the prototype which can represent all the elements of a digital patient file which could be used by



the GPs. The touch smartphone which was used in this session was a Samsung smartphone and the platform on which the application was developed is android.



**Figure 4.18: Image of digital prototype being used by Durbanville GP. Images were taken from the video recording footage (Author's construct, 2012)**



**Figure 4.19: Image of digital prototype being viewed and discussed by Durbanville GPs and research team member. Images were taken from the video recording footage (Author's construct, 2012)**

#### 4.4.3.1 Design workshop 3 findings

Research findings and design actions done in Design Workshop 3 are presented.

**Table 4.6: Research findings and design actions done in Design Workshop 3**

Research findings found in workshop	Design actions done in workshop for the research finding
GPs note that the user sequence of the application is nice; the sequence of going into a patient file is easy to understand.	
The design colour layout which was discussed in Design Workshop 1 and 2 was confirmed in Design Workshop 3.	Design action: <ul style="list-style-type: none"> <li>• Application background is white and black font would be used.</li> </ul>
The GPs like the appearance of the layout and the predictive text when typing on the keyboard.	
GPs explain more about the summary page display. GPs mention that this page would display the patient's name and surname, date of birth, chronic illnesses, chronic medication and what the last consultation was about with the GP. GPs mention that the summary page is an important page, it contains the most important data of the patient on one page, GP mentions that by having the summary page first she would not make a mistake of prescribing harmful medication to the patient e.g. prescribing medication and then checking the patient file and discovering that the patient is allergic to certain medications.	Design actions: <ul style="list-style-type: none"> <li>• The summary page is placed first after the patient has been searched for in the application.</li> </ul> Summary page contains: <ul style="list-style-type: none"> <li>• name and surname,</li> <li>• date of birth,</li> <li>• chronic illnesses,</li> <li>• chronic medication and</li> <li>• the last consultation of the patient</li> </ul>
Family folders were discussed the GPs had asked to group patients to the main member of the medical aid within the family. By doing this when the GP searches for a patient, the patient would be connected to a medical aid scheme and to his or her family, if they have any family. The GPs understand this way searching as they mention that this is way they are grouping their current paper based patient files.	Design action: <ul style="list-style-type: none"> <li>• If a family consulted with a GP, a family folder would be created which linked all members to the main member. The main member is the medical aid scheme holder of the family.</li> </ul> Thus if a child was being searched for, it would be quickly identified which medical aid scheme the child or any other member belonged to.
It's noted that the GPs mention that they are from a generation that are not as familiar with touch technologies but they note that they will be able to get used to it if they had a few days with the application and the smartphone.	
Researcher notes that the GPs are not familiar with the touch screen technology; although the short interaction with the smartphone application prototype does	

<p>show that the GPs can comprehend and interact with the device in a familiar manner in a matter of minutes.</p>	
<p>The researcher notes that the digital prototype proved to be a helpful aid for the GPs in exploring the possibilities within the application. E.g. "It happens that we sort of have our own groups of patients but it does happen that one of us are away on holiday and we will see a patient of the other practice or they will phone you out of hours and then you don't know the patient and you don't have any records in your mind and then it would be nice to (positions her hand as if there is a phone in it and presses a "button") tap into the system and see at least what's been prescribed."</p>	
<p>While using the application prototype the GPs had developed more scenarios for using the application and its interfaces. E.g. "You must remember you now in a situation, could be in a situation where you socially active and you don't want this to consume a lot of your time, so it must be fast flowing, simple and you can get very quick to solving the problem."</p>	

Following are images of the patient file application.

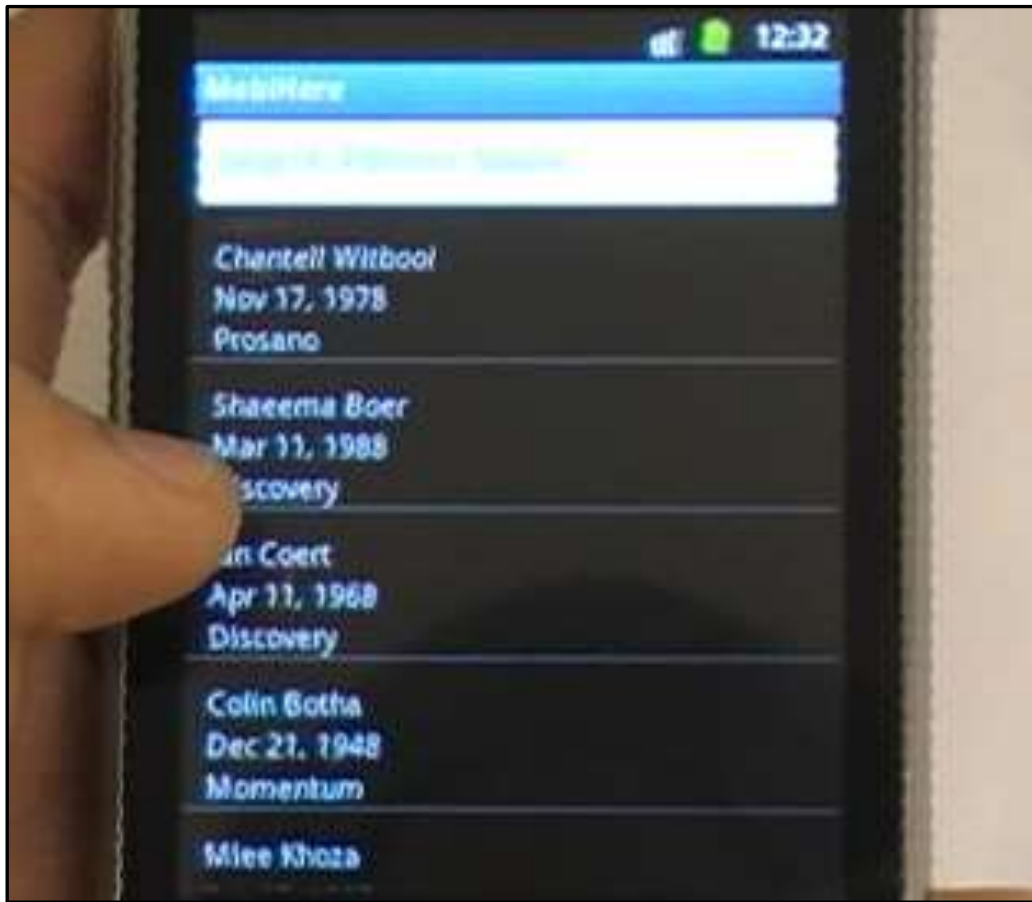


Figure 4.20: Image of digital prototype “patient search” page. The patient list is presented to the GP. In this example the GP has chosen the first patient “Chantell Witbooi”. Image was taken from the video recording footage (Author’s construct, 2012)



Figure 4.21: Image of digital prototype “family folder” page of patient Chantell Witbooi. The GP chooses the patient Chantell Witbooi on this page. Image was taken from the video recording footage (Author’s construct, 2012)

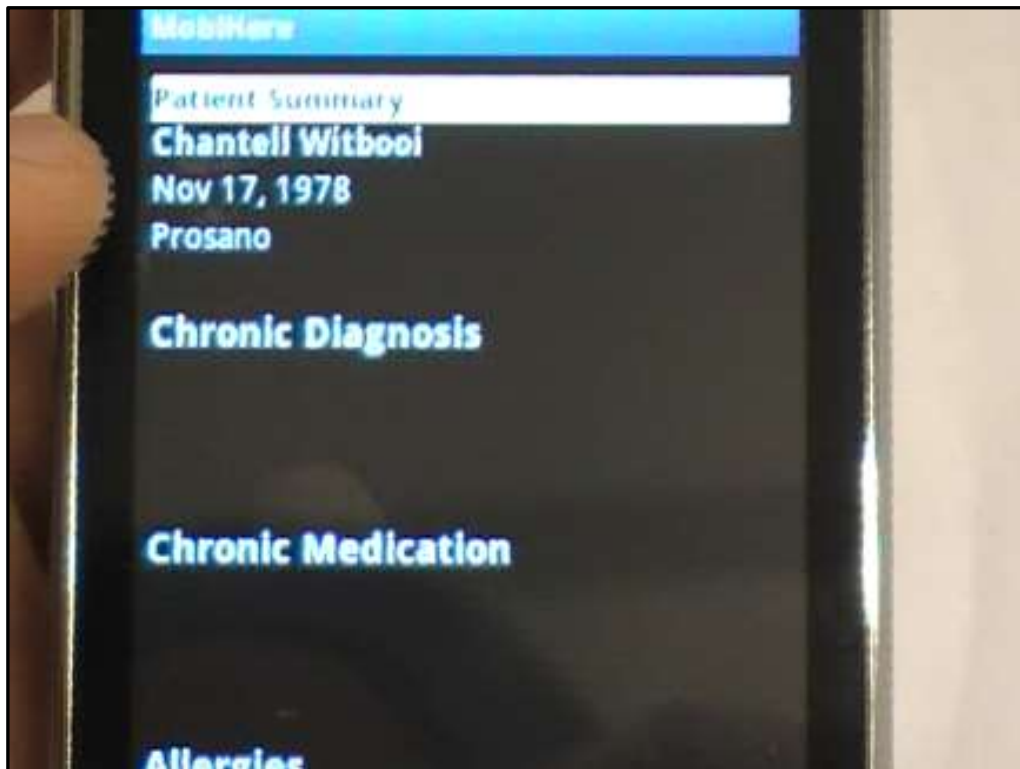


Figure 4.22: Image of digital prototype “patient summary” page of the patient Chantell Witbooi. Image was taken from the video recording footage (Author’s construct, 2012)

Figure 4.22 shows a partial image of the patient summary page of the application. It displays the patient’s name, surname and date of birth, medical aid scheme, chronic diagnosis, medication and allergies if the patient has any.

#### 4.4.3.2 Summary

This workshop focuses on the design elements which the GP’s want to keep within the application. By using the prototype the patient search family folder function, the summary page and the patient file layout remains within the design. At this point the GP’s understand the concept of the application.

As mentioned at the beginning of chapter 4 that all sessions will be presented in a chronological timeline to show the development of the application it was decided to move the SAFIPA – CSIR Conference Showcase event after all the design workshops to not disrupt the numbering sequence of the thesis.

#### 4.5 SAFIPA – CSIR Conference Showcase event

SAFIPA - CSIR (Council for Scientific and Industrial Research) showcase event.

**Date:** 18 and 19 October 2011.

After Design Workshop 1, the research team went to Pretoria to showcase the patient file application to industry and higher education academics in the SAFIPA - Council

for Scientific and Industrial Research (CSIR) showcase. The research team for the patient file application went as part of the Kujali Living Lab team, which is represented by students from the Cape Peninsula University who research and develop prototypes of projects within the field of ICT. The entire Living Lab group went to Pretoria to present the projects which were developed in the Lab.



**Figure 4.23: Research team members of Kujali Living Lab presenting the application at the SAFIPA - CSIR Conference showcase event (Images photographed by author, 2011)**

The showcase provided the research team and I with different forms of feedback for the patient file application. Feedback came in the form of advice and offerings of collaborations, others asked more technical questions in the form of security measures and how the system would be developed. The general consensus of the research team was that the patient file application project was viewed as an interesting concept by the visitors of the showcase.

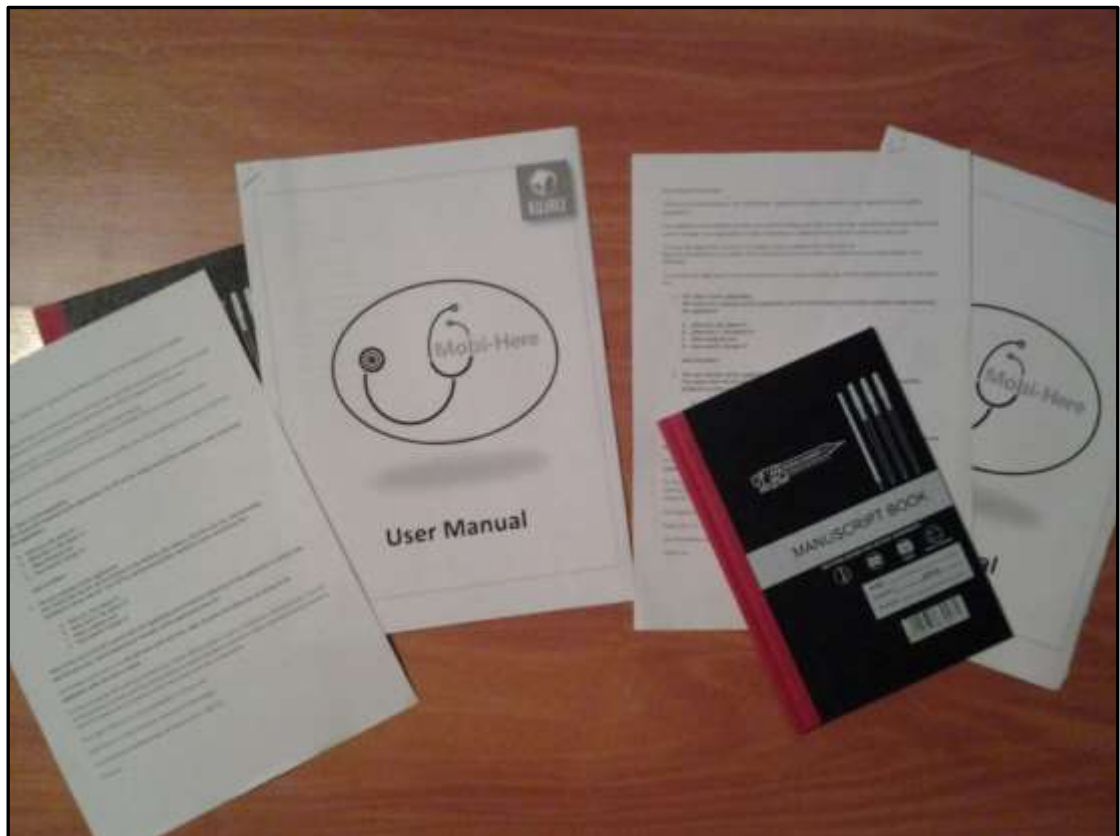
The positive response towards the patient file application at the SAFIPA - CSIR showcase encouraged the research team to continue designing the application in Design Workshops 2 and 3 through the use of refined interface sketches and dynamic paper prototyping. The feedback received from the three design workshops was used to develop the dynamic digital prototype shown in Design Workshop 3. The dynamic digital prototype was given to the Durbanville GPs to evaluate design and user experience for the application.

#### 4.6 The patient file application prototype given to Durbanville GPs

Once the patient file application prototype was completed, the researcher had assembled a “reflection pack” for the GPs in which they received a book, a user manual and instructions as to what to record in the book. The dynamic digital prototype was given to the Durbanville GPs on the 4 October 2012 to interact with for two weeks.

The reflection pack was used to gather the thoughts of the GPs in regards to the user experience of the application and the aesthetics of the application. Figure 4.24 show the reflection packages used by the GPs. (See appendix G for detailed user manual)

After the two weeks had come to an end, the GPs each had a week to experiment with the digital prototype, the researcher had returned to the practice for a feedback session in relation to the patient file application.



**Figure 4.24: Reflection packages used by the Durbanville GPs (Author's construct, 2012)**

This section will show an overview of the patient file application at this stage of the research study which had been developed for the GP testing. The idea behind the patient application is to provide access to patient information when a GP needs to

assist a patient after office hours. The patient application concept is displayed in the figures to follow.



**Figure 4.25: Storyboard 1, the arrow on top (1) is the General Practitioner Davis office, the arrow below (2) is where he lives. Sometimes GP Davis receives calls from patients in the evenings at home or when “out on the town”, at times he would need to travel back to the office to retrieve patient information in order to assist the patient. (Author’s construct, 2012)**





Figure 4.26: Storyboard 2, General Practitioner Davis receives a call at 9:41 PM. It's a call from a patient; he answers the call, speaks for a few minutes and ends the call. He needs to get to the office in order to retrieve patient information needed to better assist the patient.  
(Author's construct, 2012)



Figure 4.27: Storyboard 3, rather than rushing to the office over a great distance, the GP uses the Mobi-Here patient file android application. (Mobi-Here is the patient file application name given by the research team)  
(Author's construct, 2012)

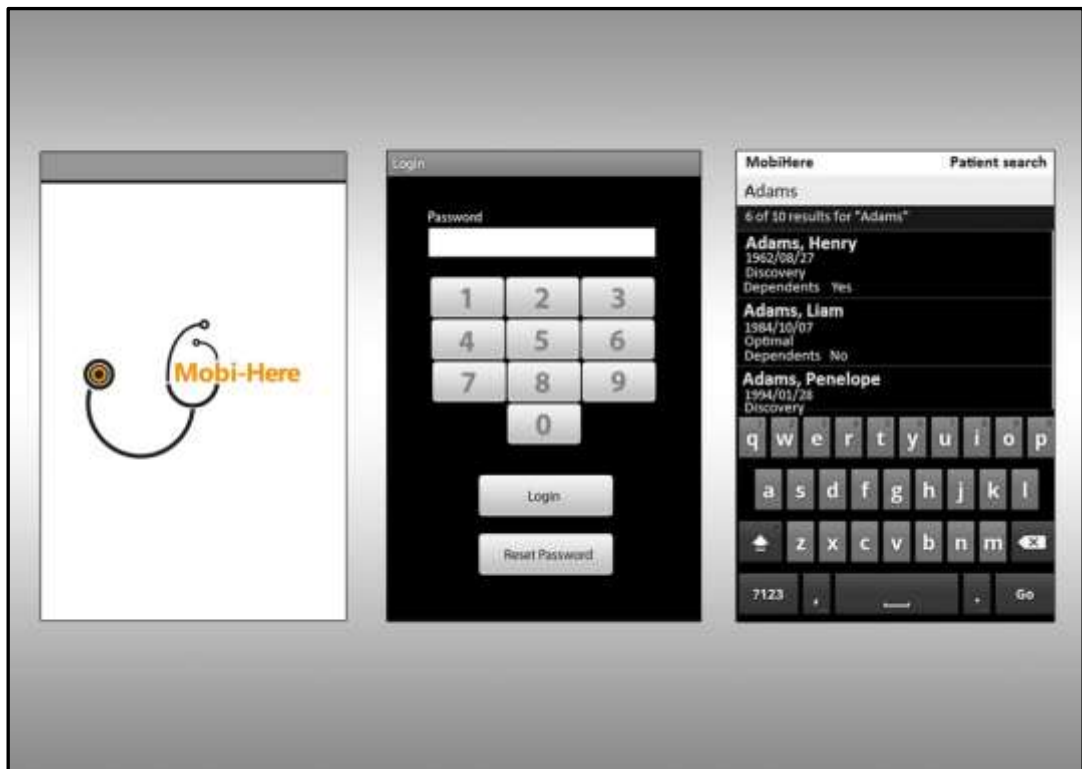


Figure 4.28: Storyboard 4, the GP logs into the application and then starts to search for the patient who had contacted him (Author's construct, 2012)

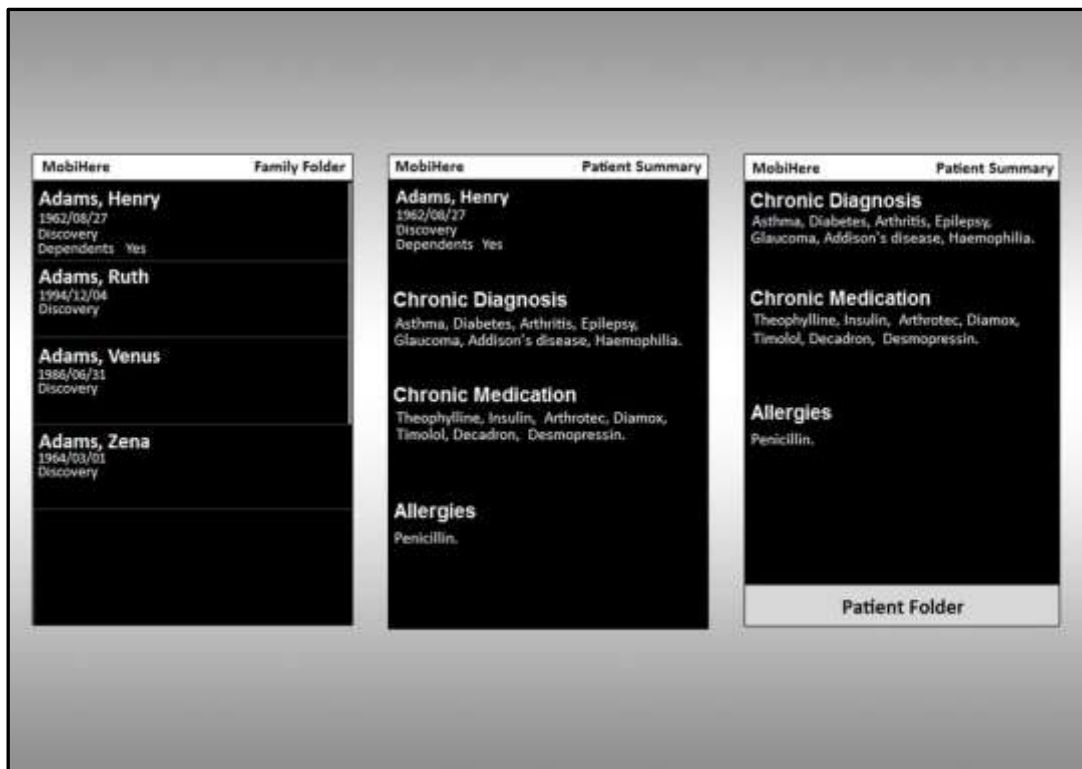


Figure 4.29: Storyboard 5, the GP searches through the application for the information that he needs to assist the patient (Author's construct, 2012)



Figure 4.30: Storyboard 6, GP Davis exits the Mobi-Here patient file application after he has read the patient information that he had been searching for and then calls the patient to assist. By using the Mobi-Here patient file android application GP Davis was able to save time by accessing his patient's information via his mobile smartphone instead of commuting to the office to retrieve the information. (Author's construct, 2012)

#### 4.6.1 Feedback session about the dynamic digital prototype for the GPs

**Methods:** Unstructured interview and my journal notes.

**Participants:** One designer (Shaema Boer), one business analyst (Siviwe Henda) and two GPs.

**Location:** Durbanville (Northern suburb of Cape Town).

**Date:** 18 October 2012.

**Aim:** To discover the first thoughts about the digital prototype concept from the GPs.

**Overview:** With the aid of the reflection pack the GPs gave constructive feedback regarding their time spent interacting with prototype application.

#### 4.6.2 Findings from the feedback session

The findings which emerged during the feedback session are presented under the three headings:

- Technology and interactions
- Design and design criteria

- Motivation

#### **4.6.2.1 Technology and interactions**

The GPs experienced the following while interacting with the dynamic digital prototype:

- First time that the GP's had interacted with a touchscreen smartphone.
- GPs mention that the screen size should be larger of the smartphone.
- GPs had trouble with the on screen keyboard in the beginning stages of interacting with the application which prevented them from entering data in a fast manner.

#### **4.6.2.2 Design and design criteria**

The GPs experienced the following while interacting with the dynamic digital prototype:

- The summary page which shows the overview of the patients file was expected to be interactive by the GPs. This feedback would not have surfaced if it were not for the digital prototype. In the design workshop sessions this summary page was understood by the research team as merely a viewing page.
- The patient search and family groupings and the patient file layout were understood by the GPs.
- GPs mention that the application could be simplified further to prevent confusion and mistakes. (E.g. The GP indicated that the buttons which allowed the user to go from one screen to the next could be designed in a simpler way. The GP mentions "one procedure, very simple I think the whole thing can be simpler, but there mustn't be too many buttons to press".)

#### **4.6.2.3 Motivation**

The GPs experienced the following while interacting with the dynamic digital prototype:

- GPs mention that in social situations they want the application to take less time to perform functions so they would not be removed from their environment for too long.
- They make mention that the application will be used for fast patient viewing purposes and not as a normal patient file e.g. GP says she would just want to

quickly view a patient's diagnosis and then medication which was given and then that's it.

#### **4.6.3 Further reflections about the dynamic digital prototype**

These are reflections recognized by both the GPs and myself:

- The researcher picked up that the GPs made many remarks in regards to being from an older generation who are not familiar with new technologies. Many of their difficulties were blamed on this conception. Even though there were experiences the GPs mentioned alternative ways in approaching the issue, they were very proactive in finding solutions to solving problems which they were experiencing. Example of this is with the difficulty of typing using the touch screen keyboard, the GP mentions "it's not a user friendly keypad, but you can use those, I know you can use those stylus or just to press on ... it's those little pens that you get for the screen."
- I could see how important the interaction with the prototype was. Many design elements which were discussed and added into the prototype were reviewed by the GPs and feedback could only have been given by experiencing the digital prototype. E.g. the functionality of the application the GP mentions that "with the functions, it didn't flow easy for me, easy enough and when I want to change from the one function to the next, I would get into a place that I didn't know how I got there, and also not know how to get out of here."
- The GPs understood the purpose of the two weeks with the digital prototype, they understood the concept of the application and although experiencing some difficulties, they still had the view that the application would be beneficial for its purpose, but that it needed to be developed further.

#### **4.6.4 Summary of the feedback session**

The evolution of the development of the application could be seen through the design workshops. Some of the main design objectives of the application were the patient search function which shows the patient which the GP is searching for but it would also display dependents if the patient had any.

Another objective of the application was the displaying of the patient information. When selecting the patient until reaching the patient file this displays the diagnosis, medication and allergies sections and when touching those sections a detailed page of that section is shown. This was agreed upon in the first design workshop until the third. The obstacles within the design had surfaced once the GP's had tested the prototype. The GP's had understood the concept of the layout for the patient file but

struggled with the functionality when they had used it. Once they had started going into the application, entering data and moving between the different screens, this proved to be difficult and frustrating for them. This frustration was a hurdle for one of their main criteria objectives which was to access information quickly. Although the GP's were experiencing difficulties this did not discourage them. During the feedback session they provided suggestions such as using a stylus as opposed to the onscreen keypad of the smartphone which they were struggling to use. Another suggestion was to simplify the sequences of the different screens to incorporate less functionality by suggesting fewer buttons to move between the screens, by developing a simple procedure to enter data or by getting a larger screened device.

At this point in the study due to constraints such as: budget in acquiring the latest smart phone mobile technology; program developing knowledge of the programmers; resource of developers in the project; the limited in depth scope of the general practice working environment and even time constraints of the project itself; the digital prototype is a partially completed proof of concept at this stage of the research project. The researcher had decide to give the digital prototype to the GPs to have a user's perspective on the concept, there were no expectations that the prototype would generate outstanding results it would only deliver what the next step of adjustments which would be needed to improve the working concept.

As mentioned in chapter one, the research project would only be taken through to conceptualization stage until the proof of concept stage. It was decided to stop the project at the digital prototype, as the proof of concept. The project had lasted for 15 months from its inception in August 2011 to the feedback session on 18 October 2012.

#### **4.7 Themes that emerged during the research process**

The interviews conducted in the interview study, the three design workshops and the feedback session with the GPs after the evaluation of the digital prototype were all recorded via video recorder. I then transcribed each interview, design workshop and feedback session into Microsoft word format. The transcribed interviews, design workshops and feedback session were imported into a computer assisted qualitative data analysis software program (QDA Miner), after which I read through each transcription and highlight sections within the text that had been identified as a theme.

The themes were identified by keeping the research objectives in mind. These were to identify the context in which the possible solution would be developed, to identify

the user requirements and design parameters and to identify the tools used to design and develop the smartphone application. Any text within the transcription which reflected these objectives was highlighted as a theme by the researcher. These themes which are discovered form the building blocks for the study in order to answer the research question and goals of the study.

#### 4.7.1 Themes

The important themes will be displayed in the table below which shows the objective, theme, the description of the theme and an example within the research study. Appendix H displays the themes in a graph according to highest and lowest frequency of themes that were discovered throughout the design process.

**Table 4.7: Examples of themes found in research process**

No.	Objective	Theme	Description	Example
1.	User requirements / design parameters	"User requirements"	These are items which the GP needs the application to have	" <i>the patient's date of birth, then the known allergies, chronic medication that the patient is on, any pre-existing problematic problems and also the most recent, medication that the patient's been issued with</i> "
		"Importance for certain sections in application"	Reasons why the GP emphasizes on certain sections for the application	" <i>But the medication is the biggest problem... the patient's don't know medications, they not supposed to know and dosages, they get mixed up, some names are very close (uses hands to show that some names are very similar in sounding) but it's completely different stuff. So we can't expect them to take the responsibility and to know exactly, so that would be very nice if we could have the patient details ... the medication quickly put that on the system so that we can retrieve that</i> "
2.	Context	"Technology experience and perception of GP"	Comments made by GP which reflects her experience or perception of technology	" <i>And I don't see that I would ever change, writing stuff down. I'm one those people where I must see my notes, even if it will go onto the computer eventually. I will still keep the notes. I'm always dead scared that I could lose that information (points at the computer)</i> "
3.	Context	"General practice experience for GP"	These are events which the GP experiences at the general practice	" <i>We are currently doing everything on paper so if a patient phones my receptionist would not put the phone, the call through without giving me the file, so I always have the file to see because that's just for a safety mechanism to make</i>

				<b>sure that you have all the facts in front of you</b> , so I always access the file if I speak to a patient”
		“Actual scenarios”	These are situations which the GP has experienced and would've liked the application to be present	“Like for instance take <b>this weekend</b> , I had a <b>patient</b> that I saw her two weeks ago, and the <b>mother phoned</b> and <b>they couldn't remember what medication the patient took</b> and I would have <b>loved to have then be able to quickly access, see then and then to have helped her in a more proper way”</b>
		“Scenarios for using the application – Improvised”	These are scenarios made up by the GP's to better explain the way in which the application would be used	“ <b>one of us are away on holiday</b> and we will <b>see a patient of the other practice</b> or they will <b>phone you out of hours</b> and then you <b>don't know the patient</b> and you <b>don't have any records</b> in your mind and <b>then it would be nice to (makes hand as if there is a phone in it and presses a “button”) tap into the system and see at least what's been prescribed”</b>
4.	<b>Identify the tools used to design and develop the smartphone application</b>	“Design tools - GP”	GP using design tools to explain concept further	“ <b>But I still want that acute information, I still want to have access at it there (GP points to the interface sketch with the three windows)</b> because if the patient phones tomorrow and say listen the medication you gave me yesterday I had a reaction, <b>then I want to see it (GP points to the three window patient file interface sketch)...”</b>
		“Design tools - Research team”	Research team using design tools to explain concept further	“ <b>We'll have these various topics (research team member pointing to the interface sketch patient file page with allergies, diagnosis and medication)</b> we've arbitrary chosen allergies, what's that diagnosis and medication, if you want anything else, it's not that difficult, the idea is to show you only the latest information here. (referring to the interface sketch with the blocks below the topics – allergies, medication and diagnosis)”
5.	<b>User requirements / design parameters</b>	“Patient file is made up of”	These are items which the patient file is made up of	“ <b>This consists of a medication list (chronic), diagnosis (acute/chronic), allergies (acute/chronic), along with a number of other notes such as how many dependents the patient has, what operations they had gone for...</b> ”



## 4.8 Summary

In chapter 4 the design process was presented. The design process showed the data collection methods (interviews and diaries) that were used to gather information about the design context. This information was used to produce design tools such as personas and scenario storyboard to stimulate progress in the designing of a mobile patient file application system.

Looking at the design process as a whole, the information gathered and the design tools such as interface sketches and dynamic paper prototypes used in the Design Workshop 1 was implemented to develop a clearer understanding of the application for the GPs, but it also was used to develop a clearer design which aided in developing more refined designs presented in the Design Workshop 2. The refined designs had generated feedback which was used to develop the digital prototype for Design Workshop 3.

All the design tools and methods used in the design process fed into “the next step” within the design process of developing the smartphone patient file system. This idea is illustrated at the beginning of the chapter (see figure 4.0). By combining the research process and the design process in chapter 4, the reader was taken through the stages of the designing of the patient file smartphone application which includes the interaction of the Durbanville GPs as potential users. It also showed the involvement of the researcher and the research team.

The refining of the design process was observed in detail. An Overview of the themes was identified in accordance with the objectives of the research study. The analysis of the data collected will be discussed in chapter 5.

## CHAPTER FIVE DISCUSSION

### 5.0 Introduction

Chapter five focuses on the study as a whole. The focus is on the objectives mentioned in chapter one and the connection of the points mentioned in chapter two up until and including the design process in chapter four. How all these aspects connect with one another in the research study are discussed, in order to gain a holistic understanding of the study. The following objectives of the study will be focused on:

- Objective 1: To understand what characterises a GP's work practice in Cape Town, this involved identifying the context in which the possible solution could work.
- Objective 2: To identify the situations in which the GP's would need such an application, which also entailed defining the user requirements and design parameters.
- Objective 3: To identify the tools which could be used to design and develop such an application.

### 5.1 Discussion

The challenge to design a mobile health application which could be used by general practitioners to access their patients' data when they are not in the office after normal working hours was undertaken in the study. The main question is based on how mobile access can contribute a possible solution in supporting GP's with accessing of their patient data when they are not in their offices. In order to answer the main question objectives were thought of. The objectives mentioned are to understand what characterises a GP's work practice in Cape Town, this involved identifying the context in which the possible solution could work. The second objective was to identify the situations in which the GP's would need such an application, which also entailed defining the user requirements and design parameters. The last objective was to identify the tools which could be used to design and develop such an application.

**5.1.1 Objective 1: To understand what characterises a GP's work practice in Cape Town, this involved identifying the context in which the possible solution could work.**

The first interview that was described in chapter four was with the Durbanville GPs (Ch. 4.2.1). The practitioners had noted that they experienced after hours situations where their assistance was needed. This was further confirmed in the interview with the Athlone GP (Ch. 4.2.3) in which the GP confirmed the experience of after hours assistance. In relation to the first objective, identifying the context is briefly dealt with in chapter two. Designing a mobile medical application is not an easy task as identified by Fitzpatrick (2000) in chapter two. It is important to understand the complexities of the clinical practice so it is important for the researcher and research team to understand the general practice of the participating GPs as well as the potential use situations for the application. The research team used methods such as interviews and self – reporting diaries to gain an understanding of the context and the potential use situations for the mobile medical application.

Through the interviews it was discovered that the two general practices in the study were managed by the GPs in the general practice, this related to the statement in chapter 2 which mentioned that GPs tend to run practices on their own or in small groups. The Durbanville practice had two GPs managing the practice together with a secretary. The Athlone GP who managed two practices had one secretary. Another point made in the literature in chapter two is that GPs notes for patients' files are not as extensive as a specialist's, which was confirmed in the interview with the public health doctor. In chapter four (Ch. 4.2.2) it was noted that there are a larger number of stakeholders in the public hospital setting thus the notes for a patients file would result at a larger volume. Other research findings in regards to the Durbanville practice was that the practice was paper based. The GPs were starting the process of implementing a electronic medical health record system. The GPs were female between the ages of 35 and 50. The GPs perform minor surgeries, they treat minor ailments and they offer basic psychiatric help as well.

**5.1.2 Objective 2: To identify the situations in which the GP's would need such an application, which also entailed defining the user requirements and design parameters.**

To answer objective 2 this section will be presented as follows:

- **Use situations for the patient file application**
- **User requirements for the patient file application**

- **Design parameters of the patient file application**

#### **5.1.2.1 Use situations for the patient file application**

In answering the second objective for identifying the use situations for the application as well as defining the user requirements and the design parameters. Self – reporting done in the diaries by the Durbanville GPs (Ch.4.3) identified events and motivations for wanting to have patient information readily available when they (Durbanville GPs) were not in the general practice. The diaries revealed that GPs wanted to access patient information routinely on a daily basis. The most common hours for accessing would be at 11:00 am, 16:00 pm, 18:00 pm and 20:00 pm. Diaries showed that the most common places the GPs wanted to check information was in the car, at gym and on holiday. A few reasons for wanting to access patient information was when a patient contacted the GP for advice, the GP would need the patient's information to offer correct advice. An example of this was when one of the Durbanville GPs mentioned the following:

Like for instance take this weekend, I had a patient that I saw two weeks ago, and the mother phoned and they couldn't remember what medication the patient took and I would have loved to have then be able to quickly access, see then and then to have helped her in a more proper way.

Another reason for accessing the application is to provide medicine scripts to patients telephonically when needed. The Athlone GP (Ch. 4.2.3) provided a different context in which he could access his patients file while traveling between his two practices when he receives a surprise patient who has no scheduled appointment, he could access the information easily and quickly. The GP also imagined the application as being interactive with patients, where the patient could send pictures of ailments and the doctor could make a diagnosis via images and chat. An important factor for the Durbanville GPs is “reaction time”, which refers to when the GP has a thought about a patient and the times she would want to contact a patient for a check-up or even enquire about a certain issue the patient had. She could do so within those moments, the application could provide her with immediate reaction in providing her service which she feels would widen the scope of her services in a better way. In chapter two in the mobile technology section (Ch. 2.3), indicated that wireless smartphone technology proved to be beneficial in improving productivity.

The GP also mentions that such an application would be of benefit as she would not need to travel to the office if patient information is needed, this was found to be consistent when the Durbanville GP mentioned the following:

The patient would often phone me at 8 o' clock at night and say listen I'm not sure, this has happened, what do you think and then for me to then quickly access, then I don't have to drive here (general practice).

#### **5.1.2.2 User requirements for the patient file application**

In order to understand what the user requirements (part of the second objective) are for the application, in chapter 2 the consultation was researched because the patient information is extracted from this process to form the patient file. The main aim of the consultation is to discover what the patient's ailment is and which treatments are needed for the patient, this is done verbally and then recorded into the patient file. The research findings found in the interviews that the information was recorded chronologically. The durbanville GPs have a summary page which contains the most recent information about the patient. Patient identifiers for the patient file are the name, surname, date of birth, Identification (ID) number and medical aid information of the patient. Files are stored alphabetically. The patient file application would have the following sections: the summary page, medication, allergies, diagnosis, billing and a notes section. The operating function requirements which were noted in the self – reporting diaries were the following: the patient file application should have the patient identifiers (name, surname, ID number, list all of the patient identifiers), that the GP should be allowed to record, edit and delete information pertaining to the medication, allergies and diagnosis sections within the application.

Through the design workshops in chapter four a few of the following requirements were identified:

- The diagnosis and medication of the patient file should indicate the chronic and acute information of the patient.
- The smartphone screen should not be cramped with information.
- Family patient folders are added so that patients are groups are clearer.
- For security reasons, the use of a numbered password was agreed on.

#### **5.1.2.3 Design parameters of the patient file application**

The main parameters in the development of the application are time and technology experience. Time is a factor in the GPs daily lives as they work all day at the practice

and still have to perform their family responsibilities at home, so they would want an application which could help deliver a faster and better service to the patient. The Durbanville GP mentions the following in regards to fast accessing of patient information when she is not at the office

You must remember you now in a situation, could be in a situation where you're socially active and you don't want this to consume a lot of your time, so it must be fast flowing simple and you can get very quick to solving the problem.

The theme "Technology experience and perception" aided in providing an analysis of the users for the application. By identifying this theme in the design process the research team had discovered that the Durbanville GPs were open to learning new technologies, but their experience was quite moderate or even at a beginner level in using new technologies. This was identified as a design parameter which helped the research team to develop an application in which the technology would be simple enough to be understood and used by the GPs.

### **5.1.3 Objective 3: To identify the tools which could be used to design and develop such an application.**

The last research objective was to identify the tools which could be used to design and develop the smartphone application. In chapter three the research tools such as interviews and self - reporting diaries are used to gather data and the design tools such as interface sketches, paper prototyping, storyboards, personas and digital prototyping are mentioned. In the design process in chapter four the interview and diaries laid the foundation for the research team to understand the background of the general practice operational functions. The data collected produced the design tools such as the scenario storyboard in the Design Workshop 1 (Ch 4.4.1). The scenario storyboard was used to interpret the scenario concept in which the application would be used. Interface sketches used in the Design Workshop 1 and Design Workshop 2 (Ch. 4.4.1 and Ch.4.4.2) became communication tools between the research team and the GPs in conveying how the design of the application would develop. The tools used in the Design Workshop 1 and Design Workshop 2 provided feedback which then lead to the making of the digital prototype shown in the Design Workshop 3 (Ch 4.4.3).



**Figure 5.1: Image of scenario storyboard and line drawing interface sketch design tools in Design Workshop 1 (Author's construct, 2011 )**

Figure 5.1 shows the storyboard and paper prototype tools used in the Design Workshop 1. Making use of the storyboard and prototype tools the following main design elements were decided upon in the workshop:

- Patient identifiers which will be used and how the identifiers would be displayed,
- The patients would be displayed in an alphabetical order and in family groups
- How the patient information would be displayed e.g. summary page, medication, diagnosis and allergy sections.



**Figure 5.2: Refined interface sketch design tool in Design Workshop 2 (Author's construct, 2011 )**

The refined interface sketches which were used in the Design Workshop 2 are shown in Figure 5.2, these were used to display the elements which were decided on in the Design Workshop 1 in a much clearer way. In the third design workshop, the digital prototype tool shown in Figure 5.3 was used. This was to show the GPs what the design elements decided upon in the previous workshops would look like and how the GPs could interact with these in the smart phone patient file application.



**Figure 5.3: Image of dynamic digital prototype design tool in Design Workshop 3 (Author's construct, 2012 )**

The design tools were used by the research team as a means of communication but also by the GP's as a means of conveying their understanding of how the application would work. An example of this is when one of the GPs mentions that once information is added to a section such as medication it would reflect on the screen on the other page in the following way. "Then does it get added to that (GP points to the interface with the allergies, medication and diagnosis)."

The data collected during the study resulted in the development of the research and design tools that were used for the three design workshops. Furthermore the research and design process continued to produce data which fed into the design evolution of the smartphone patient file application.

## **5.2 Summary**

The discussion shows that the research and design tools mentioned in chapter three, provided data which was discovered in chapter 2 and used in chapter 4 in the development of the design. It is important in Interaction design (IxD) to understand the context for which one is designing, hence the literature presented in chapter two. Research and design tools were then needed to design and develop the application. The research and design tools mentioned in chapter 3 helped with the understanding of the context and were used as communication tools by me and the research team.



Significantly these tools also acted as feedback and communication tools for the GPs to understand the requirements and even parameters for the application.

The discussion shows that through the data collection methods such as diaries and group and single interview sessions along with the design methods such as personas, storyboards, scenarios, interface sketches, dynamic paper prototyping and dynamic digital prototyping which were used, the objectives needed for the development of the application became clearer and guided the design process . Through reflection on the study, conclusions will drawn in chapter six to see if the main research question was answered.

## **CHAPTER SIX CONCLUSION**

### **6.0 Introduction**

An overview of each chapter in the thesis is presented in chapter six. The research questions are revisited followed by reflections of the study and a conclusion.

### **6.1 Chapter overview**

#### **Chapter 1: Introduction**

Chapter one introduced the thesis; it consisted of a brief background of the area of study, the objectives of the study as well as a brief layout of the thesis and the research scope of the study.

#### **Chapter 2: The literature**

In Chapter two the literature was reviewed, providing the background understanding of the area of study. This background included an overview of the operational functions of a medical general practice, what is involved in conducting a patient consultation and the background of mobile technology within the global setting and in South Africa within the health sector.

#### **Chapter 3: Research methodology**

In Chapter three the research methodology for the study was discussed. A brief introduction of Interaction design and the Research through Design framework used in the study was given in chapter three. It also introduces the ontological and epistemology viewpoints of the study along with the qualitative research methods and design tools which were implemented.

#### **Chapter 4: Design process**

Chapter four focused on the design process of the research study. All the participants of the study were shown in this section. The data collection methods along with the design tools and the results of the process were discussed in detail in chapter four. The themes that emerged from the study were also investigated briefly.

#### **Chapter 5: Findings and analysis**

A holistic discussion of the study was presented in chapter five, looking at the information gathered within chapters 2, 3 and 4 and how this information relates to the objectives of the research study.

## **Chapter 6: Conclusion**

Reflecting on the research process, chapter six presents the degree, to which the research questions have been answered, the contributions of the study and further recommendations in relation to the study.

### **6.2 Research question revisited**

#### **6.2.1 Statement of the research problem**

Although general practitioners attend to patients during office hours while having access to all patient information, it is not clear how they would react to situations when they are not at the office when access to patient information is not possible, but necessary and even vital at times.

#### **6.2.2 Research question:**

How can mobile applications contribute to a possible solution to support general practitioners with the accessing of patient information when not at the office?

#### **6.2.3 Sub - questions:**

##### **Sub- question 1**

What characterises the work practice of general practitioners in Cape Town, South Africa?

The characteristics of the general practice work environment were investigated in chapter two in the literature review. Specifically, the consultation and working realities in the general practice were researched. In the design process in chapter four interviews and self – reporting diaries were used by the Durbanville GPs (case study) and by another GP in the Athlone area to discover the GPs working realities in the different practices.

The research revealed the following:

- The general practices of the Athlone GP and the Durbanville GPs were managed by the GPs and each of the practices had a secretary.
- Both practices were operating on a paper basis. The Durbanville practice was in the process of implementing an electronic system and the Athlone practice had an electronic billing system.
- The GPs performed minor surgeries, they treat minor ailments and they offer psychiatry as well.

- Consultations are conducted verbally and then recorded into the patient file.
- The GPs and the secretaries are bound by an ethical code which upholds the privacy and conduct between patient and the doctor.

### **Sub-question 2**

What characterises the use situations where general practitioners need access to patient information?

The Durbanville GPs used self – reporting diaries which acted as the application. The aim of the diary was to record all the events when the GP’s would want to access patient information. In the diaries the date, time and location of the GP was recorded. This information gave the research team and me an idea as to how, when and where the application would be used by the GPs. In chapter four the case study GPs (Durbanville GPs) we asked in an interview if they experience any afterhours calls from patients for assistance, their replies were “yes”, although they admit that the frequency of the calls is not at a high volume it was interesting to see the results of the self – reporting diaries which showed that an patient file smartphone application would not only be used for after hour calls but to check, correct and even edit patient information at different times during the day as was needed.

Key information that emerged from the self-reporting diaries used by the GPs are given in point form as follows:

- Every day (particularly on weekends) there was some sort of patient information which the GP wanted to access.
- The hours of accessing happens between 9:00 am to 21:00 pm, the times show that the most common hours were 11:00 am, 16:00 pm, 18:00 pm and 20:00 pm.
- When a patient contacts the GP for advice they would need the patient’s information to offer correct advice.
- Although there was a need to access patient data all day, the places at which time information needed to be accessed through the smart phone application was when the GP was at home, in the car, on holiday, in gym, while shopping or when attending lectures.
- When a patient calls for a script the GPs need access to the patient file to check medication information.
- The GP needed to access the patient file to refer a patient to a specialist.

- The GP needed access to the patient file to check medication and allergies of a patient.
- Access to the patient file was necessary to add notes e.g. when a patient has a reaction to something.
- When patients are on holiday they often forget medication and phone the GP, in these cases the GP does not remember every patient's information and would like to have access to it.

### **Sub-Question 3**

How can a smartphone application be designed to provide adequate access to patient information for general practitioners when not at their office?

By involving the general practitioners in the design process of developing the application, the research team and the GPs used design tools such as persona's, scenario storyboards, interface sketches and even paper and digital prototypes to communicate, design and demonstrate how patient information can be accessed when the GPs were not in their practices. What emerged in chapter four was that it was not only the use of the design tools but that the research tools such as interviews and diaries which played a significant role in gathering data. The data continued to be gathered at different stages of the study, during the interviews, the self-reporting diaries and the design workshops. The data collected during the different stages of the study contributed to the development and refinement of the design process.

### **6.3 Answering the research question: How can mobile applications contribute to a possible solution to support general practitioners with the accessing of patient information when not at the office?**

The research study showed that the prototype still needs to be developed further. However the feedback from the GPs it is seen that the design concept is a potential solution for bridging the gap between the patient and after hours assistance from the GPs. The data collected from the self-reporting diaries (Ch. 4.3) in the study showed that a smartphone patient file application has good potential to solve patient assistance when a GP is not at the office. The diaries showed that every day there were instances when the GP would want to access patient data. So to have the mobile device in situations where the GP is not physically at the office would be beneficial in delivering an accurate consultation. This gap which possibly could be bridged by implementing a smartphone patient file application such as developed in this study would allow GPs to react at a moment's notice. GPs would also be able to use the application to edit or even to make notes to the patient information.

Productivity would increase through use of the application by the GP, the task of travelling to and from the office when important patient information was needed when providing information in emergency situations. By having the ability to access information when the GP is away from the office not only opens up the possibility for assisting the patient when they might call after hours, but it has also has shown that the application would be used for other purposes as well.

#### **6.4 Conclusion**

Before the development of the smart phone patient file application for the study, the GPs would sometimes drive to their practices to access patient information from the files stored in the office, or they would take patient files home. The element of time in assisting a patient had become longer. Through the development of the smart phone patient file application with the GPs, they were enabled to deliver a faster and more accurate service after hours and during office hours. Although the results of the testing stage shows that more adjustments need to be made the GPs still see the smart phone patient file application as a beneficial solution in addressing the issue of afterhours assistance to patients and even more so a tool which could help them deliver a better service.

#### **6.5 Reflection**

To design an application in the medical sector has a number of complexities attached to it. For the fifteen months of data collected in this project, it seems like the tip of the starting point in the direction of designing an application that could be used by GPs. Using Interaction design (IxD) to drive the process of designing an application is very useful. Not only does IxD encourage the notion of understanding the environment and the potential users, it also included the user (Durbanville GPs) in the designing process. Research through design (RtD) as a framework to approach the research study placed the research team and me in an environment filled with rich data aided by working with the GPs in the designing process of the application. To be exposed to the GPs knowledge of how the data should be arranged and how it should be accessed fed into many aspects of the design process, such as: from what data to present, how to present the data and how to access it.

Being the researcher and the designer in the project allowed me to gain a better understanding of the data which was collected from the GPs, which allowed me to better interpret the findings to the IT programmers of the research team. It was also important to have the research team involved with the design processes with the GPs because they could suggest advice in the designing process that I could not have

seen working on my own. The development of the application itself was difficult because the IT programmers were still students and it was their first time being exposed to developing an application on an Android platform, however as the GPs and I were developing the application together the information provided by us facilitated the process of the student IT programmers. The data collected during the study was understood more easily when the research team used the interface sketches to communicate with the GPs about where certain functions should go. The design tools within the design workshops had become useful communication tools in the developing of the design. Although the application was partially completed it still delivered an ample amount of rich communication. Owing to time constraints certain functions such as the billing, adding a new patient, to name a few could not be added to the digital prototype.

Holistically there were a few issues which could have improved the study such as the sample size of the GPs could have been expanded to incorporate a larger input into the data collection, but this would have brought other potential obstacles in relation to the availability of a larger number of general practitioner participants within the design process.

If the testing period with the digital prototype could have been lengthened, the level at which the application was developed could have been taken further which could have provided a better experience for the GPs.

It would be ideal for the research team to observe the GPs using the application. The data gathered from observing would be richer, but I did not want to impose on the after hour periods in the day meant for the GPs and their families. These after hour observations of the using of the smartphone patient file application by the GPs could have also exposed me to patient files which the GP could have had at these times, thus it was important that the doctor – patient relationship was upheld by the GP and the research team. As the researcher of the study I felt perhaps more could have been done, but having taken the constraints and resources of the research team and the research study participants into consideration, the research study highlighted a potential solution which could assist general practitioners to deliver a better service to their patients in after hour situations and even contribute to the running of their practice during office hours in a more holistic way.

## **6.6 Recommendation**

A suggestion for further research would be to develop the application further with the feedback which had been given, this being a larger screen and maybe with the exception of a different type of technology. To incorporate a larger participating group; this might ignite different viewpoints as to how to design and develop the application further.



## REFERENCES

- Accenture. 2010. *Overview of International EMR/EHR Markets: Results from a Survey of Leading Health Care Companies*.  
[http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture\\_EMR\\_Markets\\_Whitepaper\\_vfinal.pdf](http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_EMR_Markets_Whitepaper_vfinal.pdf) [08 November 2012].
- Accusoft Corporation. 2011. *Accessing Medical Records on Mobile Devices Part I: Android*. Pp. 1-9.  
[http://www.hcplive.com/\\_media/\\_pdf/accessing\\_medical\\_records\\_on\\_mobile\\_devices\\_hitn.pdf](http://www.hcplive.com/_media/_pdf/accessing_medical_records_on_mobile_devices_hitn.pdf) [02 December 2012].
- Al-Mujaini, A. & Ganesh, A. 2009. Electronic Medical Health Records: Have we bitten off more than we can chew. *Oman Medical Journal*, 24(1):1, January.  
<http://www.omjournal.org/Editorial/FullText/200901/ElectronicMedicalRecordSystem1-3.html> [11 February 2013].
- Armstrong, D. & Savage, R. 1990. Effect Of A General Practitioner's Consulting Style On Patients' Satisfaction: A Controlled Study. *British Medical Journal*, 301(6758):968-970, October 27.  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1664199/pdf/bmj00203-0032.pdf> [13 November 2012].
- Babbie, E. 2007. *The Practice of Social Research*. 11<sup>th</sup> ed. CA: Thomson Learning.
- Babbie, E. & Mouton, J. 2001. *The Practice of Social Research*. South African ed. South Africa: Oxford University.
- Bannon, L. 2011. Reimagining HCI: Toward a More Human – Centered Perspective. *Interactions*. 18(4): 50-57, July and August.
- Binder, T., Koskinen, I., Redstrom, J., Wensveen, S. & Zimmerman. 2011. *Design Research Through Practice: From the Lab, Field, and Showroom*. MA: Elsevier.
- Boess, S. 2009. *Designing in Research: Characteristics and Criteria*.  
<http://www.iasdr2009.org/ap/Papers/Special%20Session/Assessing%20knowledge%20generated%20by%20research%20through%20design/Designing%20in%20research%20-%20characteristics%20and%20criteria%20-%20Research%20method,%20questions%20and%20programme.pdf> [06 July 2012].
- Botha, A. & Ford, M. 2010. A Pragmatic Framework for Integrating ICT into Education in South Africa. *Proceedings of the 2010 IST-Africa Conference*, Durban, 19-21 May 2010.  
[http://researchspace.csir.co.za/dspace/bitstream/10204/4098/1/Ford\\_2010.pdf](http://researchspace.csir.co.za/dspace/bitstream/10204/4098/1/Ford_2010.pdf) [19 November 2012].
- Boulos, M. N. K., Jones, R., Tavares, C. & Wheeler, S. 2011. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. *BioMedical Engineering Online*, 10: 1-14, April 5.  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3080339/pdf/1475-925X-10-24.pdf> [02 December 2012].
- Buchanan, R. 1992. Wicked Problems in Design Thinking. *Design Issues*, 8(2): 5-21.  
<http://demianlamblet.loremipsum.com.br/esdi/46/MMRP/textos%20novembro/Buchanan%203.pdf> [02 October 2012].
- Buhari, N., Chang Hong Kit, P., Muzaini, A. & Wan Ismail, W. K. 2012. Acceptance of

Smartphone in Enhancing Patient-Caregivers Relationship. *Journal of Technology Management & Innovation*, 7(3):71-79, September 12.  
[https://docs.google.com/viewer?a=v&q=cache:kD7Ypl-97hQJ:www.jotmi.org/index.php/GT/article/download/art267/707+&hl=en&gl=za&pid=bl&srcid=ADGEEsgrbMI5MTC68n8klxrJP3IE0G4aTDQ6knmRcB1XU6GslS8ayqtEYq0RErQVO9nhJFmog0xNHanSTzt432WwcmWQNH\\_iUXjTzNqpwm4cEjIXAmDniypcklt3WsA2EQRfuTASbg&sig=AHIEtbTZHw5fksbjpECo0s8vhKklpiLBXg](https://docs.google.com/viewer?a=v&q=cache:kD7Ypl-97hQJ:www.jotmi.org/index.php/GT/article/download/art267/707+&hl=en&gl=za&pid=bl&srcid=ADGEEsgrbMI5MTC68n8klxrJP3IE0G4aTDQ6knmRcB1XU6GslS8ayqtEYq0RErQVO9nhJFmog0xNHanSTzt432WwcmWQNH_iUXjTzNqpwm4cEjIXAmDniypcklt3WsA2EQRfuTASbg&sig=AHIEtbTZHw5fksbjpECo0s8vhKklpiLBXg)  
[02 December 2012].

Burrell, G. & Morgan, G. 1979. *Sociological Paradigms and Organizational Analysis: Elements of the Sociology of Corporate life*. London: Heinemann.

Campbell, M.J., Jiwa, M., Maheswaran, R., Munro, J., Nicholl, J. & Pearson, T. 2007. Impact of NHS walk-in centres on primary care access times: ecological study. *British Medical Journal*, 334:838. <http://www.bmj.com/content/334/7598/838> [13 February 2013].

Chandratheva, A., Giles, F. M., Lasserson, D. S., Mant, D. & Rothwell, P. M. 2008. Influence of general practice opening hours on delay in seeking medical attention after transient ischaemic attack (TIA) and minor stroke: prospective population based study. *British Medical Journal*, 337:a1569.  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2548294/>  
[06 January 2013].

Chen, J., Kumar, A., Meacham, A., Purandare, A. & Subramanian, L. 2009. *ELMR: Lightweight Mobile Health Records*. *Proceedings of the 2009 SIGMOD International Conference on Management of data*, RI, 29 June – 02 July 2009. New York: ACM Press: 1035-1038  
<http://dl.acm.org/citation.cfm?id=1559974> [19 November 2012].

Churchman, C.W. 1967. Wicked Problems. *Management Science*, 14(4): B141- B142.  
<http://www.jstor.org/stable/2628678?seq=1> [04 October 2012].

Collins English Dictionary.2014.  
<http://www.collinsdictionary.com/dictionary/english/proof-of-concept>. [24 March 2014].

Communicaid Group Ltd. 2009. *Doing Business in South Africa: South African Social and Business Culture*. <http://www.communicaid.com/access/pdf/library/culture/doing-business-in/Doing%20Business%20in%20South%20Africa.pdf>  
[05 January 2013].

Congdon, J.D. & Dunham, A.E. 1999. *Defining the Beginning: The Importance of Research Design*. <http://mtsg.files.wordpress.com/2010/07/14-defining-the-beginning.pdf> [12 June 2012].

*Connecting*, 2012. CA: Bassett & Partners. [On-line video].

Council for Scientific and Industrial Research. 2009. Primary Healthcare. *Sciencescope*, 56-59, November.  
[http://www.csir.co.za/publications/pdfs/014\\_pdfsam\\_SSNovforweb\\_PRIMARYHEALTHCARE.pdf](http://www.csir.co.za/publications/pdfs/014_pdfsam_SSNovforweb_PRIMARYHEALTHCARE.pdf)  
[19 November 2012].

Davis, J. & Law, D. 2007. GP Assist Tasmania afterhours doctor.  
[http://www.gpat.com.au/gpat\\_brochure.pdf](http://www.gpat.com.au/gpat_brochure.pdf) [13 February 2013].

- Discovery.n.d. DiscoveryHealthID.  
[http://www.discovery.co.za/microsites\\_za/health\\_id/flash/](http://www.discovery.co.za/microsites_za/health_id/flash/)  
 [12 February 2013].
- E-Agriculture. n.d. E-Agriculture. <http://www.e-agriculture.org/e-agriculture>  
 [25 March 2013].
- Ellis, T.J & Levy, Y. 2009. Towards a Guide for Novice Researchers on Research Methodology: Review and Proposed Methods. *Informing Science and Information Technology*, 6:323-337. <http://iisit.org/Vol6/IISITv6p323-337Ellis663.pdf> [06 June 2012].
- Fallman, D. 2008. *The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration*.  
<http://daniel.fallman.org/resources/papers/dfallman-di20082434.pdf> [13 June 2012].
- Fitzpatrick, G. 2000. *Understanding the Paper Health Record in Practice: Implications for EHRs*.  
<http://130.203.133.150/viewdoc/similar;jsessionid=69FDC1B715CB76010F09100ED2790980?doi=10.1.1.22.5653&type=ab>  
 [31 October 2012].
- Frayling, C. 1993. Research in Art and Design. *Royal College of Art Research Papers*, 1(1): 1-5.  
[http://www.uacj.mx/DINNOVA/Documents/SABERES%20VERANO%202012/Christopher\\_Frayling.pdf](http://www.uacj.mx/DINNOVA/Documents/SABERES%20VERANO%202012/Christopher_Frayling.pdf) [04 October 2012].
- Forlizzi, J., Stolterman, E. & Zimmerman, J. 2010. *An Analysis and Critique of Research Through Design: Towards a Formalization of a Research Approach*.  
[http://delivery.acm.org/10.1145/1860000/1858228/p310-zimmerman.pdf?ip=155.238.101.164&acc=ACTIVE%20SERVICE&CFID=168399959&CFTOKEN=91803867&\\_\\_acm\\_\\_=1349345024\\_40c3e06493bbfa490897577f42f1cb5f](http://delivery.acm.org/10.1145/1860000/1858228/p310-zimmerman.pdf?ip=155.238.101.164&acc=ACTIVE%20SERVICE&CFID=168399959&CFTOKEN=91803867&__acm__=1349345024_40c3e06493bbfa490897577f42f1cb5f) [04 October 2012].
- Gardien, P. & Kyffin, S. 2009. Navigating the Innovation Matrix: An Approach to Design-led Innovation. *International Journal of Design*, 3(1).  
<http://www.ijdesign.org/ojs/index.php/IJDesign/article/viewFile/305/241>  
 [10 September 2012].
- Gaver, W. 2012. *What Should We Expect from Research through Design?*  
[http://delivery.acm.org/10.1145/2210000/2208538/p937-gaver.pdf?ip=155.238.100.222&acc=ACTIVE%20SERVICE&CFID=167274702&CFTOKEN=21898085&\\_\\_acm\\_\\_=1349168425\\_92c8c7d6f02f5b5aabdb1cd604ffd79a](http://delivery.acm.org/10.1145/2210000/2208538/p937-gaver.pdf?ip=155.238.100.222&acc=ACTIVE%20SERVICE&CFID=167274702&CFTOKEN=21898085&__acm__=1349168425_92c8c7d6f02f5b5aabdb1cd604ffd79a)  
 [02 October 2012].
- Ge, X., McDermid, J.A. & Paige, R. F. 2009. Domain Analysis on an Electronic Health Record System. *Proceedings of the 2009 First International Workshop on Feature-Oriented Software Development*, CO, 06 October 2009. New York: ACM Press: 49-54. <http://lscits.cs.bris.ac.uk/docs/fosd09.pdf>  
 [02 November 2012].
- GoStudy. 2008. *Medical Doctor/ General Practitioner*.  
<http://www.gostudy.mobi/careers/View.aspx?oid=220>  
 [05 January 2013].
- Gurley, L. 2004. *Advantages and Disadvantages of the Electronic Medical Record*.  
[http://unosolution.co.in/pdf/Gurley\\_article.pdf](http://unosolution.co.in/pdf/Gurley_article.pdf).

[29 October 2012].

Handygo. 2009. *Homepage*.  
<http://handygo.com/handy/NewSite/index.html>  
[19 November 2012].

Hardt, M. 2006. *Design the Term Design*. <http://www.michael-hardt.com/PDF/lectures/design-definition.pdf> [14 June 2012].

Harper, R.H.R. & Sellen, A.J. 1997. Paper as an Analytic Resource for the Design of New Technologies. *Proceedings of the 1997 Conference on Human factors in Computing Systems*, GA, 22-27 March 1997. New York: ACM Press: 319-326.  
<http://research.microsoft.com/enus/um/people/asellen/publications/analytic%20resource%2097.pdf>  
[01 November 2012].

Heath, C. & Luff, P. 1998. Mobility in Collaboration. *Proceedings of the 1998 ACM conference on Computer Supported Cooperative Work*, SEA, 14-18 November 1998. New York: ACM Press: 305-314.  
[http://www.academia.edu/1274683/Mobility\\_in\\_collaboration](http://www.academia.edu/1274683/Mobility_in_collaboration) [02 November 2012].

HIMSS Global Enterprise Task Force. 2008. *Electronic Health Records: A Global Perspective*.  
[http://www.himss.org/content/files/200808\\_ehrglobalperspective\\_whitepaper.pdf](http://www.himss.org/content/files/200808_ehrglobalperspective_whitepaper.pdf).  
[07 November 2012].

Huang, K. 2009. Challenges in Human-Computer Interaction Design for Mobile Devices. *Proceedings of the 2009 World Congress on Engineering and Computer Science*, SF, 20-22 October.  
[http://www.iaeng.org/publication/WCECS2009/WCECS2009\\_pp236-241.pdf](http://www.iaeng.org/publication/WCECS2009/WCECS2009_pp236-241.pdf)  
[21 November 2012].

Jones, M. & Marsden, G. 2006. *Mobile Interaction Design*. England: John Wiley & Sons.

Jie, L. 2012. Embracing 'mobile' healthcare. *China Daily*. 24 December.  
[http://usa.chinadaily.com.cn/china/2012-12/24/content\\_16044973.htm](http://usa.chinadaily.com.cn/china/2012-12/24/content_16044973.htm)  
[31 February 2013].

Kleynhans, A. 2011. Is South Africa ready for a national Electronic Health Record (EHR)?  
MBL, University of South Africa.  
<http://uir.unisa.ac.za/bitstream/handle/10500/6128/2011%20MBL3%20Research%20Report%20A-M%20Kleynhans.pdf?sequence=1>  
[31 October 2012].

Koch, S., Shereen, A. & Staggers, N. 2009. Using Personas and Prototypes to Define Nurses' Requirements for a Novel Patient Monitoring Display, *Proceedings of the 2009 Nursing Informatics- Connecting Health and Humans*. Netherlands: IOS Press: 69-73 [19 November 2012].

Klootwijk, P., Meij, S.H., Nelwan, S. P. & van Dam, T. B. 2002. Ubiquitous Mobile Access to Real-time Patient Monitoring Data. *Computers in Cardiology*, 29:557-560.  
<http://web.cinc.org/archives/2002/pdf/557.pdf>  
[30 August 2012].

- Kotonya, G. & Sommerville, I. 1998. *Requirements Engineering Processes and Techniques*.  
<http://www.csm.ornl.gov/~sheldon/cs531/ch9.pdf>. [25 March 2013].
- Kujawski, M. 2013. Finally some 2012 Statistics for the African Mobile Phone Market.  
<http://www.mikekujawski.ca/2012/05/30/finally-some-2012-statistics-for-the-african-mobile-phone-market/>  
 [13 February 2013].
- Kunze, C., Mueller-Gorchs, M. & Rosales Saurer, B. 2009. Scenario-based Design of an ICT Platform for Mobile Information Services in Ambulatory Care Nursing. *Proceedings of the 2009 Nursing Informatics- Connecting Health and Humans*. Netherlands: IOS Press: 64-68 [19 November 2012].
- Lakhani, M. (ed). 2003. *A Celebration of General Practice*. United Kingdom: Royal College of General Practitioners.  
[http://books.google.co.za/books?id=OeiJ8rEkDroC&pg=PA79&lpg=PA79&dq=Celebrating+the+study+of+the+doctor%E2%80%93patient+relationship+Sally+Hull&source=bl&ots=4e1ZyoNs\\_7&sig=i8mKdAEm0gu5RnI5WEMlRh073Go&hl=en&sa=X&ei=E5aiULHjGIOShgeokoCQCg&ved=0CBwQ6AEwAA#v=onepage&q&f=false](http://books.google.co.za/books?id=OeiJ8rEkDroC&pg=PA79&lpg=PA79&dq=Celebrating+the+study+of+the+doctor%E2%80%93patient+relationship+Sally+Hull&source=bl&ots=4e1ZyoNs_7&sig=i8mKdAEm0gu5RnI5WEMlRh073Go&hl=en&sa=X&ei=E5aiULHjGIOShgeokoCQCg&ved=0CBwQ6AEwAA#v=onepage&q&f=false)  
 [13 November 2012].
- Lowgren, J. 2007. *Interaction Design, Research Practices and Design Research on the Digital Materials*. [http://webzone.k3.mahse/k3jolo/Material/id ResearchEssay.pdf](http://webzone.k3.mahse/k3jolo/Material/id%20ResearchEssay.pdf)  
 [20 August 2011].
- Lowgren, J. & Stolterman, E. 2004. *Thoughtful Interaction Design: A Design Perspective on Information Technology*. MA: Massachusetts Institute of Technology.
- Mars, M. & Seebregts, C. n.d. Country Case Study for e-Health South Africa.  
<http://ehealth-connection.org/files/resources/County%20Case%20Study%20for%20eHealth%20South%20Africa.pdf>  
 [11 February 2013].
- Marshall, C. & Rossman, G.B. 1999. *Designing Qualitative Research*. 3<sup>rd</sup> ed. CA: Sage.
- Martin, C. M. & Sturmberg, J. P. 2005. General Practice: Chaos, Complexity and Innovation. *Medical Journal Australia*, 183(2):106- 109, July 18.  
<https://www.mja.com.au/journal/2005/183/2/general-practice-chaos-complexity-and-innovation>  
 [10 November 2012].
- Mashamaite, S. S. 2011. The Effects of an Electronic Medical Record on Patient Management In Selected Human Immunodeficiency Virus Clinics In Johannesburg. MPH, University of South Africa, Johannesburg.  
[http://uir.unisa.ac.za/bitstream/handle/10500/5734/thesis\\_mashamaite\\_s.pdf?sequence=1](http://uir.unisa.ac.za/bitstream/handle/10500/5734/thesis_mashamaite_s.pdf?sequence=1)  
 [07 November 2012].
- Maxwell, J.A. 1996. *Qualitative Research Design: An Interactive Approach*. CA: Sage.
- McLeod, H. & Ramjee, S. 2010. Private Sector Perspectives on National Health Insurance. *South African Health Review*, 179 – 194, December.  
<http://www.hst.org.za/sites/default/files/SAHR2010.pdf>

[07 November 2012].

Medical Protection Society. 2013. *Medical Records in South Africa: An MPS Guide*. <http://www.medicalprotection.org/southafrica/booklets/medical-records> [13 February 2013].

Miettinen, S. & Koivisto, M. 2009. *Designing Services with Innovative Methods*. Finland: Kuopio Academy of Design.

Mobile Monday. 2011. *Mobile Africa Report 2011*. [www.mobilemonday.net/reports/MobileAfrica\\_2011.pdf](http://www.mobilemonday.net/reports/MobileAfrica_2011.pdf) [26 August 2011].

Mobl21. 2013. *Mobile Learning Basics*. [http://www.mobl21.com/Basics\\_Of\\_Mobile\\_Learning.pdf](http://www.mobl21.com/Basics_Of_Mobile_Learning.pdf) [25 March 2013].

Moggridge, B. 2007. *Designing Interaction*. MA: Massachusetts Institute of Technology.

Murtagh, J. 2007. *General Practice*. 4<sup>th</sup> ed. Australia: McGraw-Hill.

Musen, M.A. & van Bommel, J.H. 1997. *Handbook of Medical Informatics*. <http://person.hst.aau.dk/pbe/handbook%20MI%20kap7.pdf> [29 August 2011].

National Cancer Institute. n.d. *SEER Training Modules: Composition of a Medical Record*. <http://training.seer.cancer.gov/abstracting/record/> [14 November 2012].

Neuman, W.L. 2011. *Social Research Methods: Qualitative and Quantitative Approaches*. 7th ed. MA: Pearson.

Nielsen, J. 2005. *Ten Usability Heuristics*. [http://www.useit.com/papers/heuristic/heuristic\\_list.html](http://www.useit.com/papers/heuristic/heuristic_list.html) [30 August 2012].

Norman, D.A. 1988. *The Design of Everyday Things*. NY: Doubleday.

Nuesoft. 2011. *Nuesoft Mobile*. <http://www.nuesoft.com/solutions/mobile-medical-software-app.html> [19 November 2012].

Oxford Dictionaries. 2012. <http://oxforddictionaries.com/> [30 August 2012].

Patton, M. 1990. *Qualitative Evaluation and Research methods*. <http://legacy.oise.utoronto.ca/research/field-centres/ross/ctl1014/Patton1990.pdf> [12 October 2012].

Patton, M.Q. 2002. *Qualitative Research and Evaluation Methods*. 3<sup>rd</sup> ed. CA: Sage.

Pham, A. & Pham, P. 2012. *Scrum In Action: Agile Software Project Management and Development*. MA: Cengage Learning.

Preece, J., Rogers, Y. & Sharp, H. 2002. *Interaction Design: Beyond Human – Computer Interaction*. NY: John Wiley & Sons.

Rittel, H.W. & Webber, M.M. 1973. Dilemmas in a General Theory of Planning. *Policy Sciences*, 4:155 – 169.

- [http://www.uctc.net/mwebber/Rittel+Webber+Dilemmas+General\\_Theory\\_of\\_Planning.pdf](http://www.uctc.net/mwebber/Rittel+Webber+Dilemmas+General_Theory_of_Planning.pdf). [02 October 2012].
- Robinson, E.T., Tolley, E.E. & Ulin, P.R. 2005. *Qualitative Methods in Public Health: A Field Guide for Applied Research*. CA: Jossey-Bass.
- Rule, P. & Vaughn, J. 2011. *Your Guide to Case Study Research*. Pretoria: Van Schaik.
- SAFPJ. (ed). 1981. Anatomy of a Consultation. *South African Family Practice Journal*, 2(4):21.  
<http://www.safpj.co.za/index.php/safpj/article/view/3440/0>  
[13 November 2012].
- Salisbury, C. 2007. NHS walk-in centres. *British Medical Journal*, 334(7598):808-809.  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1853183/>  
[13 February 2013].
- Simon, C. 2009. The Consultation. *InnovaAiT*, 2(2): 113-121.  
<http://rcgp-innovait.oxfordjournals.org/content/2/2/113.full.pdf+html>  
[12 November 2012].
- Skyscape. 2012. *Skyscape Medical Resources App*.  
<http://www.skyscape.com/app/>  
[19 November 2012].
- South Africa. Department of Health. 2012. eHealth Strategy South Africa: 2012-2016. Pretoria: Department of Health.  
[http://www.doh.gov.za/docs/stratdocs/2012/eHealth\\_Strategy\\_South\\_Africa\\_2012-2016.pdf](http://www.doh.gov.za/docs/stratdocs/2012/eHealth_Strategy_South_Africa_2012-2016.pdf)  
[20 December 2012].
- Stolterman, E. 2008. The Nature of Design Practice and Implications for Interaction Design Research. *International Journal of Design*, 2(1): 55-65.  
<http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/240/139>  
[08 October 2012].
- Tech Terms. 2013. Definition. <http://www.techterms.com/definition/bluetooth>  
[25 March 2013].
- The free dictionary. 2013. Home page. <http://www.thefreedictionary.com/>  
[25 March 2013].
- The Mitre Corporation. 2006. *Electronic Health Records Overview*.  
<http://www.himss.org/content/files/Code%20180%20MITRE%20Key%20Components%20of%20an%20EHR.pdf>  
[05 November 2012].
- The South African Medical Association. 2012. <http://www.samedical.org/drs-patients-rights.html> [12 October 2012].
- Thomas, G. 2011. *How to Do Your Case Study: A Guide for Students and Researchers*. London: Sage.
- Trochim, W.M.K. 2006. *Research Methods Knowledge Base*.  
<http://www.socialresearchmethods.net/kb/dedind.php> [17 September 2012].

- Tuli, F. 2011. The Basis of Distinction between Qualitative and Quantitative Research in Social Science: *Reflection on Ontological, Epistemological and Methodological Perspectives*. *Ethiopian Journal of Education and Sciences*, 6(1).  
<http://www.ajol.info/index.php/ejesc/article/viewFile/65384/53078>  
 [13 September 2012].
- University of Michigan Health System. 2012. Beyond office hours: New app, patient portal, to allow U-M patients mobile access to health records.  
<http://www.uofmhealth.org/news/0815patientportal>  
 [11 February 2013].
- Unuth, N. 2013. 3G technology – What is 3G.  
<http://voip.about.com/od/mobilevoip/p/3G.htm> [25 March 2013].
- Visser, H. 2009. An Exploration of the Nature of a Private General Medical Practice as a Social System: A Case Study. MA (Sociology) Research, Mandela Metropolitan University, Port Elizabeth.  
<http://dspace.nmmu.ac.za:8080/xmlui/bitstream/handle/10948/884/H%20Visser.pdf?sequence=1>  
 [10 November 2012].
- Von Stamm, B. 2008. *Managing Innovation, Design and Creativity*. 2<sup>nd</sup> ed. United Kingdom: John Wiley & Sons.
- Webopedia. 2013. Term 4G. <http://www.webopedia.com/TERM/4/4G.html>  
 [25 March 2013].
- Webopedia. 2014. [http://www.webopedia.com/TERM/B/back\\_end\\_system.html](http://www.webopedia.com/TERM/B/back_end_system.html)  
 [25 March 2014].
- West, D. 2012. How Mobile Devices are Transforming Healthcare.  
<http://www.brookings.edu/~media/research/files/papers/2012/5/22%20mobile%20health%20west/22%20mobile%20health%20west.pdf>  
 [22 November 2012].
- Winograd, T. 1997. From Computing Machinery to Interaction Design. *Beyond Calculations: The next Fifty Years of Computing*.  
<http://hci.stanford.edu/winograd/acm97.html> [30 July 2012].
- Wireless Technology Advisor. 2013. Definition of wireless technology.  
<http://www.wireless-technology-advisor.com/definition-of-wireless-technology.html>  
 [25 March 2013].
- Wobbrock, W.O. 2006. The Future of Mobile Device research in HCI. *Proceedings of the 2006 Conference on Human Factors in Computing System*, Montreal, 22-27 April 2006.  
[http://guzdial.cc.gatech.edu/hci-seminar/uploads/1/16\\_wobbrock.pdf](http://guzdial.cc.gatech.edu/hci-seminar/uploads/1/16_wobbrock.pdf)  
 [19 November 2012].
- World Health Organization. n.d. *Cadre definitions used in the project: Optimizing health worker roles to improve access to key maternal and newborn health interventions through task shifting*.  
[http://www.optimizemnh.org/Annexes/Annex\\_1\\_Cadre\\_definitions.pdf](http://www.optimizemnh.org/Annexes/Annex_1_Cadre_definitions.pdf)  
 [05 January 2013].



World Health Organization. 2012. Main terms used.  
<http://www.euro.who.int/en/what-we-do/health-topics/Health-systems/primary-health-care/main-terms-used>  
[09 November 2012].

World Health Organization. 2011. Mhealth New Horizons for Health through Mobile Technologies. Switzerland: WHO Press. Pp. 1-103.  
[http://www.who.int/goe/publications/goe\\_mhealth\\_web.pdf](http://www.who.int/goe/publications/goe_mhealth_web.pdf)  
[03 December 2012].

## APPENDICES

### APPENDIX A: INFORMED CONSENT FORM

Greetings, I Shaeema Boer a post graduate student attending the Cape Peninsula University of Technology is conducting research concerning a mobile application which is aimed at general practitioners, allowing the retrieval of patient information. Ideally the application will be designed in a relevant format that would be able to be understood and effectively used by general practitioners.

#### **Overview:**

General practitioners have access to their patient's information during office hours. In certain emergency cases, access to a patient's information after office hours is vital and only possible by physically accessing the patient information at the office itself. This application will be able to provide this access to the general practitioners in such cases simply by using a mobile device. The mobile application can cater in situations where the general practitioner is out of the office during office hours as well as when on holiday.

### CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

---

I have read the information presented above about a study being conducted by Shaeema Boer (Post graduate student) of the Department of Informatics and Design at the Cape Peninsula University of Technology. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

Participant Name:  
(Please print)

Participant Signature:

Witness Name:  
(Please print)

Witness Signature:

Investigator:

Date

The consent form asks for the permission and the acknowledgment of the participants for the following:

•	I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses.
•	As a participant in this study, I agree to being videotaped as a means of verifying results from other data collected. I am aware that I may withdraw this consent at any time without penalty, at which point, the videotape will be erased.
•	I am also aware that excerpts from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.
•	I am also aware that my identity information will be kept confidential.
•	I agree to allow video and/or [digital images or photographs] in which I appear to be used in a thesis/ dissertation, teaching, scientific presentations and/or publications with the understanding that I will not be identified by name. I am aware that I may withdraw this consent at any time without penalty
•	I was informed that I may withdraw my consent at any time without penalty by advising the researcher.
•	That all aspects of the research study will be shared openly with the participants.
•	That the data that has been gathered through interviews, pictures, questionnaires, journals, voice recordings and video tape recordings can be used for the purposes of the written thesis.
•	All questions directed to participants are taken into consideration as to the way it would be asked so not to harm participants in any manner.
•	Patient – doctor confidentiality and privacy policy will be respected and up held.
•	That in regards to the patient – doctor confidentiality and privacy policy, no patients will be interviewed and no actual patient data will be viewed, considered or used by the practitioner or researcher for this study.
•	Participants from the public health care sector are acting as external experts in the study and in no official way are representing the actual thoughts/ views of the public healthcare sector.

## APPENDIX B: INTERVIEW QUESTIONS FOR GENERAL PRACTITIONERS AND DOCTOR

1. Walk us through the GP's / Doctors' journey with a new patient.
  - Provides an insight into the care processes
  - Potential point of entry for how patient data is collected and used
2. What is the importance of the health record (HR) to GP's / Doctor's?
3. Are there any standards that the data must comply to?
  - If any standards are in place we will need to use conform our solution to these standards
4. Are the information requirements the same for all patients?
5. How do you currently get the information? (might already be covered in no 1)
6. When do you interact with the health record? I.e. look at it, add to it, and send it elsewhere.
  - Data touch points, this might be covered in step 1 but clarification is still important
7. Who are the stakeholders for the HR (health record)?
  - Might want to be more explicit as to what we see stakeholders as being
8. When do others interact with the HR (health record)??
9. Are there times when you would like to have access to the HR but cannot?
  - Somewhat leading, this question presumes there are times when saving cannot take place.
10. What data do they need access to (for mobile health record)?
  - The doctor might not be well versed into the concept of mobile health records or be clued into the topic of mobile phone data access
  - Alternatives:
    - i. What data do you need to access most often?
    - ii. What data do you need to access when you are outside the office?
    - iii. Do you need access to all the patients' information at any given time?
11. What are the doctors attitude toward (using) technology, i.e. computers, cell phones, the internet etc.
  - Could provide necessary understanding of how currently technology is being applied but this question is not clear on that goal
12. How often do you use technology for work related reasons? (Hours and minutes per day)
  - Computer
    - i. Software
    - ii. Emails
    - iii. Browsing

- Cellphone
  - i. Calls
  - ii. SMS
  - iii. Emails
  - iv. Browsing

13. How often do you use technology for non-work related reasons?

- Computer
  - i. Software
  - ii. Emails
  - iii. Browsing
- Cellphone
  - i. Calls
  - ii. SMS
  - iii. Emails
  - iv. Browsing

14. Do you use a BlackBerry?

15. Do you use a smart phone?

16. If yes, which one?

17. Would you like to? Why?

18. How would you feel about being able to access the HR (health record)? On your mobile?

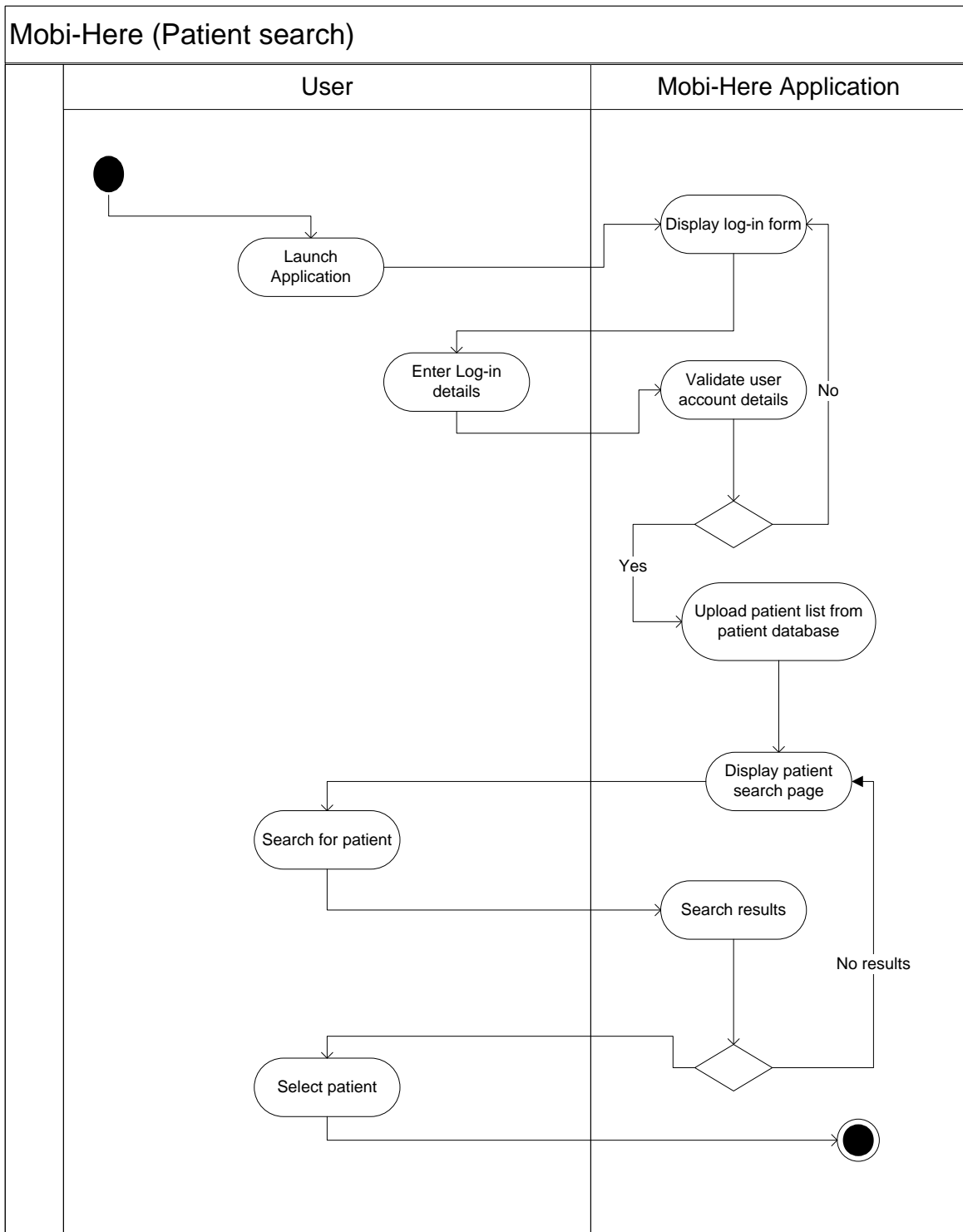
19. How do you think that this would benefit you?

20. How do you get / use the pathology results on your mobile?

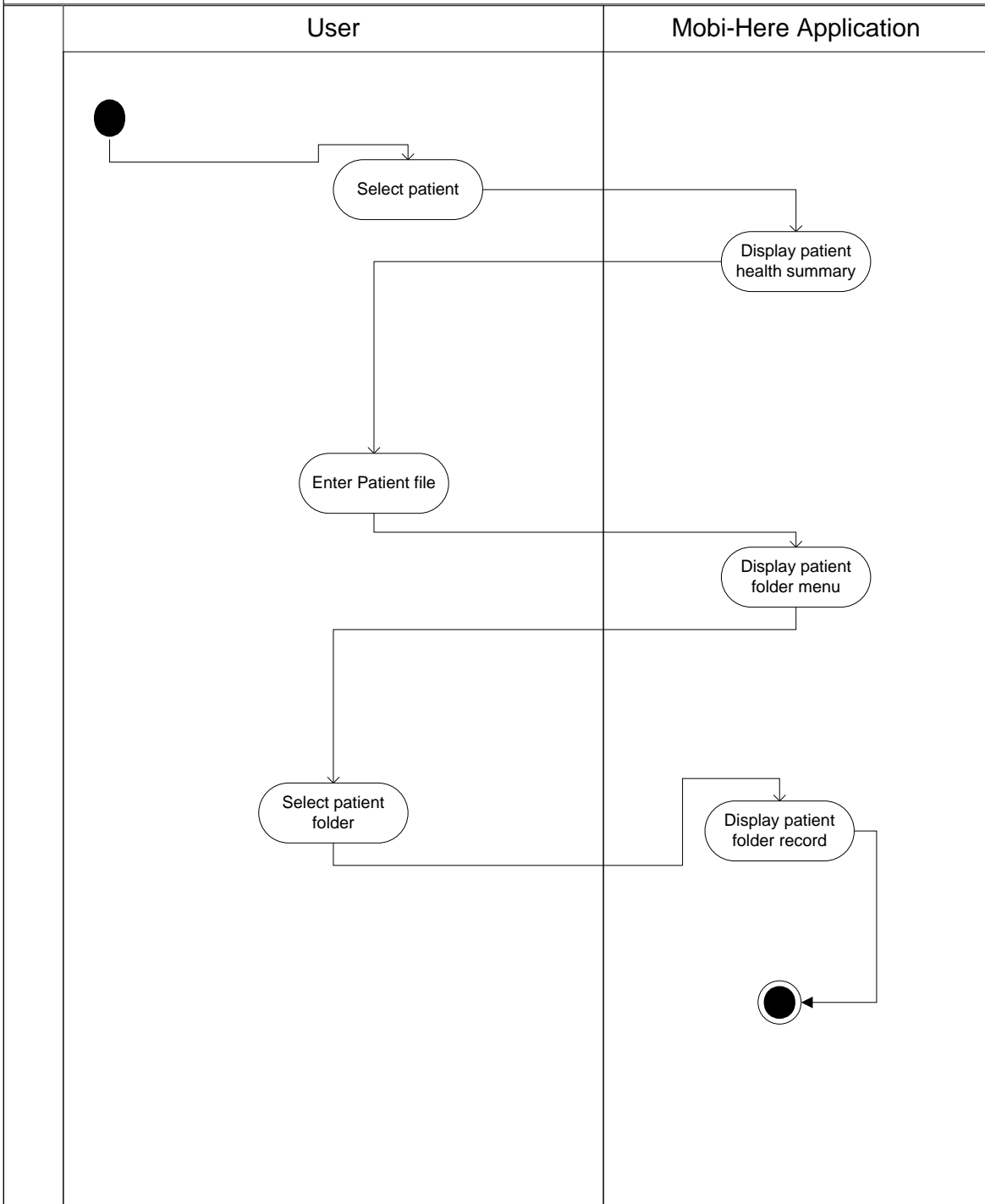
21. What else do you use your mobile for in the practice, sms's, etc.?

22. Is there anything else that you would benefit from having access to on your mobile phone?

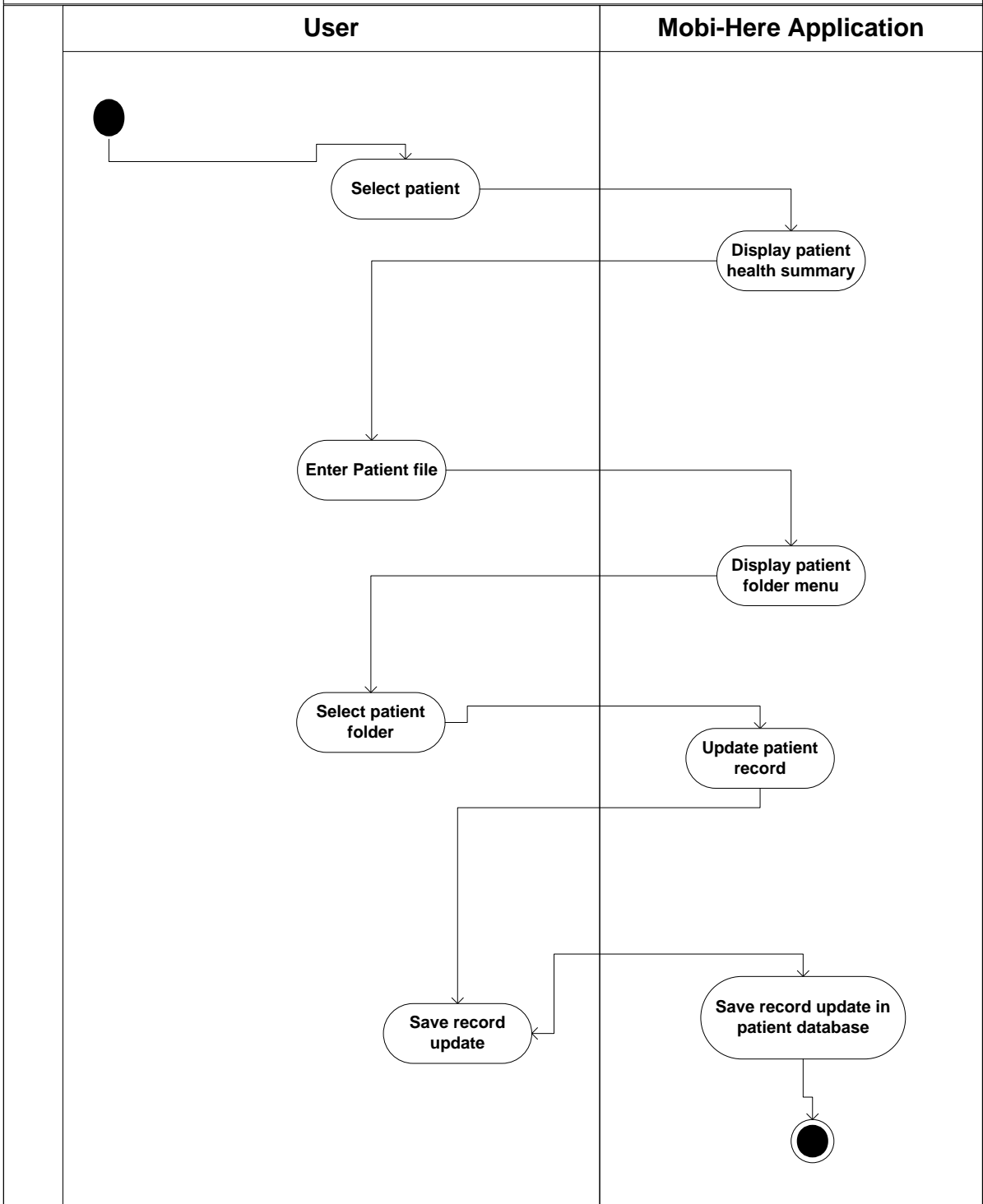
**APPENDIX C: ACTIVITY DIAGRAMS FOR PATIENT SEARCH, VIEWING A PATIENT FOLDER AND UPDATING A PATIENT FOLDER FUNCTIONS**



# Mobi-Here (View patient folder)



# Mobi-Here (Update patient record)





## APPENDIX D: GENERAL PRACTITIONER PERSONAS

### Doctor Personas

#### Persona 1



#### **Biography**

**Candice Williams, 42, Female**  
**Married with 2 children aged 5 and 8**  
**GP and partner at private practice for 5 years**

#### **Technology Use**

##### **Cell phone:**

Candice uses her cell phone very regularly during the day to send her clients SMS appointment reminders and also to make and receive phone calls from them. Patients usually request advice, which would be otherwise billed for, but is currently done out of her own good will and duty. Candice calls patients to inform them on blood test results or other results from pathologist labs. Candice can expect to receive calls 24hrs a day from any of her clients and over weekends. She regularly spends 2 to 4 hours on weekend patient-related calls.

##### **Computer:**

Candice uses a desktop computer to browse the internet for work related information, especially relating to medicine.

#### **Service needs**

Candice would like to bill her clients for telephonic consultations. This is however troublesome because there needs to be proof of the call made or received, and also the patient billing information on hand.

Candice would also like to use her mobile device to set appointments, and program reminders to activate at predetermined times. She would like these reminders to be sent to her clients at a specific time and day, which she could pre-program earlier in time (day/week/month/year).

She would like to have access to a basic patient record, especially containing medication prescriptions and diagnosis, when dealing with telephonic consultations.

#### **Attitude**

Candice does not currently use any software to help her run her practice, but is excited about the prospect of doing so. She believes technology can help her organise her practice better. She encourages the rest of her staff to think positively about new ways of doing things.

## Persona 2



### **Biography**

**Janette du Plessis, 58, Female**

**Divorced, 3 children in late 20s, 2 cats**

**GP and partner at private practice**

### **Technology Use**

#### **Cell phone:**

Janette uses her cell phone to receive calls from her patients. She may receive calls 24/7 from patients. She prefers to call from her office landline when possible. She seldom sends SMS messages for communication to her patients.

#### **Computer:**

A computer stands to one side of her desk and rarely gets switched on. She relies on her secretary and diary to remind her of appointments and also to take care of billing details.

#### **Paper:**

Yes, Janette is an old school practitioner who still writes everything down and knows where to find it all when she needs to.

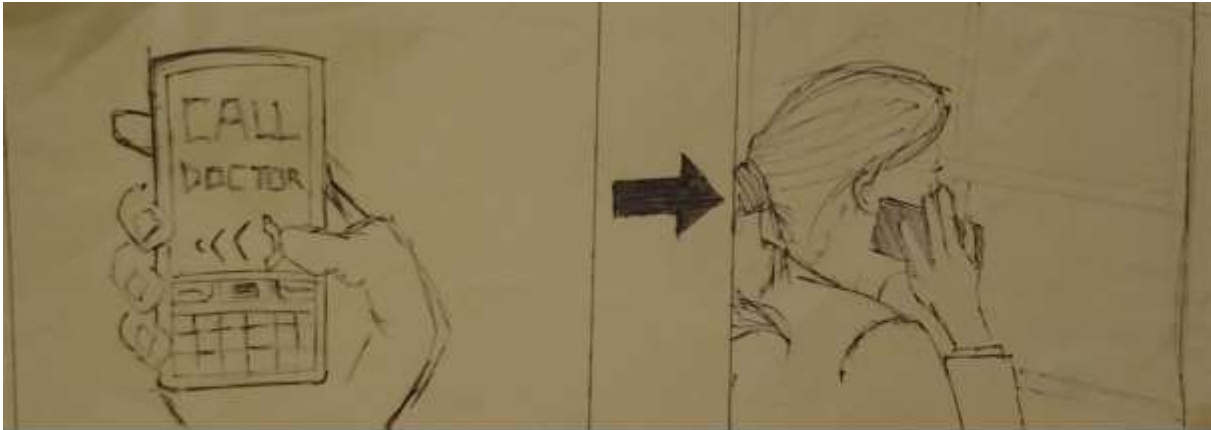
### **Service needs**

Janette needs to stay up to date on medication information. She would like to bill telephonic consultations.

### **Attitude**

Janette is comfortable with her current way of doing things. Her partners are pressurising her to modernise her system and assure her that the outcome will solve more problems than it will create (a personal worry).

## APPENDIX E: SCENARIO STORYBOARD



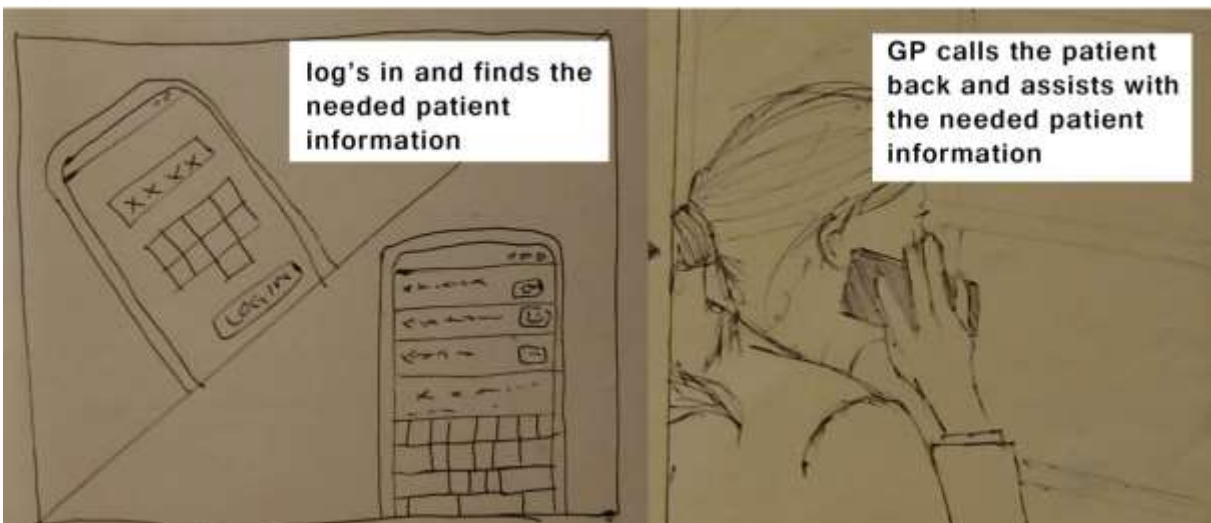
call comes in from a patient in the evening

GP answer the call its a patient that needs her help and needs to access the patient folder



GP tells the patient she will contact her within a few minutes and ends the call

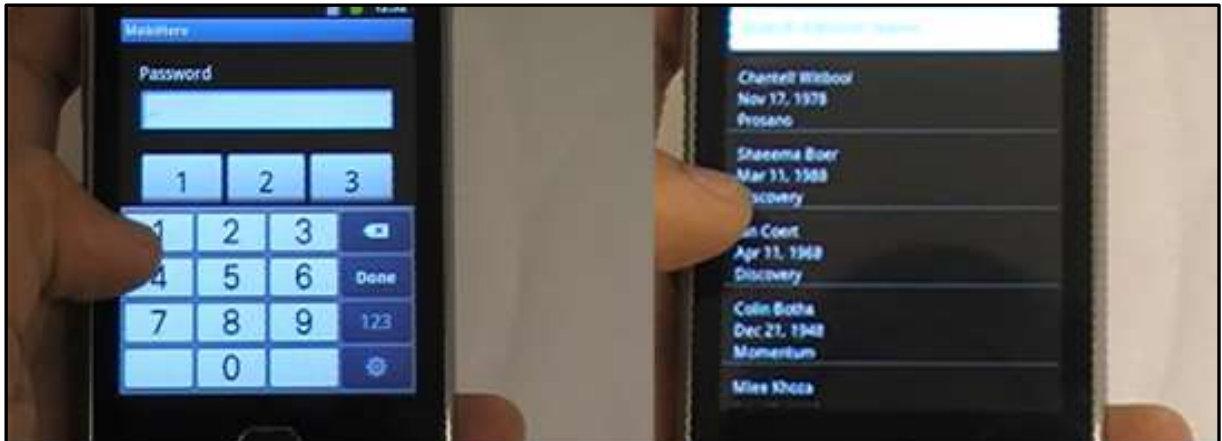
GP accesses the application on her smartphone



log's in and finds the needed patient information

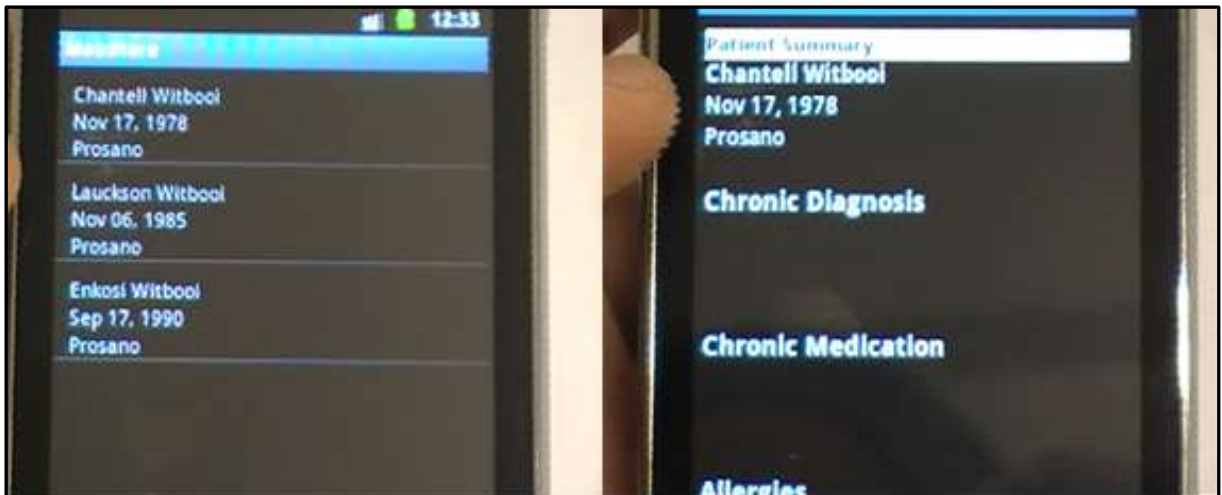
GP calls the patient back and assists with the needed patient information

## APPENDIX F: DYNAMIC DIGITAL PROTOTYPE



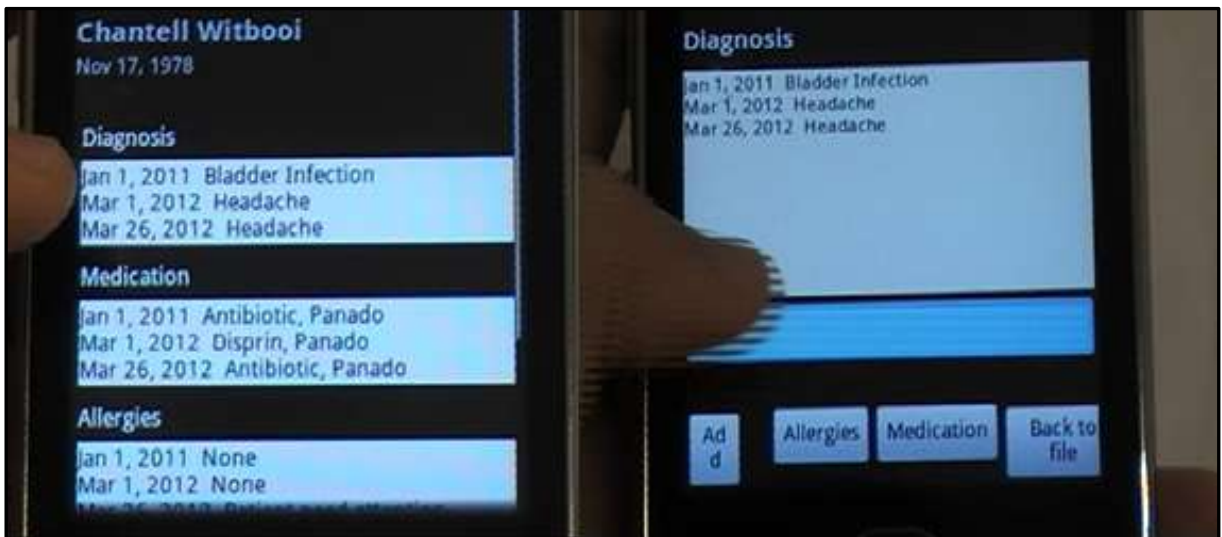
Number password  
Login

Patient list is shown when GP logs in,  
GP chooses  
patient "Witbooi"



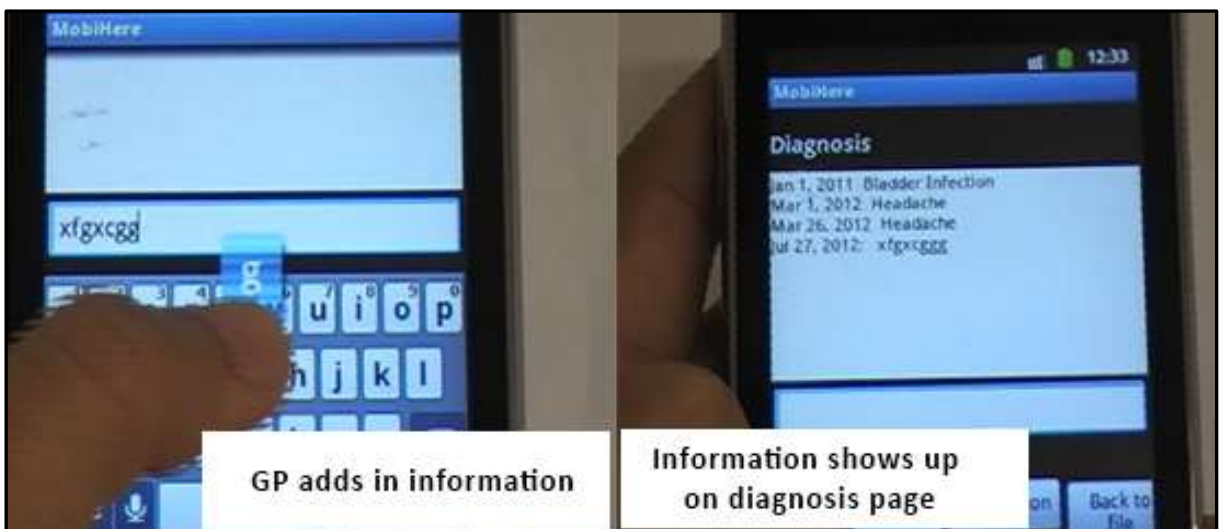
Patient "Witbooi" is part  
of a family and her family  
list is shown

GP taps on Chantell's name on screen  
and then the patients summary page  
is displayed



Chantells patient file is then displayed with the categories allergies, diagnosis and medication, GP then taps the diagnosis section

Diagnosis page is displayed with information, GP decides to add information and taps the input bar



GP adds in information

Information shows up on diagnosis page



# User Guide

## Introduction

The Mobi-Here application is designed to provide doctors with access to their patients' medical information on the go. The application is developed for mobile phones and hand held devices, allowing for instant access to patient information.

## Supported Devices

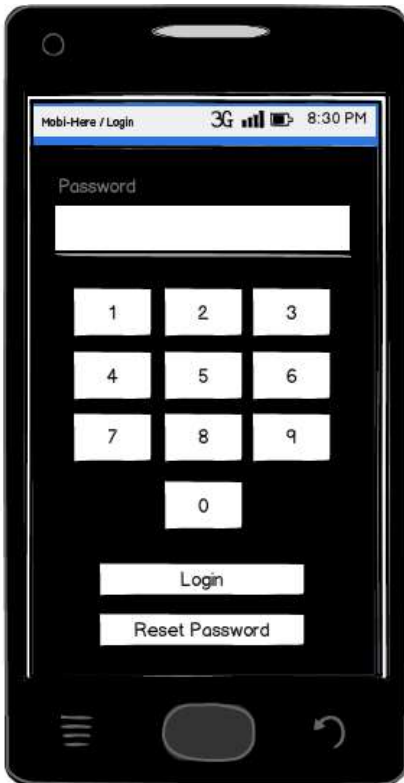
The Mobi-Here application supports devices on the android platform



### Starting the application

To launch the Mobi-Here application:

1. Press the menu button on your smartphone.
2. Go to the Mobi-Here icon.
3. Select the Mobi-Here icon.
4. Mobi-Here application will start.



## Logging in

To log into the Mobi-Here application:

1. Enter password on the keypad.
2. Tap the Login button to log into the application.



## Patient list / Search page

To launch the Mobi-Here application:

After logging in, a patient list (listing all of the main medical-aid holders) will be displayed. You can either scroll down the patient list to find the patient you are searching for, or you can enter the patient's name in the search bar located at the top of the screen.



## Searching For a Patient

To search for a patient on the database:



*Note: The search results list displays the name of the patients, the patients' date of birth, their medical aid provider and their dependents status.*

1. Type the patient's first name or surname in the search bar.
2. Results from your search query (listing all of the patients with names similar to your search query) will be displayed on the search results screen as you type out the patient's name.
3. Select the patient you are searching for from the search results list.

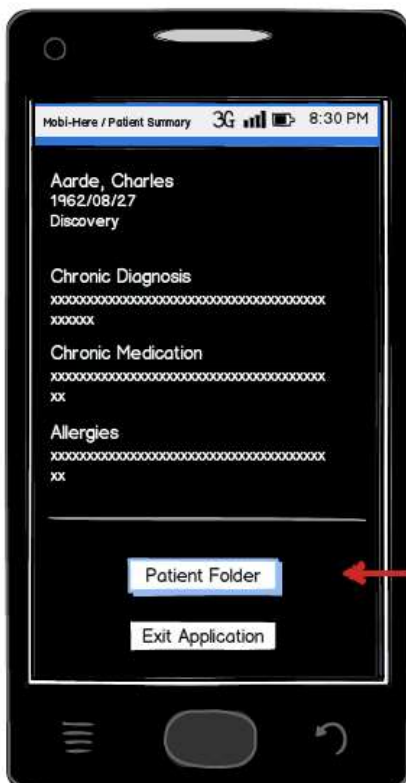
*Note: If there are no results for your search, no patient names will be displayed on the search results list. The screen will appear blank. You can perform another search by entering the patient's name in the search box.*

## Viewing patient's medical record

Select the patient's name from the search results list. A patient family folder (listing the main member of the family and the dependents) will be displayed.



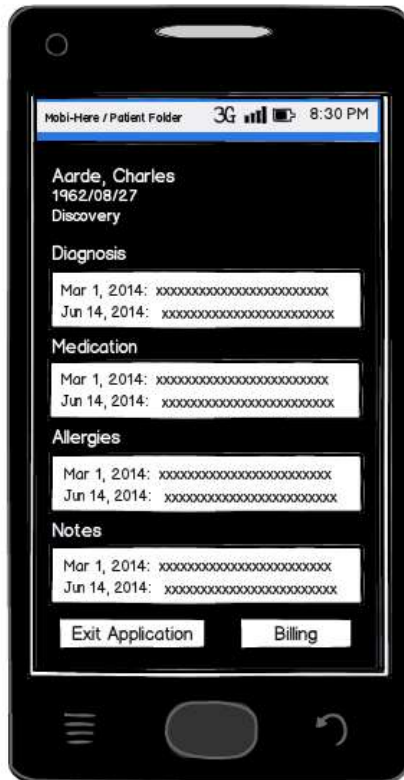
- In the family folder, select the name of the patient you are searching for. A patient summary page will be displayed. The summary page shows a medical summary of the patient's chronic diagnoses, chronic medications and allergies.



*Upon choosing the selected patient a Summary page will appear. The summary page is an overview of the patient, it displays if the patient has any chronic ailments, treatments and diagnosis.*

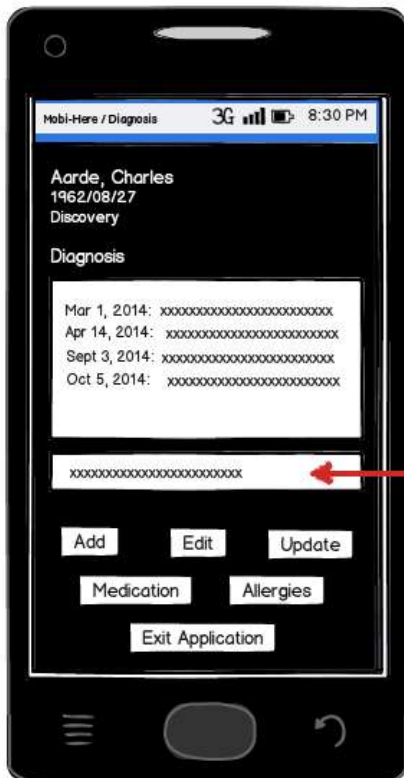
To get more details on the patient's medical history, on the patient summary page, press the patient folder button. This will allow you to enter the patient's folder, which has a record of all of the patient's prior diagnoses and medications

## Patient medical record



Once choosing the patient folder button on the summary screen the patient folder will be shown. Patient folder displays the medical information into four categories which are Diagnosis, Medication, Allergies and Notes.

To view a particular category, press on the Diagnosis, Medication, Allergies or Notes display window. The category's box will then be expanded in order to show a larger portion of the record.



## Diagnosing a Patient

1. Search for the patient you want to diagnose.
2. On the patient's summary page, press the patient folder button.
3. Select the diagnosis window.
4. Write the new diagnosis in the diagnosis text window on keyboard when it appears.
5. Press the add button.
6. Press the update button to reflect the diagnosis on the large window.

## Edit / Delete diagnosis from patients

To edit or delete a diagnosis from a patient's record:

1. Search for the patient.
2. Select the patient from the search results.
3. On the patient's summary page, press the patient folder button.
4. Once inside the patient folder, select the diagnosis window. A list of the patient's current and previous diagnoses will appear.



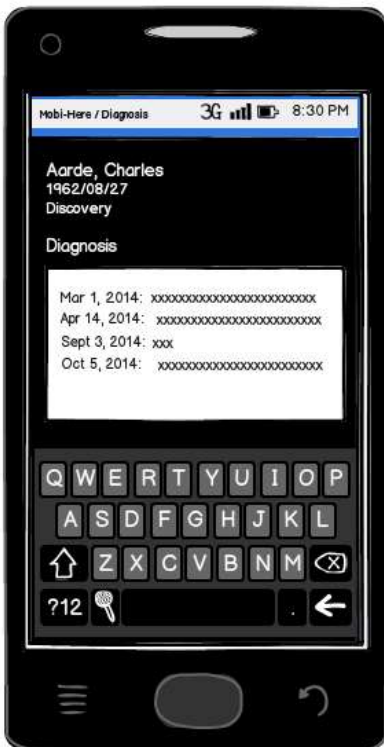
5. Press the edit button.



6. Highlight the diagnosis entry you want to edit or delete.



7. Once highlighted, press the backspace button on the keyboard to remove the selected diagnosis from the patient's record.



*Note: To edit the diagnosis highlight the selected, use the backspace button on the keyboard to remove the text, then type the changes to be made.*

8. Once keyboard withdraws, press the update button to save the changes.



## Recording Medication issued to patient

1. Search for the patient and select.
2. On the patient's summary page, press the patient folder button.
3. Select the medication window.
4. Type the new medication in the medication text window via the keyboard when it appears.
5. Press the add button.
6. Press the update button to reflect the medication on the large window.



## Edit / Delete medication from patients record

To edit or delete a medication from a patient's record:

1. Search for the patient.
2. Select the patient from the search results.
3. On the patient's summary page, press the patient folder button.
4. Once inside the patient folder, select the medication window. A list of the patient's current and previous medications will appear.
5. Press the edit button.



6. Highlight the medication entry you want to edit or delete.



7. Once highlighted, press the backspace button on the keyboard to remove the selected medication from the patient's record.

*Note: To edit the medication highlight the selected, use the backspace button on the keyboard to remove the text, then type the changes to be made.*

8. Once keyboard withdraws, press the update button to save the changes.



## Recording Allergy issued to patient record

1. Search for the patient and select.
2. On the patient's summary page, press the patient folder button.
3. Select the allergy window.
4. Type the new allergy in the allergy text window via the keyboard when it appears.
5. Press the add button.
6. Press the update button to reflect the medication on the large window.



## Edit / Delete Allergies from patients record

To edit or delete an allergies from a patients record:

1. Search for the patient.
2. Select the patient from the search results.
3. On the patient's summary page, press the patient folder button.
4. Once inside the patient folder, select the allergy window. A list of the patient's current and previous allergies will appear.
5. Press the edit button.



6

6. Highlight the allergy entry you want to edit or delete.

7

7. Once highlighted, press the backspace button on the keyboard to remove the selected allergy from the patient's record.

*Note: To edit the allergy, highlight the selected, use the backspace button on the keyboard to remove the text, then type the changes to be made.*

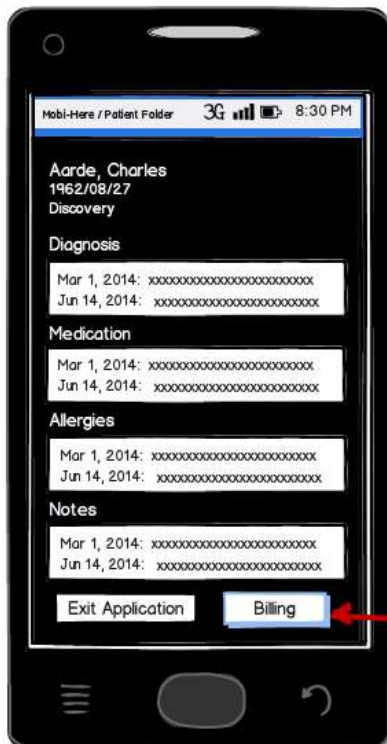
8. Once keyboard withdraws, press the update button to save the changes.



Note: To record, edit or delete patient information in the "Notes" category follow the "Record, Edit and Delete" instructions of the Diagnosis, Medication and Allergies sections.

## Telephonic Billing

The Mobi-Here application provides a feature that allows details from telephonic consultations to be recorded. To make use of this feature, a telephonic consultation between the patient and the doctor needs to take place.



1. Search for the patient.
2. Select the patient from the
3. Enter the patient summary
4. Press patient folder button.
5. Press the billing button.



6. Select patient number from call



7. Information from the call is divided into Selected time, Duration and Call date.

8. Depending if the call was for a Script or Telephonic consultation the doctor needs to tick a checkbox before submitting the report.

9. Press the submit button to save consultation details.

## APPENDIX H: THEMES GRAPH

