UNIVERSITY OF SOUTHERN QUEENSLAND
AUSTRALIA

STUDY TO INVESTIGATE FACTORS INFLUENCING ADOPTION OF MOBILE DEVICES IN THE HEALTHCARE ENVIRONMENT

A Thesis submitted by

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ABSTRACT

The rapid growth in the use of various types of mobile devices like PDAs, iPads, mobile phones and laptops has drastically changed healthcare processes and procedures, and is proving to be beneficial in the healthcare environment. Despite the potential benefits of mobile devices in healthcare, their adoption in many Telehealth activities such as Telemedicine, Telepsychiatry, patients' treatment and monitoring is slow. Mobile devices are mainly used for text messaging, emailing, maintaining diaries, sending reminders, tracking symptoms, viewing inpatient lists, viewing alerts and patients' clinical data.

Although the Health Information Technology (HIT) adoption literature indicates that various factors are responsible for the adoption of technology in healthcare, these factors are not sufficient to develop a full understanding of the adoption of mobile devices. Previous research studies into the adoption of technology in healthcare focussing on m-health, are wider in scope and not particularly focussed on mobile device adoption in Telehealth. Also, these studies are conducted in countries such as the USA, UK, Canada, New Zealand, Taiwan, Korea, Pakistan, Bangladesh, India and The Netherlands and not in the Australian healthcare system. Further, the quantitative method dominates these studies, preventing individuals from freely expressing their thoughts and ideas, and potentially limiting the exploration of important factors. Therefore, the objective of this research study is to determine the factors influencing Health Care professionals' (HCPs) intentions toward the adoption of mobile devices in the healthcare environment and to refine the initial conceptual framework which is based on the Theory of Planned Behaviour (TPB), Diffusion of Innovation (DOI) and previous HIT adoption literature.

The scope of this research study is limited to gaining an understanding of the adoption of mobile devices in the Australian Telehealth context. To investigate factors for the adoption of mobile devices in this research, the researcher has applied a pragmatic research philosophy which supports a mixed method research design. The mixed method research design is implemented sequentially in two Phases: Qualitative Phase 1 followed by Quantitative Phase 2. In both Phases, HCPs were selected from regional

areas of Queensland, Australia and were familiar with the concept of using mobile devices in Telehealth.

In the Qualitative Phase 1, six focus group discussions and two interviews were conducted to collect data. The focus group discussion technique is considered one of the best methods for obtaining rich information, and the interview is considered the best method for obtaining in-depth information on a research topic. The qualitative data obtained through the use of these techniques were analysed both manually and with N-vivo software to develop themes and factors in this research study.

In the Quantitative Phase 2, anonymised online and paper-based surveys were used. Both survey collection techniques were conducted simultaneously. The quantitative data was collected from thirty-nine surveys. This data was analysed using SPSS IBM 23 software. EFA and regression analysis was conducted in SPSS to validate the factors obtained in the Qualitative Phase 1.

This research study established six factors for mobile device adoption in the Australian healthcare context. These six factors were: 1. Intention, 2. Functional features, 3. Training, 4. Network coverage, 5. Privacy and security and 6. Trialability. The regression analysis established that the five of the factors (2-6 above) have a joint strong influence on HCPs' Intentions to use mobile devices. Further, the study also established that there is a strong significant direct positive influence of Functional features on Intention and a border line significant direct positive influence of Training on Intention to use mobile devices in the healthcare environment.

The findings of this research study have contributed to the HIT adoption literature and also have some methodological, practical and policy recommendations. Managers, developers and policy makers can use the factors obtained in this research study while developing their strategies for the adoption of mobile devices in healthcare. The assertion that there is a strong relationship between the factors Intention and Functional features indicates that the developers should provide suitable features in order to help with the adoption of mobile devices in healthcare. Further, the assertion that there is a strong relationship between the factors Intention and Training indicates that organisations should provide adequate training to HCPs for the adoption of mobile devices in the healthcare environment.

The main limitation of this research study is the small sample size used in Phase 2. A small sample size limits the generalizability of this research study findings. However, this research study can be conducted with a larger sample size in both Australia and overseas. Other research limitations are the low explanatory power of the final conceptual framework, setting up only four items for few constructs /factors, testing of the survey questionnaire with a small sample size and collecting data from one point in time only (cross-sectional). These limitations can be addressed in future studies.

This research study can be extended in future in various ways. It can be conducted from perspectives other than those of HCPs. Limited research has been conducted from the patient perspective, therefore future research could be conducted from this perspective. Further, a combined study of both HCPs' and patients' perspectives could be conducted to achieve a more holistic understanding of the adoption of mobile devices in Telehealth. In addition, to fully understand the adoption of mobile devices in healthcare, it is important to understand the moderating influences as these impact the complexity of individual behaviour, experiences and relationships. In the Australian HIT adoption literature, there is little understanding of technology adoption from the individual's perspective focussing on the moderating influences of Age and Experience on technology adoption factors. Future research can also be conducted to explain the influence of these moderating factors. In addition, the survey questionnaire developed in this research study can be further refined and validated with different countries' healthcare contexts to increase its reliability and generalizability.

CERTIFICATION OF THESIS

This thesis is entirely the work of *Vasundhara Rani* except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Student and supervisors signatures of endorsement are held at USQ.

Prof. Raj Gururajan

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Principal Supervisor

Dr. Abdul Hafeez Baig

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Associate Supervisor

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LIST OF PUBLICATIONS

International conference

Sood, RV[1], Hafeez-Baig, A & Gururajan, R 2016, 'Study to investigate factors influencing adoption of mobile devices in the health care environment: research in progress, Proceedings of ECIS, 12-16 June, Turkey Istanbul.

Sood, RV, Gururajan, R & Baig-Hafeez, A 2016, 'Adoption of mobile devices in the Australian telehealth environment: a Pilot study', Proceedings of Successes & Failures in Telehealth: 7th Annual meeting of the Australian telehealth society, 31 October-3 November, Skycity Auckland, New Zealand.

Nationwide conference

Sood, RV, Gururajan, R & Baig-Hafeez, A 2015, 'Title of PhD Project: Study to Investigate Factors Influencing Adoption of Mobile Devices in the Health Care Environment', Proceedings of ACIS 30, November-4 December, UNISA, Adelaide.

Local conference presentation

Sood, RV, Gururajan, R & Hafeez-Baig, A 2016, 'What factors determine healthcare professionals' (HCPs) acceptance of mobile devices for telehealth: a Qualitative study conducted in Queensland, Australia', Proceedings of Rural and Remote Telehealth at Home, 5-6 October 2016, Toowoomba, Australia.

Book Chapter publication

Sood, RV, Gururajan, R, Hafeez-Baig, A & Wickramasinghe, N 2016, 'Adoption of mobile devices in the Australian healthcare: a conceptual framework approach', in Handbook of Research on Healthcare Administration and Management, IGI Global, pp. 662-685, <https://www.igi-global.com>.

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[1] The reason for changing the name from "Vasundhara Rani" to "Vasundhara Rani Sood" in publication is because sood is the family name of the candidate.

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LIST OF ABBREVIATIONS

1. A→Age
2. ANOVA→Analysis of Variance
3. CFA→Centroid factor analysis
4. CP→Compatibility
5. CX→Complexity
6. DC→Demographic characteristics
7. EFA→Exploratory factor analysis
8. EHR→Electronic health records
9. E-health→Electronic health
10. E→Experience
11. FDA→Food and Drug Association
12. FGP→Focus group participant
13. FF→Functional features
14. GP→General practitioner
15. HCPs→Healthcare professionals
16. HIS→Health Information System
17. HIT→Health Information Technology
18. ICT→Information Communication Technology
19. IN→Intention
20. IR→Interview respondent
21. IVR→Interactive voice response
22. MDs→Mobile devices
23. m-health→Mobile health
24. MCAR→Missing completely at random
25. MNAR→Missing completely not at random
26. MS→Management support
27. NC→Network coverage
28. NCDs→Non-communicable diseases
29. PACS→Picture archiving and communication system
30. PCA→Principal component analysis

31. PDAs →Personal digital assistance
32. PEOU→Perceived ease of use
33. PS→Privacy and security
34. PU→Perceived usefulness
35. RA→Relative advantages
36. RI→Resource issues
37. RN→Registered nurse
38. RQ→Research question
39. SE→Self-efficacy
40. SI→Social influences
41. SMS→Short message service
42. SPSS→Statistical Package for the Social Sciences
43. TAM→Technology acceptance model
44. TPB→Theory of planned behaviour
45. TRA→Theory of reasoned action
46. TR→Training
47. TRI→Trialability
48. 2D→Two dimensions
49. 3D→Three dimensions
50. USQ→University of Southern Queensland
51. WHO→World Health Organization

Chapter 1

Introduction

CHAPTER 1: INTRODUCTION

1.1 Overview

The objective of this chapter is to provide an overview of this research study and thesis organisation. To achieve these aims, this introductory chapter is organised into eight sections as shown in Figure 1.1.

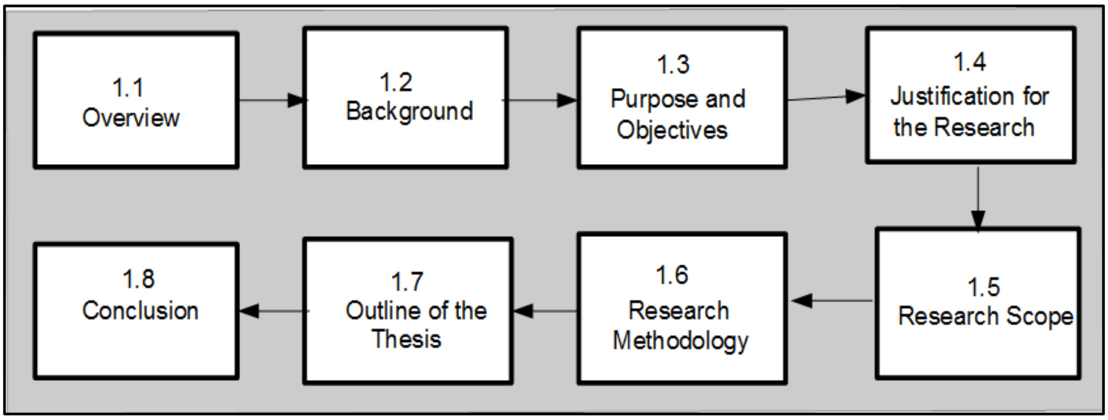

Figure 1. 1: The outline of Chapter 1 on key components of the research

Source: Developed for this research

Section 1.1 introduces the chapter. Section 1.2 provides information on the background of this research. Section 1.3 explains the purpose of this research study and its objectives. Sections 1.4 and 1.5 provide the justification for conducting this research study and the scope of the research. Section 1.6 describes the methodology used to conduct this research. In Section 1.7 the outline of the thesis is presented. Finally the conclusion is presented in Section 1.8.

1.2 Background

Globally, the impact of mobile devices has improved the healthcare environment and they will continue to take centre stage into the future (Wu, Li & Fu 2011; Lim et al. 2011; Slaper & Conkol 2014; *War Memorial Hospital: Michigan to deploy JEMS telehealth system across all divisions, specialists* 29 Jul. 2014). Using mobile devices, data can be communicated easily between Health Care Professionals (HCPs) and patients. Patient data can automatically be collected, transmitted, aggregated with other physiologic data, analysed, stored, and presented as actionable information (Klonoff 2013). Expert health professionals can use this actionable information to communicate with the patient and make diagnoses, treatment and recommendations to emergency doctors at other sites. Furthermore, primary care physicians can access specialists for consultation and diagnosis at any time using mobile devices. Mobile devices can also be used to manage patients' particular medical conditions and health risk factors (Deng, Mo & Liu 2013; *Wireless sensor networks markets will be driven by the adoption of 8.5 billion smart phones by 2019 says recent report 30* Jan. 2014, Business Wire; Wu, Wang & Lin 2007; Hebert, Korabek & Scott 2006; Coughlinet. al 2017; Tighe et al. 2017). Using real-time video-based virtual consults, people can access their health information and consult doctors in an emergency through mobile devices (Zangbar et al. 2014; Slaper & Conkol 2014). Moreover, mobile devices have the potential to reduce the inefficient use of resources in the health domain. It is predicted that, worldwide, there will be a net shortage of 15 million healthcare workers by the end of 2030; a shortage which can be managed using mobile devices (Singh & Sullivan 2011). Mobile devices are also used in emergency response, short message services (SMS), paging, automated sensing, mobile applications, media capabilities and video conferencing in healthcare (Eskinder, Chew & Yi-LwernYap 2016). These services are reducing the unnecessary hospitalisation of patients. In addition, administrative tasks, documentation, decision-making and educating health staff can be accomplished using mobile devices (Croll et al. 2012).

Along with these advantages, several health applications can be used on mobile devices. Some of these applications include as stethoscopes, sleep structure analysers, cardiac analysis systems, mental health trackers, Parkinson's disease trackers and trackers for monitoring the physiological signs of patients (Bort-Roig et al. 2014). These applications are helping health professionals and patients in various ways. An application `NumaStatus' can be downloaded to a mobile device and used for patient dose report generation and communication anywhere in the health facility (Tangorra 2015). 'Resolution Software' is a U.S. Food and Drug Administration (FDA) class II cleared solution and can be used in validated mobile devices for diagnosis and providing seamless image access across multiple departments from supported web browsers. Users of imaging applications such as ‘Resolution Software’ can view images with zoom and scrolling abilities, handle multi-frame data sets such as echocardiograms and angiograms, support play back at acquisition rates, capture images securely with the device's camera, upload medical imaging to the cloud repository and share medical imaging with physicians and patients via a network (Tangorra 2015).

Health applications can also help people to manage their own health. These applications are useful in tracking information regarding time spent exercising such as walking, running, monitoring pulse rate, calories intake, calories burnt, dietary assessment, sharing information with peers, monitoring subjective mood and anxiety levels in real time (Clifford & Clifton 2012; Mone 2014; Gaggioli 2012). Thus, it can be seen that the use of mobile devices in healthcare has great potential.

Although the use of mobile devices in healthcare is contributing to managing the health of people in various ways, their adoption in this domain is slow (Christensen & Remler 2009; Wu, Li & Fu 2011; Nour et al. 2015; Fox 2009; Slaper & Conkol 2014; Milward et al. 2015; Alaiad & Zhou 2014). Most of the mobile device-based projects in healthcare are implemented on a pilot or trial basis and the adoption of these projects remains unknown or limited (Lu & Wu 2015; Hebden et al. 2013; Shand et al. 2012; Willcox et al. 2015; Hebden et al. 2014; Clarke et al. 2014). In the health environment, mobile devices are mainly used for calling, text messaging, medication reminders, reminder emails, maintaining health diaries and symptom tracking (Muralidharan et al. 2017; Mitchell et al. 2011; West 2012; Tian et al. 2017; Wu et al. 2017; Oliver-Williams et al. 2017). Even though the use of mobile devices has great potential in remote monitoring and teleconsultation (Chow et al. 2015; Rahman et al. 2017), their use in these activities is limited. Therefore, this research study is designed to understand the adoption of mobile devices by HCPs in the healthcare environment.

1.3 Purpose and Objectives

The overall aim of this research study is to determine the factors influencing HCPs’ intentions toward the adoption of mobile devices in the healthcare environment and to refine the initial conceptual framework which is based on the Theory of Planned

Behaviour (TPB), Diffusion of Innovation (DOI) and previous Health Information Technology (HIT) adoption literature.

Secondary research objectives are:

1. To understand the literature on the adoption of technology in healthcare
2. To understand various theories/models available for the adoption of technology in the healthcare environment
3. To provide a conceptual framework for the adoption of mobile devices in Telehealth.

1.4 Justification for the Research

This research study is justified on the basis of three significant points: 1) Gaps in the literature, 2) Expected benefits and contributions to the theory and practices and 3) Expected future scope.

The first justification for this research study is related to the gaps in the health information literature in the context of technology adoption as mentioned below:

1. Mobile devices have greater potential to enhance healthcare because of their wide usage and fascinating features such as ubiquity, flexibility and ease of use (Zangbar et al. 2014). However, the adoption of mobile devices in the healthcare is slow (Wu, Li & Fu 2011; Farrell & Holmes-Walker 2011; Fox 2009; Slaper & Conkol 2014; Milward et al. 2015)

2. Numerous technologies such as video teleconferencing, Skype, the Internet, and wireless communication are available via mobile devices (Hufstader et al. 2014; Litwack et al. 2014; Armfield, Gray & Smith 2012). These technologies can be very useful in interactive real-time Telehealth activities, however, their use is limited in this domain. Mobile devices are mainly used for text messaging, emails, health diaries, reminders and symptom tracking (Rehman et al. 2017b; Triantafyllidis et al. 2015; Chow et al. 2015)

3. Many researchers have investigated the factors for understanding the adoption of technology in healthcare (Peddle 2007; Evans, Harris & Kuppuswamy 2011; Gagnon et al. 2005; Marshall & Heginbotham 2013; Adler-Milstein, Kvedar & Bates 2014; Cimperman et al. 2013; Vuononvirta et al. 2011). Previous research studies have also explored the factors influencing the adoption of mobile devices like the Personal Digital Assistant (PDA), Electronic Health Record (EHR) and smartphone (combo of cell phone and PDA) in healthcare but these are either too old, not paticularly focussed on the Telehealth context or conducted in different countries (Hafeez-Baig & Gururajan 2010; Wu, Li & Fu 2011; Wu, Wang & Lin 2007; Gagnon et al. 2012; Sun & Qu 2014; Palvia 2012; Istepanian 2014), such as USA, UK, New Zealand, Taiwan, Korea, Canada and the Netherlands (Castro, Miller & Nagar 2014; Goswami & Chandra 2013; Sezgin, Özkan-Yildirim & Yildirim 2016; Wu, Wang & Lin 2007; Yangil & Chen 2007; Furukawa et al. 2008; Gagnon et al. 2005)

4. Further, limited literature is available to understand the adoption of technology in the Australian healthcare context and is either too old, not focussed on mobile devices adoption or not limited to the Telehealth context (Hafeez-Baig 2010; Tiong, Hafeez-Baig, Gururajan & Soar 2006)

5. Most of the previous research studies on technology adoption in healthcare have been conducted using one method alone: the quantitative method. However, the factors required for better understanding of the adoption of mobile devices can be obtained using the qualitative method and then further validated using the quantitative method.

The second and third justifications for conducting this research study are the expected benefits to the Technology developers, Policy makers, Management and Research community. Technology developers may consider the results of this research study to design improved mobile devices to facilitate the delivery of Telehealth services. Policy makers may consider the findings of this research study to refine policies conducive to the implementation of mobile devices in the Telehealth context. Management can use the findings of this research study for directing the efforts and resources towards the implementation of mobile devices within the health facility in an effective way as a result of which, both health professionals and patients can benefit from the improved environment of the health domain. The findings of this research study will also add to the HIT adoption literature and enable the research community to conduct future research into the mobile health environment from other perspectives such as patient and management perspectives.

1.5 Research Scope

The scope of this research study is limited to Telehealth only. The operational definition for Telehealth is:

> *'An interactive real-time clinical activity provided for an admitted patient or outpatient within a Telehealth session' (2014).*

Over the past few decades, the use of Telehealth technology has provided improved health services in geographically remote places (Barbash & Glied 2010; Hebert, Korabek & Scott 2006; Evans, Harris & Kuppuswamy 2011; Sarkis & Mwanri 2014). Real time emergencies and remote monitoring of patients is possible in Telehealth (Gao et al. 2005). However, the goal of eliminating time constraints in Telehealth is yet to be fully achieved but could be made possible by using mobile devices. A patient who is sick in the middle of the night can access Telehealth services via mobile devices and potentially avoid an unnecessary trip to the emergency room. Consequently, this will place less of a burden on the available health resources. Mobile devices also have the potential to communicate time sensitive information. Stroke care, for example, is extremely time-sensitive. The ability to access images quickly and remotely with capabilities such as communication via digital video cameras and Internet telecommunications, robotic Telepresence along with smartphones can reduce patient disability from strokes and potentially save many lives. However, the use of mobile devices is limited in Telehealth real-time clinical activities (Chow et al. 2015; Rehman et al. 2017b; Triantafyllidis et al. 2015; Slaper & Conkol 2014; Zangbar et al. 2014). Hence, the scope of this research study is limited to understanding the adoption of mobile devices in the Telehealth context.

The scope of data collection in this study is limited to Australia only because, in the Australian healthcare context, limited research has been conducted in understanding the factors influencing the adoption of mobile devices. Further, Telehealth technology is used in Australia but the use of mobile devices in video consultation among HCPs is limited (Fatehi et al.2015). Other reasons for conducting this research study are time, finance and resources constraints on the researcher. Due to limited finances, resources and time, this research study cannot be conducted in other countries.

1.6 Research Methodology

This research study has used a pragmatic research philosophy. This philosophy allows the researcher to use both the qualitative and quantitative approaches to understand the research problem, support the framework synthesis and enable transferability of results (Houghton et al. 2017; Morgan 2007); which are all aimed in this research. The detailed justification of the selection of a pragmatic research philosophy and a mixed methodology is given in the research methodology Chapter 3.

In this research, a sequential mixed methodology, (that is a qualitative, followed by a quantitative method) is used because a mixing of methods can overcome the drawbacks of both qualitative and quantitative research designs (Venkatesh, Brown & Bala 2013).

The first Phase of this research study was the Qualitative Phase. The Qualitative phase is necessary because the adoption of mobile device technology in healthcare is an emerging trend and therefore, limited information exits in the literature regarding this research area. By using a qualitative research design, rich information on a new research topic can be collected (Andrew & Halcomb 2007; Sofaer 1999). In this research, the Qualitative phase allowed the researcher to gain more insights into the adoption of mobile devices in healthcare.

Six focus group discussions and two individual interviews were conducted to collect qualitative data. Both of these techniques are considered suitable for qualitative data collection in the health domain (Sofaer 1999; Gill et al. 2008). Focus group discussions provided rich information and interviews provided in-depth experiences and perceptions of HCPs in understanding the factors influencing the adoption of mobile devices in healthcare.

The qualitative data was mainly collected in the form of audio recordings, which were later transcribed by the researcher. Further, the transcribed files were analysed manually and in N-vivo software for text analysis and thematic analysis and for ensuring reliability and transparency of participants' responses (Pope, Ziebland & Mays 2000; Rabiee 2004; Gururajan et al. 2014). In the manual and N-vivo analysis, four themes and fourteen factors were obtained which were represented using the researcher's description supported by participants' quotations (Krueger 2014). Based on the interpretations of the findings, the initial conceptual framework (developed from the technology adoption literature) was refined and hypotheses were concluded. A detailed explanation of Qualitative Phase findings is given in Chapter 5.

The second Phase of this research study was the Quantitative Phase, which was used to validate the findings of the first Phase (Qualitative) (Tiong et al. 2006). The survey method was used to collect quantitative data, because this Phase aimed at validating the factors obtained in the Qualitative Phase and the survey is one of the most used data collection techniques for confirming and quantifying the findings of qualitative research (Castro, Ben and Miller 2014). Cross-sectional anonymous online and paper based surveys were used to collect quantitative data. The researcher also faced some challenges in this Phase of data collection, which resulted in 39 usable responses for quantitative data.

Quantitative data was analysed using the Statistical Package for the Social Sciences (SPSS) IBM 23 software. The data was analysed for descriptive, Exploratory Factor Analysis (EFA) and regression analysis. EFA allowed the researcher to refine the initial conceptual framework by means of extracting the main factors and regression analysis validated the factors extracted in EFA. The main results in this Phase were represented in the form of frequency tables, variance tables, inter-item correlation, homoscedasticity and scree plots. A detailed explanation of implementation of the Quantitative Phase is given in quantitative data collection Chapter 6 and quantitative data analysis Chapter 7.

1.7 Outline of the Thesis

An outline of the thesis pertaining to this research study is represented in Figure 1.2.

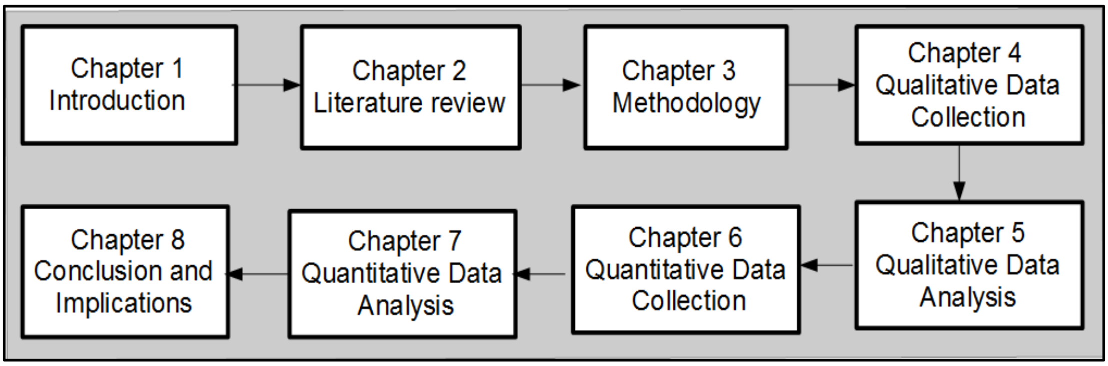

Figure 1. 2: Overview of thesis organisation

Source: Developed for this research

This thesis is comprised of eight chapters, which are strongly linked to each other in a logical order. Each chapter is separated in the context of reviewing literature, suitability of mix methodologies by incorporating the suitable data collection and analysis techniques, representing the findings of each methodology, contributions and future scope of this research.

Chapter 1 - Introduction

This chapter provides introductory information concerning this research. The chapter briefly discusses the research background, objectives, justification for the research, research scope, research methodology, outline of the thesis, contributions and future research. The key outcomes of the introductory chapter are an overview of the research and the thesis organisation.

Chapter 2 - Literature Review

This chapter defines healthcare, mobile devices and the meaning of adoption pertaining to this research, information on adoption theories concerned with the adoption of technology in healthcare, a literature review of technology adoption in healthcare, gaps in the HIT adoption literature and the research question. The chapter concludes with an initial conceptual framework developed for understanding the adoption of mobile devices in healthcare. The key outcomes of this chapter are the research question and an initial conceptual framework.

Chapter 3 - Methodology

The methodology chapter brings into light the research design and the techniques adopted in this research study to address the research question. The key output of this chapter is a detailed plan on various qualitative and quantitative research design parameters suitable for this research.

Chapter 4 - Qualitative Data Collection

This chapter provides information regarding the procedure followed for developing a Discussion Questions Guide and collecting qualitative data. The key outcomes of this chapter are the procedures followed for the development of the Discussion Questions Guide and collection of qualitative data.

Chapter 5 - Qualitative Data Analysis

Information on how qualitative data was analysed using N-vivo software and manual analysis is covered in this chapter. It also provides information regarding the extraction of themes and factors from qualitative data, explanations of each factor extracted from qualitative data, list of items extracted for each factor from participants' views, refinement of the initial conceptual framework and conclusion of the hypotheses. The key outcomes of this chapter are an explanation of factors extracted from the qualitative data, extracting items for each factor from participants' views and a refined conceptual framework.

Chapter 6 - Quantitative Data Collection

This chapter provides information on the development of the survey questionnaire and the processes and procedures followed to collect quantitative data. The key outcomes of this chapter are presentation of the processes and procedures followed to collect the quantitative data.

Chapter 7 - Quantitative Data Analysis

This chapter covers information concerning various techniques used to analyse the quantitative data and includes information on assumptions considered, such as validation of normality and preconditions before conducting the Exploratory Factor Analysis (EFA). The key outcome of this chapter is the validation of the factors obtained in the Qualitative Phase.

Chapter 8 - Conclusions and Recommendations

This is the final chapter of the thesis. It provides information on the discussion, conclusion, implications, limitations and future scope of this research. The key outcomes of this chapter are recommendations arising from the study and possible future scope of this research.

1.8 Conclusion

This chapter has provided an outline of the research by introducing the research background, purpose and objectives, justification for conducting the research, research scope, research methodology, contributions and future research. It also provides the foundation for the thesis. On the basis of the foundation laid out in this chapter, subsequent chapters of the thesis have proceeded. In the next chapter, the meaning of Telehealth, mobile devices and adoption relevant to this research study will be provided. Also, the suitability of the Theory of Planned Behaviour, the Diffusion of Innovation theory and a critical review on technology adoption in healthcare will be provided. Based on this review, gaps in the literature and research questions will be derived. Chapter 2 will be completed by presenting an initial conceptual framework for understanding the adoption of mobile devices in this research.

Chapter 2

Literature Review

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In the previous chapter, an overview of this research study was presented including information on the background of the study, the research purpose and objectives, justification for the selection of this research study, scope of the research, methodology used and outline of the thesis. In this chapter, the HIT adoption literature is reviewed and gaps are identified. These gaps helped to drive a research question and develop an initial conceptual framework to further guide this research study.

To present this information, Chapter 2 is organised into eleven sections as shown in Figure 2.1.

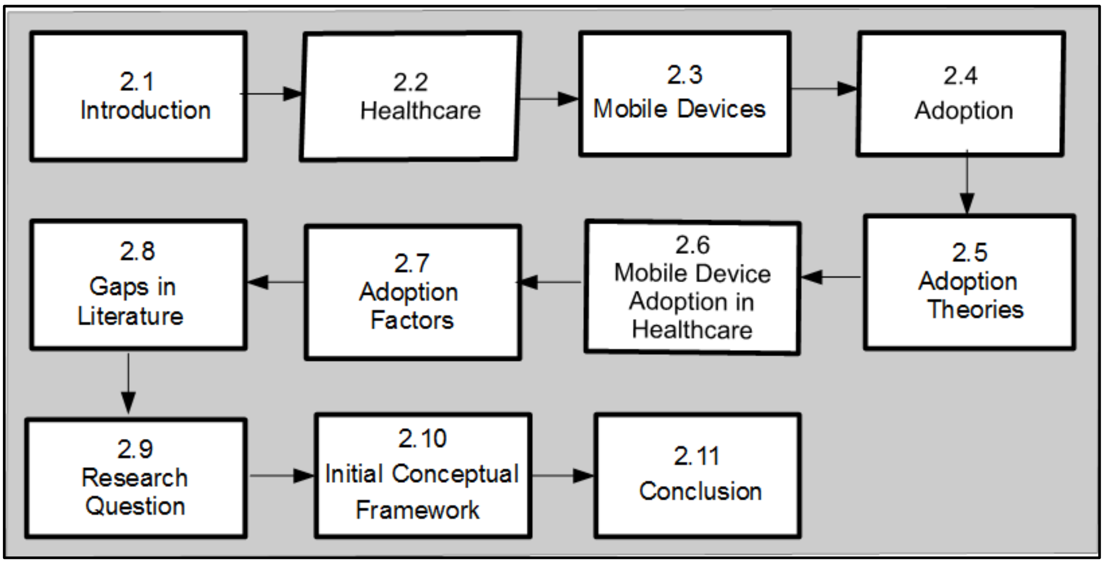

Figure 2. 1: The outline of Chapter 2 on literature review

Source: Developed for this research

Section 2.1 outlines an overview of this chapter. Sections 2.2, 2.3 and 2.4 present information on: healthcare, mobile devices and adoption respectively. Section 2.5 describes adoption theories used in healthcare. Section 2.6 discusses mobile device adoption in healthcare. Section 2.7 presents various technology adoption factors, given in the HIT adoption literature. In Section 2.8, the relevant gaps in the literature are outlined. Sections 2.9 and 2.10 sketch the research question and the initial conceptual framework for this research respectively. Finally, a conclusion is presented in Section 2.11.

2.2 Healthcare

This research study is focussed on the adoption of mobile devices in the Australian healthcare environment, which includes various health services. In the Australian health domain the main health services are: primary care, hospitals, special medical practices and specialist community based services (Australian Institution of Health and Welfare 2014; Australian Institution of Health and Welfare 2016). Primary care is a person's first point of contact and is generally provided outside the hospital through general practitioners, dieticians, allied health practices and chiropractors (WHO 2013; Australian Institution of Health and Welfare 2014; Parliament of Australia 2013). In the assessment and referral process patients are directed from one primary care practice to another and back again which is called secondary care. Hospitals are owned by the government and private organisations (Australian Institution of Health and Welfare 2013; Australian Institute of Health and Welfare 2012; Parliament of Australia 2013). Some hospitals provide specialised services and community based services while others provide acute and rehabilitation services. Telehealth, a component of healthcare is used in most healthcare services.

2.2.1 Telehealth

Telehealth is a technology, which is integrated with other technologies to provide healthcare services remotely. In the literature, the term Telehealth is used interchangeably with telemedicine, e-health and m-health (Rowell et al. 2014; Clifford & Clifton 2012). Telehealth was introduced in the 1970s to represent the broader scope of health services such as education and administration (Fatehi & Wootton 2012; Istepanian 2014). Further expansion in technology and services led to the introduction of the term e-health in the 2000s to cover a broad range of data processing and computer networking applications (including use of the Internet) in health care (Fatehi & Wootton 2012; Istepanian 2014). The latest edition is m-health, which was introduced in 2003 to provide health services using mobile computing, medical sensor communications technologies (Clifford & Clifton 2012; Istepanian 2014). Klonoff (2013) considered m-health as a subset of telemedicine. Zhang and Ho (2015) mentioned m-health as one of the components of e-health. A chronological observation of the literature's usage of the terms Telemedicine, Telehealth, e-health and m-health suggest that these terms can be used interchangeably and one is an expansion over the other (Fatehi & Wootton 2012; Clifford & Clifton 2012; Victor 2011).

In the literature, Telehealth is defined as:

> *'Medical practices mediated remotely, such as over the phone, by video, or asynchronously through a web service' Clifford and Clifton' (2012, p. 480).*

In this research, Telehealth is defined as:

> *'An interactive real-time clinical activity provided for an admitted patient or outpatient within a Telehealth session' (Source: Developed for this research).*

Modes of Telehealth Operation

Telehealth mainly operates in two modes: 1. Real time and 2. Store and forward. In real time Telehealth (synchronous), live interactive audio and/or video links are used for clinical consultations and for educational purposes (Queensland Health 2014). Real time Telehealth could be as simple as a telephone call or as complex as robotic surgery. Real time Telehealth may require the presence of both parties, patient and practitioner at the same time with no place barrier or it may happen between HCPs to provide services to the patient in need of treatment.

In store and forward Telehealth (asynchronous), clinical/patient data captured (stored) at one location is transmitted securely at a convenient time to another location where it is studied by the relevant specialists (Queensland Health 2014). The stored and transmitted data may be in the form of digital images, video or audio.

The mode of the Telehealth operation considered in this research study is real time Telehealth. Real-time Telehealth can be remote monitoring of patients and remote consultation; for care planning, medical record imaging and critical bedside care or for any other type of care.

Worldwide Telehealth Scenario

Global efforts to encourage the wider consideration of Telehealth began in the 1990s (Clifford & Clifton 2012). In remote areas of Canada there has been an improvement in the use and implementation of Telehealth programs since 2002 (Canada's Health Informatics Association 2013). All Canadian provinces and regions have established telemedicine networks and provide a free Telehealth service 24 hours a day (Canada's Health Informatics Association 2013; Allin & Rudoler n.d.).

Scotland is recognised as a leader in the development and use of Telehealth. The Scottish Centre for Telehealth and Telecare (SCTT) was established in 2006, and was further incorporated into NHS24 in 2010. The NHS24 provides health information and self-care advice in Scotland (Parliamentary Committees 2014; The Scottish Centre For Telehealth and Telecare 2018)**.**

In the European Union, Denmark has the highest deployment of Telehealth (Parliamentary Committees 2014). Video conferencing technology is used in Denmark for consulting patients in their home environment (Nøhr et al. 2015). Approximately 150,000 interpretations are carried out using video consultation in Danish hospitals with GPs every year (Danish Ministry of Health 2012).

Hong-Kong is one of the leading countries for Telehealth in Asia. Its emphasis is on the use of 'store-and-forward' Telehealth and some videoconferencing. The most common areas of use are radiology for orthopaedics, neurology, home Telehealth, ophthalmology, pathology, emergency medicine and cardiology (Parliamentary Committees 2014).

There are around 60 telemedicine projects currently running across the United Kingdom's National Health Service in England (Clifford & Clifton 2012). One of the largest Telehealth services in the United Kingdom is 'Ask the Doctor'. This Telehealth services currently has over 500, 000 active users (HIT Consultant Media 2015).

Delivering health services is not easy in remote areas of Australia. A significant proportion of Aboriginal and Torres Strait Islander people live in very remote areas and face health inequalities (Australian Institution of Health and Welfare 2014: Australian Institution of Health and Welfare 2016). Transport services are slow in these areas (Australian Institution of Health and Welfare 2014). Furthermore, patients often have to wait too long to receive health services in regional areas. To improve health in remote areas of Australia, the use of Telehealth commenced in the 1990s and has been supported by federal government (Parliamentary Committees 2014). Today Telehealth is managed and coordinated in all Australian states and territories. In some places it is centrally coordinated and in others it is managed by primary care providers, hospitals or regional alliances (Parliamentary Committees 2014).

In New South Wales, Telehealth is centrally coordinated through the NSW Telehealth Network (Parliamentary Committees 2014). Telehealth facilities are available in the majority of hospitals in NSW. The most commonly used Telehealth technology in New South Wales is video-conferencing (NSW Ministry of Health 2015).

In Victoria, Telehealth is run through the Rural Health Alliance across 40 sites (Parliamentary Committees 2014). There are many Telehealth projects which are planned to be implemented and which have been implemented in Victoria (State Government of Victoria n.d.).

Telehealth in Western Australia and South Australia is managed through individual hospitals. South Australia's Digital Telehealth Network has been primarily used for mental health, and more recently has been used for other clinical specialities, such as cardiology, cancer, rehabilitation, geriatric evaluation, plastic surgery, urology, speech pathology, management and palliative care services (Parliamentary Committees 2014; Government of Western Australia 2011).

Tasmania's Telecare Online Services network enables the support and delivery of health services via the use of video conferencing. The network covers a range of primary care services including wound management, diabetes education and support, specialist clinics, mental health, palliative care, and health professional support and education.

The Northern Territory's (NT) Telehealth services works with the Aboriginal Medical Services Alliance to enable video consultation into the NT Hospital network. The Network provides the following Telehealth services: Tele-Critical care, Tele-Gastro, pre-admissions clinics, Tele-Rheumatology, Tele-Renal, Tele-Oncology and Tele-Respiratory (Parliamentary Committees 2014).

Many Telehealth projects have been implemented in Queensland. Most of these Telehealth projects have demonstrated positive outcomes. In 2004, a trial of pre-admission consultations by Telehealth for regional patients was introduced in the Southwest Region of Queensland. This Telehealth pre-admission clinic model has been continued and introduced in other locations (Parliamentary Committees 2014). Between May 2004 and January 2008, a further 20 hospitals chose to participate in Telehealth pre-admission assessments.

The Townsville Cancer Centre project, implemented in 2007 has been accepted by patients and staff and has shown a positive impact in healthcare (Mooi et al. 2012). The Townsville Cancer Centre also proved to be financially beneficial showing yearly savings of $320,118.

The Cairns Diabetes Telehealth Centre was introduced in 2009, and has supported 365 video-linked consultations and continues to deliver Telehealth services.

Queensland Health's 'AUSCARE diabetic foot', which was implemented between August 2009 and February 2010 across six Queensland Health sites, has also reported that Telehealth use has improved patient outcomes.

The pre-admission clinic at the Toowoomba Base Hospital uses Telehealth services to conduct pre-surgery consultations with rural and remote surgical patients. Patients arrive at the recipient site 30 minutes before the teleconference so that the staff can take the necessary observations and send the results to the hospital.

The Royal Brisbane Women's Hospital (RBWH) Speech Pathology Telehealth Service supports the swallowing rehabilitation and communication management of head and neck cancer patients living in regional sites within the Central Integrated Regional Cancer Service area. The service covers four sites: RBWH, Nambour, Hervey Bay and Rockhampton.

The literature on worldwide Telehealth use and adoption indicates that, globally, Telehealth is widely adopted and advantageous in providing health services to remote areas. In the Australian healthcare context, Telehealth services are serving the remote areas and people are benefitting from them. However, creating a sustainable and profitable telehealth service model is still challenging in Australia. Using mobile devices these challenges can be reduced because mobile devices are the de factor method of communication and are becoming more powerful and secure. People are preferring to use mobile devices for health related activities which can make Telehealth viable and can reduce health facilities' costs. The Australian Government is in favour of using mobile devices in Telehealth. Still the use of these devices in Telehealth is slow (Bursell et al. 2013).

This research study is focussed on understanding the adoption of mobile devices in Telehealth, therefore the meaning of mobile devices is presented in the following sections.

2.3 Mobile Devices

The use of mobile devices in healthcare is termed as m-health. However, this research study is not using the term as it is not focused on understanding all components of m-health. m-health includes various components such as mobile devices, sensors and application software used in mobile devices (Istepanian 2014). This research study is focused on only one component of m-health, mobile devices, therefore to keep this research study understandable to the participants (HCPs) the term mobile devices is used instead of m-health.

Mobile devices in the HIT literature is defined as:

> *'Medical and public health practices supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices' (Heerden, Tomlinson & Swartz 2012, p. 392).*

Mobile devices in this research study is defined as:

> *'Any wireless device such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices which can be adopted by HCPs to provide Telehealth services' (Source: developed for this research).*

Mobile device based healthcare services are available globally and are shown to be benefitting the health domain. Mobile device based interventions are effective in helping people manage their health in areas such as diabetes, physical inactivity and smoking cessation (Whittaker et al. 2009; Ramirez et al. 2017). Mobile device based applications are also used in decision support systems (DSS) to assist healthcare providers and people with their health. Mobile device based healthcare has the potential to tackle the epidemics in diabetes and cardio-vascular diseases (CVDs); reducing the risk of such diseases in many countries (Shrivastava et al. 2017; Rehman et al. 2017a). Despite the widespread availability, usage and benefits of mobile devices, their adoption in healthcare is slow. In the next section, the meaning of adoption relevant to this research context is explained.

2.4 Adoption

Adoption is the mental process through which an individual goes before final adoption of an innovation. Innovation can be an idea, a product or service (Rogers 2003).

> *'Adoption, denotes the full use of an innovation as the best course of action available' Rogers (2003, p. 473).*

It is important to understand adoption because the use of any product or service depends on an individual's acceptance or adoption (Obstfelder, Engeseth & Wynn 2007).

The literature defines individual adoption of technology as follows:

> *'An individual's psychological state with regard to his or her voluntary or intended use of a particular technology' (Chau & Hu 2002b, p. 298).*

This research study defines technology adoption as:

> *'HCPs intention to use mobile devices in the real time Telehealth environment (Source: developed for this research).*

In the healthcare domain, various technologies are adopted. These technologies are adopted from two main perspectives: Individual and Organisational (Obstfelder, Engeseth & Wynn 2007; Hu, Chau & Sheng 2002). In the Individual perspective, technology adoption is considered from either patients' or HCPs' viewpoints. Some of the triggers of adoption of technology from an Individual perspective are: Intention, Attitude, Culture, Prior experience and Self-efficacy (Sarker, Urbaczewski & Wells 2002; Gagnon et al. 2012; Honka et al. 2011). On the other hand, from an Organisational perspective some of the triggers of technology adoption are Training, Availability of funds and Organisational policies (Brod, Tesler & Christensen 2009; Hu, Chau & Sheng 2002). These triggers indicate that the adoption of technology varies from one perspective to another.

This research study is based on understanding individual health professionals' perspectives as the success of technology implementation depends on its users

(Obstfelder, Engeseth & Wynn 2007). Further, in the health domain, HCPs are the main drivers for technology use and play a major role in adoption decision (Bernstein, McCreless & Cote 2007). However, while adopting technology, HCPs feel insecure and behave like Roger's group of late majority and laggards (Fox 2009; Slaper & Conkol 2014; Wu, Wang & Lin 2007; Wu, Li & Fu 2011; Rogers 2003; Milward et al. 2015). Rogers (2003) described five groups of people in the process of adoption of innovation: 1. Innovators, 2. Early adopters, 3. Early majority, 4. Late majority and 5. Laggards. Late majority (conservative) adopters are technology shy and cautious people who adopt innovation due to peer pressure and are motivated by their own needs. Laggards (sceptics) are the people who do not care about innovation or think that technology is an obstacle to various processes. Even though, the government is encouraging health professionals to use technology many clinicians still prefer face-to-face consultation (Parliamentary Committees 2014). Furthermore, government efforts to encourage technology use at the organisational level can be achieved if the technology is adopted at an individual level, as organisational adoption of technology depends on the individuals (Cellucci, Spil & Wiggins 2014; Hu, Chau & Sheng 2002). In the healthcare environment, HCPs are the main users of technology. Therefore, this research study is an attempt to understand the adoption of mobile devices from the individual health professionals' perspective.

HCPs in this research study are defined as:

> *'HCPs include but are not limited to doctors, nurses, oral health practitioners, speech pathologist, occupational therapists and management staff who are familiar with, or working in, the Telehealth environment' (Source: developed for this research).*

Individual's technology adoption is a complex phenomenon. An individual does not immediately use any new innovation, product or service. Before adoption, an individual goes through a sequence of five stages (Rogers 2003). These five stages are:

1. Awareness/knowledge

2. Persuasion/interest
3. Decision/evaluation
4. Implementation/trial
5. Confirmation/adoption.

During these stages the individual constructs unique perceptions about the technology which influences adoption. Unique perceptions about technology are constructed from-cognitive, emotional and contextual concerns which influence an individual's intention to adopt the technology (Straub 2009). If an individual perceives any innovation to be unsuitable, it will not be adopted as it may not be perceived as useful by an individual (Khoumbati 2009). To understand HCPs technology adoption behaviour, previous HIT adoption researchers used various theories. These theories have not originated in the health domain but are borrowed from other domains. Some of these theories used in the health information literature for explaining adoption of technology are outlined below.

2.5 Adoption Theories

In the healthcare domain, several theories/models are used to explain the behaviour of individuals regarding their adoption of technology. Some of the most common theories used in the health literature are: Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Usage (UTAUT) and Diffusion of Innovation (DOI). Their use is shown in Table 2.1.

Table 2. 1: Adoption theories used by HIT adoption researchers

No	Theory	Authorship and country	Participants	Technology used
1.	UTAUT	(Tiong et al. 2006) - Australia	Clinicians	Wireless technology
2.	TAM+TPB+DOI	(Mun et al. 2006) -USA	Physicians	PDA
3.	TAM+DOI	(Yangil & Chen 2007) -USA	Medical doctors and nurses	Smartphone
4.	TAM	(Wu, Wang & Lin 2007)	Medical directors and chief of information system	Mobile computing
5.	TAM+ TPB	(Wu, Li & Fu 2011) - Taiwan	Hospital's professionals	Mobile healthcare

Table 2.1 Continued from previous Page 25

No	Theory	Authorship and country	Participants	Technology used
6.	Usage and Gratification	(Saad, Alias & Ismail 2013) - Malaysia	People who use m-health portal	Telehealth (MyHealthPortal)
7.	Value Attitude Behaviour Model+	(Deng, Mo & Liu 2013) -China	Middle aged and older people	m-health
8.	TAM+DOI	(Wang, Park, Chung & Choi 2014)	Adults	Smart Health User applications
9.	UTAUT	(Liu, Miguel Cruz, Rios Rincon, Buttar, Ranson &	Therapists	New technology
10.	UTAUT	(Sezgin, Özkan-Yildirim & Yildirim 2016)	Physicians	m-health application
11.	Extended TAM	(Hoque 2016) -Bangladesh	Patients	e-health
12.	UTAUT + TAM	(Kim, Lee, Hwang & Yoo 2016)	HCPs'	Mobile electronic medical record
13.	UTAUT	(Hoque & Sorwar 2017) -Bangladesh	Elderly people	m-health
14.	DOI	(Lin & Bautista 2017) -Singapore	m-health application users	m-health application
15.	UTAUT	(Bawack & Kala Kamdjoug 2018)	Clinicians	Health Information System

TAM is one of the theories widely used in the HIT adoption literature to explain the adoption of technology, as shown in Table 2.1 (Benbasat & Barki 2007; Mun et al. 2006; Yangil & Chen 2007; Kim et al. 2016; Wu, Wang & Lin 2007; Wu, Li & Fu 2011). The constructs of TAM are given in Figure 2.2.

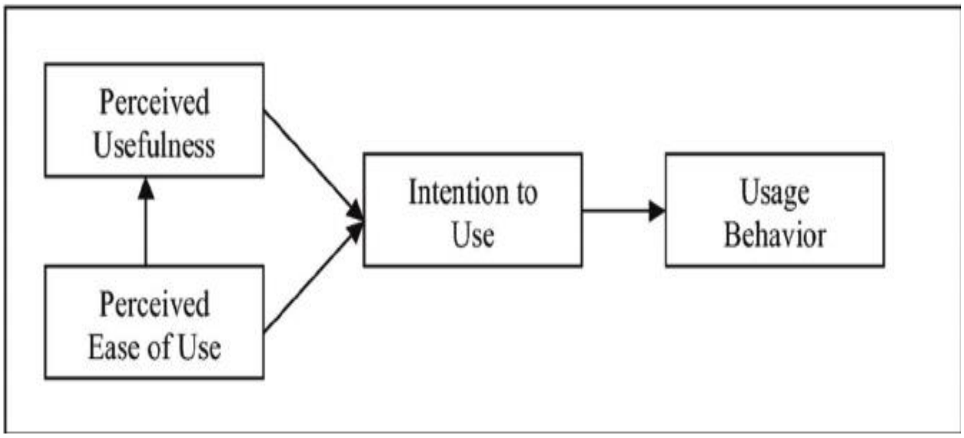

Figure 2. 2: Technology Acceptance Model

Source: Adapted from Davis (1989)

The two constructs, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), of TAM are believed to be the fundamental predictors that explain the adoption of various technologies (Moon & Kim 2001). However, independent use of TAM in the health information literature is rare. TAM is usually combined with other theories such as TPB and DOI to explain individual adoption of technology (Wu, Li & Fu 2011).

Consistent with previous literature, two constructs of TAM are important in this research, but these two constructs alone may not be able to present a complete picture of HCPs' mobile device adoption behaviour because individual adoption of technology is a socio-technical phenomenon and TAM cannot support this phenomenon. However, if TAM is combined with another adoption theory, then it may become a useful tool for developing an understanding of the adoption of mobile devices. In the HIT adoption literature TAM is usually combined with the TPB and the DOI theory.

TRA (as shown in Figure 2.3) is another theory used to explain individual technology adoption behaviour in general but it is rarely used in the HIT adoption literature.

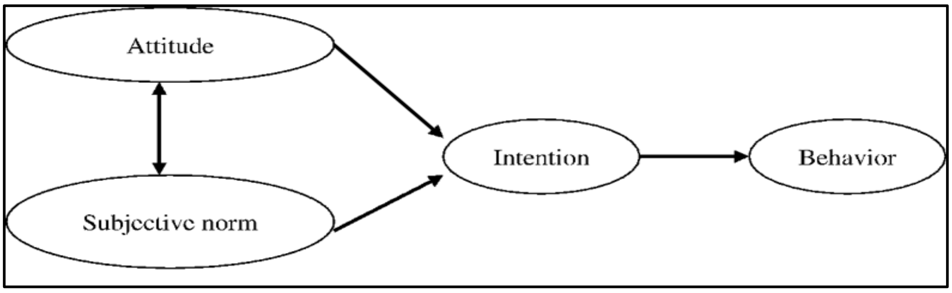

Figure 2. 3: Theory of Reasoned Action

Source: Adapted from Ajzen (1988)

TRA has two main independent constructs: subjective norm and attitude (Ajzen 1988). TRA may be useful for explaining the adoption of mobile devices because it covers the social-technical phenomenon. However, it does not explain the most important constructs: Perceived ease of use and Perceived usefulness of TAM. Therefore, it was determined that TRA would not be used as an underlying theory in this research.

TPB is a successor to TRA, and extends TRA by adding one more construct: 'perceived behaviour control' (Ajzen 1991). TPB states that behaviour intention is determined by three constructs: Attitude, Subjective norms and Perceived behaviour control as shown in Figure 2.4.

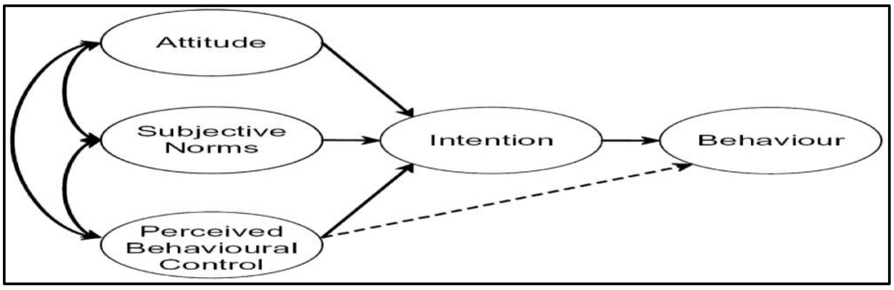

Figure 2. 4: Theory of Planned Behaviour

Source: Adapted from Ajzen (1988)

TPB can be used to explain the adoption of mobile devices in this research study as, similar to TRA, it covers the construct of social-technical phenomenon. However, similar to TRA, TPB overlooks the most important constructs of the TAM model. Still, it could be used as one of the underlying theories in this research study if combined with another theory of technology adoption as mentioned in the existing HIT adoption literature. In the existing literature, TPB is combined with TAM and DOI to explain technology adoption behaviour (Mun et al. 2006; Wu, Li & Fu 2011).

DOI is also recognised as one of the well-established theories used by previous HIT adoption researchers. DOI theory employs five attributes of technology adoption behaviour, as shown in Figure 2.5.

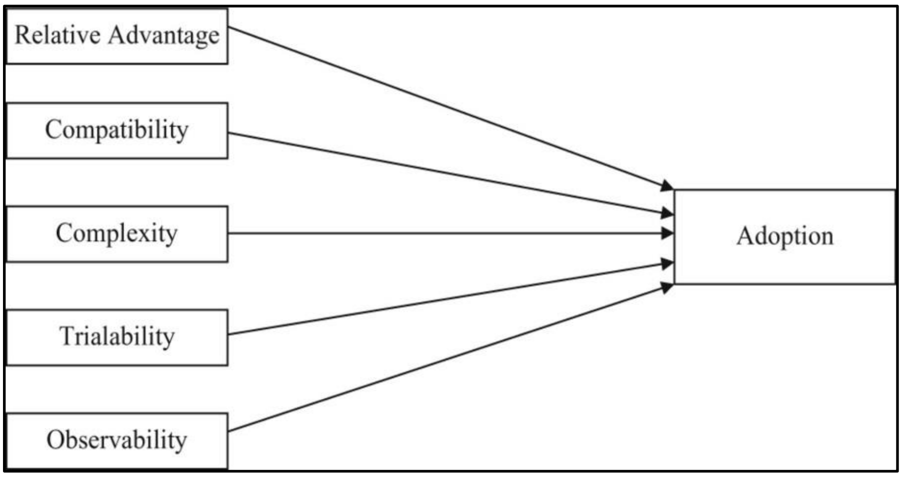

Figure 2. 5: Diffusion of Innovation Theory

Source: Adapted from Rogers (2003)

These five attributes are: 1. Relative advantages, 2. Compatibility, 3. Complexity, 4. Trialability/result demonstrability/reversible and 5. Observability/ visibility. DOI theory has the potential to explain the TAM's fundamental predictors of technology adoption, which are widely used in the HIT adoption literature to explain consumers' technology adoption behaviour (Mun et al. 2006; Wu, Wang & Lin 2007; Wu, Li & Fu 2011; Yangil & Chen 2007) and could be suitable in this research study context. The Relative advantages predictor is similar to PU, and the Complexity predictor is similar to PEOU (Wu, Wang & Lin 2007). DOI also has the potential to explain context specific attributes. In this research, context specific attributes can be useful for explaining mobile device adoption, as the primary aim of the health domain is to provide health services, and if the technology available is not aligned with the health processes, then health professionals may not feel inclined to use it. Therefore, DOI can be used as an underlying theory in this research.

Another very common technology adoption theory mentioned in the HIT adoption literature is UTAUT, which combines the previous eight models[2] of technology adoption and represents four constructs (Venkatesh et al. 2003), as shown in Figure 2.6.

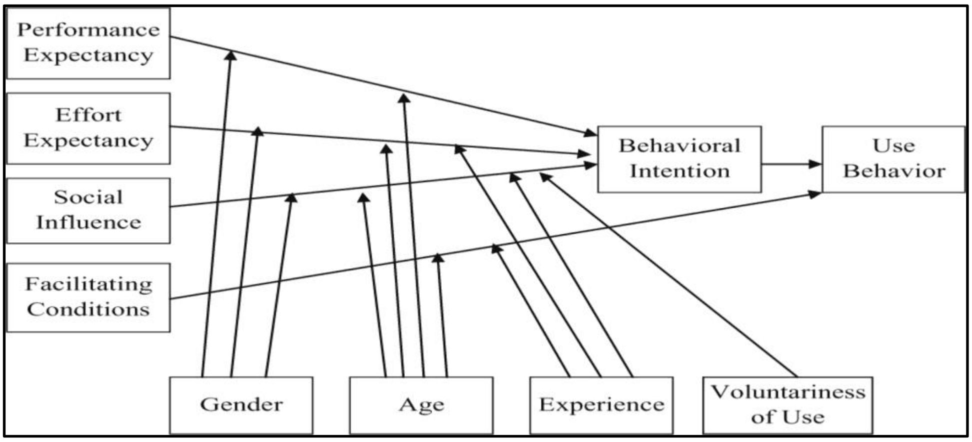

Figure 2. 6: Unified Technology Acceptance and Utilisation Theory

Source: Adapted from Venkatesh et al. (2003)

[2] Eight models used to develop UTAUT are: 1. TRA, 2. TAM, 3. Motivational Model (MM), 4. TPB, 5. Combined TAM and TPB, 6. Model of PC utilization (MPCU), 7. DOI and 8. Social Cognitive theory. Venkatesh, V, Morris, MG, Davis, GB & Davis, FD 2003, 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, vol. 27, no. 3, pp. 425-478.

Its constructs are: 1. Performance expectancy, 2. Effort expectancy, 3. Social influence and 5. Facilitating conditions. Even though UTAUT includes the fundamental predictors of performance expectancy and effort expectancy of technology adoption and has been used by previous researchers to explain m-health adoption, it does not explain any context specific technology adoption constructs (Bawack & Kala Kamdjoug 2018) which are important to research context. Also, this theory is not considered adequate for technology adoption from the individual perspective (Bawack & Kala Kamdjoug 2018). Therefore, UTAUT is unsuitable for this research.

After exploring the available technology adoption theories used in the HIT adoption literature and analysing their suitability for this research, it is found that using one theory alone is not sufficient to explain individual technology adoption behaviour. Using one single underlying theory will explain either the healthcare context or individual context related predictors. Therefore, there is a need to combine two or more theories to develop a deeper understanding of the adoption of mobile devices, as this research study seeks to do.

TPB and DOI are used as the two underlying theories to provide a base for this research study. These theories provide a foundation for understanding the research problem from two viewpoints- the Individual context and the Usage context. TPB and DOI, either jointly or separately, have been used by previous researchers in the health domain for understanding the adoption of various types of technology (Andrews, Tonkin, Lancastle & Kirk 2014; Cellucci, Spil & Wiggins 2014). DOI can explain the Usage context specific predictors and TPB has the potential to explain the Individual context predictors such as Perceived behaviour control/self-efficacy/confidence to use technology. DOI on its own or in combination with other theories such as TPB is used by previous health researchers to understand the individual technology adoption behaviour for various types of technologies such as m-health adoption, PDA adoption and telemedicine technology adoption (Perkinset al. 2007; Wu, Li & Fu 2011; Chau & Hu 2002b; Armitage et al. 1999; Casper 2007; Mun et al. 2006). Therefore, TPB and DOI are considered the most appropriate underlying theories of this research study.

Two predictors, Trialability and Observability of DOI, are considered unimportant in this research study as mobile devices are not provided to health professionals on a trial basis, thus enabling the observation of their adoption behaviour. Further, two factors of TPB namely, attitude and actual behaviour, are not studied in this research context. Attitude is a weak predictor of behaviour intention to use technology (Wu, Wang & Lin 2007), and is unsuitable in this research study. Actual behaviour is not studied because this research study is about understanding perceptions and experiences of HCPs for mobile devices adoption in Telehealth, and some of the HCPs may not be using them in their current job.

In this research, understanding mobile technology adoption using TPB and DOI may provide insights into the Individual and Usage context but may not provide a complete overview as these theories provide no information about the Technological context. Including Individual and Usage context, Technological context is also an important theme to understand in this research study because if HCPs face any technical difficulty in using such devices, the chances of HCPs adopting them will be significantly reduced. Therefore, for developing a complete understanding of mobile devices adoption in this research study context, there is a need to review literature on use of the mobile device adoption.

2.6 Mobile Device Adoption in Healthcare

Globally, the use of mobile device technology in healthcare has produced a mixed impact. For example, on the one hand this technology provides access to information, a network to share and a method for tracking symptoms or measurements, thereby promoting patient engagement and improving communication between physicians and patients. On the other hand, HCPs are of the opinion that they can face the dependability problem, as they might feel the need for technical support while using such technology (Cinque, 2013). Further, the use of technology (such as mobile devices) in healthcare may create security risks due to malware, phishing, loss of data due to equipment malfunction and causing distractions for HCPs (Testa, 2015; Cinque, 2013; Gaggioli 2012). However, the advantages of using technology outweigh the disadvantages.

A tabular summary of worldwide mobile devices based health services (as presented in Appendix 2.1 on Page 324),indicates that mobile devices based health services are used for various purposes, are capable of catering for the healthcare needs of fast growing global populations and are benefiting the health domain. The outline of some of these mobile device based health services is presented in the following paragraphs.

The Indian government launched various nationwide m-health initiatives under the Digital India Program on 15th January 2016. These initiatives are the ‘Kilkari’, ‘Mobile Academy’, ‘M-Cessation’ and ‘TAB Missed Call’. These programs are used for sending messages to the beneficiaries, toll-free number services and training health workers (Ahamed et al. 2017). The ‘Sankara Electronic Remote Vision Information System programme (SERVIS)’, a mobile device intervention for preventing blindness in rural areas of India, has demonstrated significantly positive results in eye screening programs after the introduction of an android based tablet application in place of the standard manual documentation used with screening tools (Imtiaz et al. 2017).

In Bangladesh, mobile devices are being used to provide telemedicine services and pregnancy care advice via SMS (Hoque & Sorwar 2017). A study conducted in Bangladesh evaluated the effectiveness of the online m-health application, ‘Blood Information Management Application (BIMA) system’, reducing lag time in the blood transfusion process. It was observed that after the introduction of BIMA, the time lag between the identified need for blood and blood transfusion was reduced by 24 minutes (Rahman et al. 2017).

In Sub-Saharan Africa, mobile device based health interventions are contributing to improving the care and treatment of patients with non-communicable diseases (NCDs). In many Sub-Saharan African nations’ health facilities, an inadequate stock of essential medicines remains a major challenge. ‘SMS for Life’ is one of the m-health programs which was highly successful in eliminating malaria by managing the supply of medicine in three health facilities in the rural districts of Lindi, Ulanga and Kigoma in Tanzania during its pilot study in 2009 (Borish & Forbes; Barrington et al. 2010). Another systemic review study from 2003 to 2013 in the African healthcare context reveals that m-health initiatives are mainly used for patient follow ups, medication adherence, and are extremely limited in other areas such as disease surveillance and intervention monitoring (Aranda-Jan, Mohutsiwa-Dibe & Loukanova 2014).

A randomised controlled trial in Sri Lanka indicated that mobile device based interventions can reduce suicide cases (Marasinghe et al. 2012).

A randomised controlled trial conducted in the Netherlands is expected to demonstrate that the mobile device based health program, Smart Pregnancy can improve nutrition and life-style in couples contemplating pregnancy (Van et al. 2017).

In America, mobile devices such as iPads and iPhones are used to provide high quality health care services (Castro, D. 2014). In the UK, according to statista.com, mobile sleep health applications positively impacted people's health and wellbeing in 2015.

The Australian, New Zealand and British Dietetic Association reported that the use of mobile devices health apps in dietetic practice was high but mobile devices were not an integral component of dietetic practice (Chen et al 2017). In the Australian healthcare context, most of the mobile device based studies are conducted on the implementation of application software on mobile devices. Most of these studies have been conducted on a pilot basis and through randomised control trials (Tsai & Kong 2013; Chow et al. 2015). These studies indicate that mobile communication in the Australian healthcare system has proven satisfactory outcomes (Worringham, Rojek & Stewart 2011; Lu & Wu 2015; Bort-Roig et al. 2014; Shand et al. 2013; Tay et al. 2017; Chow et al. 2015). However, the Australian literature is limited for understanding adoption of mobile devices in healthcare. Most of the pilot randomised control trials (mentioned in the literature) ran for six months to one year but information on further adoption is unavailable. Therefore, it is important to understand the adoption of mobile devices in the Australian healthcare sector.

The HIT adoption literature indicates that a number of countries, including Australia, have m-health initiatives at the pilot stage or currently underway. However, there is little published material on adoption of mobile devices based on these initiatives (Sobnath et al. 2017). Mobile devices are not currently being used to their full potential in healthcare (Rehman et al. 2017a; Tian et al. 2017; Chen et al. 2017). They are mainly used for text messages, reminders for using health applications, patient follow ups, medication adherence and guidelines, creation of health call centres responding to patient enquiries, education, calendar and diaries, reminder and symptom tracking (Aranda-Jan, Mohutsiwa-Dibe & Loukanova 2014; Sobnath et al. 2017; Chen et al. 2017). The use of mobile devices has the capacity to reduce barriers such as time and distance. Patients can be contacted using Interactive Voice Response (IVR) (Soron 2017). However, the use of mobile devices in many Telehealth activities such as telemedicine, telepsychiarty, patients' records, treatment and patient monitoring is low (Soron 2017; Zapata et al. 2015; West 2012). The Australian government health departments (especially Queensland Health), are in favour of using mobile solutions because they offer a cost effective service delivery (Parliamentary Committees 2014). Some of the clinicians in the Australian public health sector also want to access the Telehealth network on their personal devices. Some sites in the Australian healthcare domain are using iPads for videoconferencing but these are limited in number as most HCPs still prefer face-to-face consultations (Smith et al. 2012). Thus, the factors which influence mobile device adoption in healthcare need to be explored.

In the HIT adoption literature, there are limited research studies explaining adoption of mobile device factors in healthcare. Therefore, in the next section the research studies indicating various HIT adoption factors are explained.

2.7 Adoption Factors

In the healthcare environment, a number of factors influence technology adoption (Kay 2011; Tomlinson et al. 2013; Morilla et al. 2017) but these factors are rarely based on understanding mobile device adoption in healthcare. Still, these factors can be used for providing an overview to design an initial conceptual framework in this research study.

A list of these factors to explain the adoption of technologies is provided in Appendix 2.2 on Page 329. These factors can be broadly classified into the following four categories:

1. Individual context
2. Usage context

3. Technological context
4. Organisational context.

The first context is Individual context. This context includes certain characteristics or traits of an individual that influence his or her behaviour towards the adoption of technology. Many research studies into healthcare technology adoption have been conducted from the Individual's context. These studies are conducted from either the patients' perspective or from the HCPs' perspective. The studies conducted from the patients' perspective indicate that perceived value, attitude, perceived behaviour control, resistance to change, technology anxiety, self-actualization needs, user friendly design, relevant technology and technology values are some of the factors which influence individual technology adoption (Shareef, Kumar & Kumar 2014; Wang et al. 2010; Deng, Mo & Liu 2013; Hoque & Sorwar 2017). The patient perspective is outside the scope of this research, therefore factors given from the patient's perspective may not be helpful to explain the technology adoption from the individual healthcare professional's (HCPs) perspective. The research studies conducted from individual HCPs' perspective of adoption of technology indicate that Intention, Self-efficacy and Social influences are some the most common factors influencing their adoption behaviour. As this research study understands mobile device adoption from individual HCPs' perspective, the most common factors given in this context can be used to design the initial conceptual framework.

The second context is Usage context. This context defines the usage characteristics of technology in the healthcare environment. The HIT literature discusses various factors in this context. Some of the most common factors in this context are: Relative advantages, Complexity and Compatibility. These most common factors given in this context can be used to design the initial conceptual framework because the individual interaction with the use of technology influences its adoption.

The third context is Technological context. This context explains the technical characteristics considered essential and significant by the user who is considering technology use in the health domain. The literature provides a number of factors related to the Technological context. Some of the most common factors in this context are: Design and Technical concerns and perceived privacy and security. These most common factors given in this context can be suitable to design the initial conceptual framework because the health domain is a lifesaving domain and if HCPs experience any difficulty with technological features, their perception for technology adoption will be low.

Organisational context deals with organisational functions and responsibilities and how these influence the adoption of technology. For the organisational context, the literature provides a number of factors influencing technology adoption (Tamrat & Kachnowski 2012; Haffey, Brady & Maxwell 2013). Some of these factors are: Policies, Professional agendas, Hospital size, Hospital location, Availability of the necessary equipment, Human resources and Training (Castro, Miller & Nager 2014; Gagnon et al. 2005; Peddle 2007). As this research study is based on understanding the adoption from the Individual HCP's perspective, factors from the Organisational context of technology adoption remains out of scope for this research. The remaining three contexts may be used to understand adoption of mobile devices in the healthcare environment.

Previous studies have explored many factors explaining technology adoption from the Individual, Technological and Usage contexts and the most common factors found are: Intention, Self-efficacy, Social influences, Relative advantages, Compatibility, Complexity, Design and technical concerns, Privacy and security. These factors may be used in this research study. However, these factors may not fully explain mobile device adoption as these were explored in countries such as USA, UK, Canada, New Zealand, Taiwan, Korea, Pakistan, Bangladesh, India and The Netherlands (Wang et al. 2010; Bradford et al. 2014; Deng, Mo & Liu 2013; Daim, Basoglu & Topacan 2013). Further, these studies were conducted for various types of technologies such as Telehealth, e-health and m-health and not specifically for explaining the adoption of mobile devices. Mobile device adoption research studies are limited and applied to mobile devices that are now obsolete (Yangil & Chen 2007; Andersen et al. 2009; Garritty & El Emam 2006).

As mobile devices are a part of m-health, the literature review has also been conducted to gain insights into the adoption factors associated with m-health. The factors associated with m-health adoption have been identified through research focussed on non-Australian healthcare contexts such as South-East Asia, Turkey, America, Europe, Western Pacific, Africa, Canada and UK (Sezgin, Özkan-Yildirim & Yildirim 2016). These research studies in non-Australian healthcare contexts can give an idea of how mobile devices are adopted in healthcare but may not be fully relevant for exploring the adoption of technology in the Australian healthcare context because of the differences in the countries' healthcare contexts. Furthermore, previous research studies on the adoption of m-health may not be fully applicable to this research study context because m-health includes various components such as application software used in mobile devices, which are not within the scope of this study. Moreover, previous studies seeking to explain the adoption of technology in healthcare have mainly used the survey method, which cannot fully explore the adoption factors. The actual experiences of health professionals regarding technology use can be most effectively investigated using qualitative methods and can be validated through quantitative methods.

In the Australian healthcare context, only a few studies have been conducted to explain the factors influencing the adoption of various types of technologies from the individual HCP's perspective (Tiong et al. 2006; Hafeez-Baig & Gururajan 2010; Tsai & Kong 2013). As with the international research outlined above, these studies alone may not be sufficient to understand the adoption factors of mobile devices in this research study context due to their wider scope and the studied technology being obsolete (Tiong et al. 2006; Hafeez-Baig & Gururajan 2010; Tsai & Kong 2013). However, the adoption factors identified in these studies may help to bring out the most influential factors to be used in designing this study's initial conceptual framework.

In the next section, explanations of the various gaps in the existing literature relevant to this research study are described.

2.8 Gaps in Literature

Globally, the use of mobile devices is increasing but their adoption in the healthcare environment is slow (Wu, Li & Fu 2011; Kay 2011; Fox 2011; Slaper & Conkol 2014; Milward et al. 2015).

In a scientific statement from the American Heart Association (AHA) on consumer use of mobile health for Cardio Vascular Disease (CVD) prevention, it was stated that mobile technologies have the potential to provide the information required to counsel and motivate individuals to engage in behaviours that prevent CVD. However, the use of mobile technology is not an integral part of the current CVD prevention process (Chen et al. 2017).

Further, (as discussed earlier in this chapter), most m-health projects are implemented on a pilot basis and the output of these projects are largely unknown. Tamrat and Kachnowski (2012) claimed that the sustainable adoption of prenatal and neonatal m-health services remains under-developed worldwide. According to a World Bank report, even after the implementation of 500 m-health pilot projects in various countries, the uptake, best strategies for engagement, efficacy or effectiveness of initiatives are still unknown (Qiang et al. 2011).

Furthermore, there is a wide range of mobile device based applications in the Google Play store, iTunes store and on the Internet. These mobile device based technologies and apps are being used in clinical trials for managing particular medication conditions and risk factors with promising results (Chen et al. 2017). Still, most of the mobile devices based applications are not standardized, have not been rigorously tested, are being used for short durations and their future adoption has not been reported in the literature (Gaggioli 2012; Burke et al. 2015). Moreover, in the healthcare context, effective communication and coordination is important for improving collaborative care delivery among different healthcare providers. The integration of mobile devices into healthcare has the potential to improve collaborative care delivery in the live environment using IVR and video conferencing (Soron 2017). However, globally in healthcare, mobile devices are mainly used for text messaging, emails, maintaining diaries, reminders, symptom tracking, viewing inpatients lists, viewing the alerts and accessing patients' clinical data (Rehman et al. 2017b; Triantafyllidis et al. 2015; Kim et al. 2016). Despite the potential benefits of mobile devices, their use in many Telehealth activities such as telemedicine, Telepsychiatry, patients' treatment and monitoring is slow (Soron 2017; Zapata et al. 2015).

The videoconferencing features of mobile devices in the Australian healthcare context can be applied as a cheaper solution to improve teleconsultation. Even after videoconferencing implementation in Australia, the majority of consultations are still conducted face-to-face (Smith et al. 2012). Clinicians argued that claims made by m-health companies need a government stamp of approval before they can be considered for clinical use (Gee 2015). Even after this government approval mobile device use is not increasing. The Queensland Health department is in favour of using mobile devices in Telehealth, but they are mainly used for text messaging patient alerts and for using certain interventions (Parliamentary Committees 2014; Chow et al. 2015). Despite significant government efforts, the use of mobile devices in healthcare remains slow (Hebden et al. 2013; Shand et al. 2013; Willcox et al. 2015; Hebden et al. 2014; Clarke et al. 2014).

The HIT adoption literature offers various factors to explain the adoption of technology in healthcare but the findings so far are insufficient to explain the adoption of mobile devices in this research study context. Most research studies into the adoption of mobile devices focussing on m-health are wider in scope than this study and are not particularly focussed on mobile devices adoption in Telehealth (Furukawa et al. 2008; Wang et al. 2010; Singh et al. 2012; Zinszer et al. 2013; Daim, Basoglu & Topacan 2013; Deng, Mo & Liu 2013; Westbrook et al. 2008). Further, the quantitative method is the dominant method used in an attempt to explore technology adoption factors from an individual perspective (Yangil & Chen 2007; Wu, Wang & Lin 2007; Kim & Garrison 2008; Wu, Li & Fu 2011; Sanders et al. 2012; Singh et al. 2012; Deng, Mo & Liu 2013; Thomas, Yao & Guo 2014; Karahanna, Straub & Chervany 1999). However, in the quantitative research methodology, individuals cannot freely express their thoughts and ideas and real factors may not be explored. Furthermore, most of the previous studies on HCPs' adoption of technology are conducted in countries such as USA, UK, Canada, New Zealand, Taiwan, Korea, Canada, and the Netherlands. As cultural differences influence the adoption of technology in the healthcare environment (Peddle 2007; Tiong et al. 2006; Ackerman et al. 2010), these studies cannot be fully applied to the Australian healthcare context due to the cultural differences and different countries' healthcare contexts (Furukawa et al. 2008; Saad, Alias & Ismail 2013; Heidarian & Mason 2013; Singh et al. 2010; Gagnon et al. 2005; Yangil & Chen 2007; Wu, Wang & Lin 2007; Kim & Garrison 2008; Castro, Miller & Nager 2014).

In the Australian healthcare context, there is limited literature addressing the adoption of technology, and this literature is rarely based on the adoption of mobile devices (Hafeez-Baig Abdul & Raj, 2010; Tsai & Kong, 2013; Tiong et al. 2006)). The studies based on m-health in the Australian healthcare context are mainly conducted on trial bases for observing the impact of various health applications used in mobile devices. These studies indicate that the applications developed for mobile devices are benefitting people, but the subsequent adoption of these applications is not discussed in the literature. Therefore, the existing literature appears to be insufficient to explain the adoption of mobile devices in this research study context.

This study's research question, derived from the identified literature gaps, is explored in the next section.

2.9 Research Question

Most previous studies indicate that the mobile devices adoption process is slow in the healthcare industry. Also, many research studies indicate that mobile devices offer great patient care potential but are used on a voluntary basis for email, text messages and sending reminders to patients. Further, mobile device use in Telehealth activities such as real time consultation, is very low. Further still, although previous studies have presented a wide variety of technology adoption factors, previous research may not be fully applicable in this research study context because of the different countries' healthcare contexts, different technology adoption, the out-dated nature of the research studies, varying scope of research and dominance of the quantitative only methodology (Wu, Li & Fu 2011; Wu, Wang & Lin 2007; Yangil & Chen 2007; Brown III et al. 2013; West 2012; Shareef, Kumar & Kumar 2014; Sezgin, Özkan-Yildirim & Yildirim 2016). Moreover, it is evident that most studies conducted for m-health adoption in healthcare attempt to provide various factors but cannot provide any satisfactory theoretical framework. Also, most studies in the Australian healthcare context, are based on pilot and randomised control trials and there is limited published research on future adoption subsequent to the pilot period. Therefore, this research study is designed to understand the use of mobile devices in healthcare focusing on the following research question:

> *What factors influence the adoption of mobile devices in the healthcare environment from the health care professional's perspective?*

This research study is mainly focused on developing an integrative conceptual framework using a comprehensive approach (literature review and sequential mixed method) to explain HCPs' intentions for the use of mobile devices in Telehealth.

As mentioned earlier, many factors influence the adoption of a particular technology in the health environment. Although all of the factors mentioned in the existing literature may not be fully applicable to this research study context, some of them are used to design the initial conceptual framework. The development of an initial conceptual framework and justification for including some of the factors in the initial conceptual framework are given in the next section.

2.10 Initial Conceptual Framework

The initial conceptual framework provides the foundation upon which this research study proceeds further (Chau & Hu 2002a). The initial conceptual framework proposed in this research study was developed considering the three themes and nine factors as below:

1. Individual (health professionals) context
    a. Intention (Tan 2013)
    b. Technology readiness (Caison et al. 2008; Parasuraman 2000; Hafeez-Baig, Gururajan & Wickramasinghe 2018)
    c. Self-efficacy (Tan 2013)
    d. Social influences (Tan 2013)

e. Demographic factors (Age and Experience) (Zhao, Ni & Zhou In Press; Nair & Dreyfus 2018; Bawack & Kala Kamdjoug 2018)

2. Usage context
    a. Relative advantages (Tan 2013)
    b. Complexity (Tan 2013)
    c. Compatibility (Tan 2013)

3. Technological (mobile devices) context
    a. Functional features (Gagnon et al. 2016).

An initial conceptual framework for the adoption of mobile devices from the perspective of individual HCPs is developed in this chapter as shown in Figure 2.7.

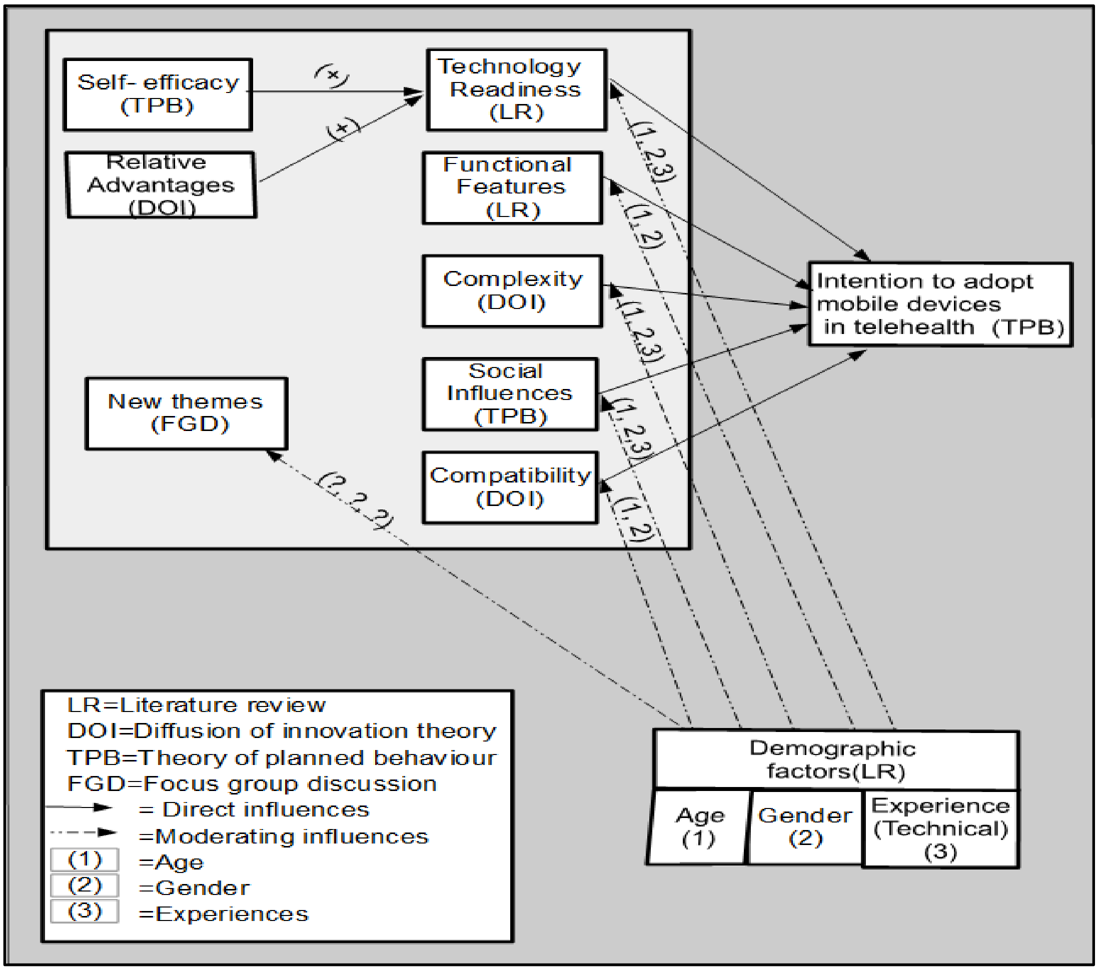

Figure 2. 7: An Initial conceptual framework

Source: Adapted from Sood et al. (2016) with some modifications

The proposed initial conceptual framework does not include the Organisational context related factors because they are out of the scope of this research study topic as this research study is based on an Individual health professional's perspective of technology adoption. Consequently, in this research, the Organisational context has a limited impact on participants' technology adoption decisions.

The first theme, the Individual context was considered important to the initial conceptual framework design as individual HCPs are the main users of technology in the healthcare system. HCPs may exhibit different characteristics from other technology users because their domain is time sensitive and critical and, in most instances, they have to make their own decisions to adopt technology. The Individual's context theme refers to:

> *'Health professionals' characteristics influencing the adoption of mobile devices in Telehealth' (Source: developed for this research).*

In the Individual context, the focus was to identify the essential individual healthcare professional's characteristics, which can influence the adoption of mobile devices in Telehealth. The five factors proposed in Individual context are: 1. Intention, 2. Technology readiness, 3. Self-efficacy, 4. Social influences and 5. Demographic factors (Age, Gender and Experience).

Of these five factors:

- Two factors, Technology readiness and Demographic factors, were chosen from the literature review on adoption of technology in healthcare
- The remaining three factors, Intention, Self-efficacy and Social influences, were selected from the TPB.

The second theme, the Usage context, was considered important because if technology usage is not aligned, too complex and not beneficial with the Healthcare context then HCPs may not be interested in adopting it.

The Usage context theme refers to:

> *'The suitability of mobile devices to the Telehealth environment' (Source: developed for this research).*

The Usage context focuses on important usage characteristics of the technology in underlying clinical task. HCPs prefer technology which can help them perform clinical work efficiently. The technology needs to be compatible and easy to use with the clinical work processes and with their style of working. In the Usage context the three factors considered from DOI are:

1. Relative advantages
2. Complexity
3. Compatibility.

These factors were chosen from the DOI theory.

The third theme, the Technological context was considered important for developing the initial conceptual framework because the healthcare domain is primarily concerned with the health of a person and technology used should have good supporting features. If HCPs struggle while using technology in the clinical environment their intention for adoption will be low. The Technological context theme refers to:

> *'The functional features of mobile devices influencing usage and adoption in the Telehealth environment' (Source: developed for this research).*

HCPs are qualified to treat patients and are generally not interested in how technology is performing a task (the engineering and programming components of the technology). They are concerned with how accurately, easily and conveniently they can complete their task with the use of technology. Therefore, the Functional features embedded in the mobile device that HCPs are using to perform a task become the most important features. For example, Ben-Zeev et al. (2013) developed a smartphone system FOCUS for the self-management of Schizophrenia. During the testing of this system, it was found that individuals were facing problems while using it and these problems arose mainly due to Functional features such as smaller touch space, small diameter of the buttons, smaller touch sensitivity abbreviations, large amounts of text, difficult wording and font size. This shows that mobile devices should have features sensitive to the needs and demands of the healthcare domain, which HCPs can easily understand and operate in real clinical situation. Therefore, the most critical factor considered in the Technological context after reviewing the HIT adoption literature, is Functional features.

Thus, nine factors classified into three themes (Individual context, Technological context and Usage context) are considered the most likely to deliver a good understanding of the adoption of mobile devices and to design the initial conceptual framework in this research study. All other factors explored in the HIT literature for technology adoption in healthcare are excluded for the following reasons:

- Some of the factors such as self-actualisation needs and observability in the field of mobile device adoption in the healthcare have been investigated in the existing limited studies from the patient perspective and have been found to be unsuitable for this research topic
- The role of some factors, such as perceived value and cost remain unclear for understanding the adoption of mobile device technology in healthcare
- Many factors have similar meanings but are represented with different names. For example, Self-efficacy was closely related to perceived behaviour control, and individual confidence. Performance expectancy is similar in meaning to Relative advantages. These types of factors with similar meanings but a different name were considered as one factor and the same.

Each factor considered for the development of the conceptual framework in this research, is operationalised. Factor/construct operationalisation is a process of achieving clear and practical meanings for the factors/constructs of the chosen context. It includes an agreed definition of the factors/constructs from the literature, clear meaning of the constructs and the identification of key concept properties which can describe the constructs (Ayers & Olander, 2013; Bhattacherjee et al. 2007). The factors considered under each theme were operationalised further.

1. Intention

In this study, Intention refers to:

> *'The measure of the likelihood of using mobile devices in the healthcare environment' (Source: developed for this research).*

The successful use and adoption of technology requires user Intention (Lyzwinski et al. 2017). Intention to adopt technology in healthcare has a major influence on individual behaviour as it is influenced by many other factors (Ajzen & Fishbein 1980). The role of Intention as one of the dependent factors has been well established not only in healthcare but also in Information Systems in general. Therefore, Intention is considered as a dependent variable in this research study (Tavares & Oliveira 2016). Figure 2.7 depicts all the independent variables assumed to be influencing individual intention for the adoption of mobile devices in healthcare.

2. Technology readiness

In this research, Technology readiness refers to:

> *'An individual health professional's ability to embrace and adopt mobile devices in the healthcare environment' (Source: developed for this research).*

Technology readiness is a factor that has emerged from previous studies into the adoption of new technologies (Caison et al. 2008). The Technology readiness construct can be viewed as an overall state of mind resulting from a gestalt of mental enablers and inhibitors that collectively determine a person's predisposition to use new technologies (Tsourela & Roumeliotis 2015). Therefore, it is important to consider Technology readiness factors in the initial conceptual framework.

Technology readiness is influenced by positive feelings towards the advantages offered by technology or the negative feelings of being overwhelmed (Parasuraman 2000). Advantages offered by technology may trigger positive feelings and help the individual to adopt technology, while an individual's lack of confidence in using technology may make them unwilling to use it. Thus, the positive influence of Relative advantages and Self-efficacy/confidence on Technology readiness is proposed to explain each individual HCP's adoption of mobile devices in this research study context.

Age, Gender and Experience have a moderating effect on Technology readiness for the adoption of technology (Caison et al. 2008). Usually young male adults consider themselves more tech- savvy (Xue et al. 2012; Lim et al. 2011). Caison et al. (2008) found that young male HCPs and medical students show great curiosity technology use. Therefore, it can be proposed that men are more self-efficacious compared to women, and that they are more ready to adopt mobile devices in Telehealth than women. Hence, the moderating effect of Age, Gender and Experience on Technology readiness can be studied and hypothesised as below:

H1: The influences of Technology readiness on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience, such that the effect will be stronger for older individuals, particularly females who are inexperienced in the use of technology.

3. Self- efficacy

Self-efficacy in this research study refers to:

> *'The individual's confidence in his/her own capabilities and strength to use mobile devices in the healthcare environment'*
> *(Source: developed for this research).*

According to TPB, the level of technology adoption exhibited by an individual may also be influenced by their perceived behaviour control/self-efficacy/confidence to use it (Tan 2013). The literature mentions that knowledge and familiarity with technology and its previous use enhances the Self-efficacy and has a direct positive influence on an individual's Intention to adopt technology (Yangil & Chen 2007; Wu, Li & Fu 2011). This research study is investigating the indirect positive impact of Self-efficacy on Intention through Technology readiness.

H2: Technology readiness for the adoption of mobile devices in healthcare will be positively influenced by an individual's Self-efficacy towards the use of these devices in healthcare.

4. Social influences

In this study, Social influences is defined as:

> *'The influences of the social circle on individuals' adoption of mobile devices in the healthcare environment' (Source: developed for this research).*

Social influences/subjective norm has a great influence on individual adoption of innovation and is considered by previous studies to be one of the essential constructs (Wu, Li & Fu 2011; Tiong et al. 2006; Mun et al. 2006). TRA and TPB theories of technology adoption have also mentioned social norm as an important construct for technology adoption (Mun et al. 2006; Tan 2013). Social influences are an important factor in this research study context because HCPs consider the opinions and suggestions of their peers and may be influenced for or against the use of mobile devices in health care (Mun et al. 2006). This indicates a direct influence of the Social influences factor on Intention and hence is represented in the initial conceptual framework.

Social influences are moderately affected by Age, Gender and Experience. Women prefer more social interactions compared to men and, as a result, they are more likely to listen and follow the opinion of their friends and co-workers (Liu & Guo 2017). It has been observed that elderly people with less experience in technology are easily influenced by their friends and peers (Lim et al. 2011; Morris & Venkatesh 2000; Venkatesh et al. 2003). Thus, it is hypothesized that Social influences are moderated by Age, Gender and Experiences.

H3 The influence of the Social influences on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience such that the effect will be stronger for women, particularly older women who have less experience with technology.

5. Demographic factors

In this study, Demographic factors refers to:

> *'An individual health professional's age, gender and technical experience' (Source: developed for this research).*

Demographic factors are included in this research study because these factors are known to impact on health related technology acceptance (Zhang et al. 2017; Bawack & Kala Kamdjoug 2018). The literature suggests that a person's physical and psychological activities change as their age and experience increases (Zhao, Ni & Zhou In Press; Kim 2008; Nikou 2015), and that these changes indirectly influence intention for technology use in healthcare. The literature also suggests that in some cultures men are more dominant, interact more with technology and consider themselves more tech savvy (Caison et al. 2008; Lim et al. 2011; Xue et al. 2012) which may indirectly influence Intention to adopt mobile devices in healthcare. Demographic factors are included as moderating[3] variables because this research study is based on understanding individual HCPs' experiences and perceptions, and moderating variables can be used in research studies which focus on understanding individual behaviour and experiences (MacKinnon 2011). The moderating influences of Age, Gender and Experience are considered in this research.

6. Relative advantages

In this study, Relative advantages refers to:

> *'Benefits of using mobile devices in the healthcare environment' (Source: developed for this research).*

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[3] A moderating variable is a variable that modifies the strength of the relationship between an independent and a dependent variable MacKinnon, DP 2011, 'Integrating mediators and moderators in research design', *Research on Social Work Practice,* vol. 21, no. 6, pp. 675-681.

According to DOI and the literature on technology adoption in healthcare, Relative advantages positively impact the individual Intention to adopt technology (Lyzwinski et al. 2017; Wu, Li & Fu 2011; Wang et al. 2010; Tan 2013). Many researchers have studied the direct influence of Relative advantages on individual Intention to adopt technology (Mun et al. 2006; Gagnon et al. 2012). This research study is investigating the indirect influence of Relative advantages on Intention through the Technology readiness factor because Relative advantages trigger positive feelings which influence an individual's Technology readiness, to adopt technology and as is hypothesised below:

H4: Technology readiness for the adoption of mobile devices in healthcare will be positively influenced by Relative advantages offered by mobile devices in the healthcare process.

7. Complexity

In this study, Complexity refers to:

> *'The degree of difficulty associated with the use of mobile devices in the healthcare environment' (Source: developed for this research).*

In the healthcare environment, the adopted technology should make the healthcare process more convenient (Wu, Li & Fu 2011). If HCPs experience any difficulty operating such technology in clinical settings, their Intention to adopt will be weak. Complexity has the opposite meaning of 'perceived ease of use' which has been mentioned by previous researchers for understanding the adoption of technology, and it is one of the important factors of DOI theory. Consistently, in this research study the direct influence of Complexity on behaviour Intention is considered.

Age, Gender and Experience have a moderating effect on Complexity. In the healthcare domain, various other technologies are also used and users' Age, Gender and Experience with these technologies can influence an individual's Intention to adopt technology (Venkatesh et al. 2003; Tsourela & Roumeliotis 2015). Technically experienced individuals find it easy to use technology. Further, different age groups have specific moderating effects on technology adoption (Zhao, Ni & Zhou In Press; Bawack & Kala Kamdjoug 2018). The 'gender gap' has also been at the forefront of technology adoption (Bugler, McGeown & St Clair-Thompson 2015; Tsourela & Roumeliotis 2015), therefore it can be hypothesised that Complexity in the operation of mobile devices in Telehealth processes is moderated by Age, Gender and Experience and this influence is more important for older inexperienced women:

H5: The influence of Complexity on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience such that the effect will be greater for older inexperienced women.

8. Compatibility

In this study, Compatibility with the clinical practices refers to:

> *'The alignment of mobile devices with HCPs' practice styles and clinical processes' (Source: developed for this research).*

HCPs are so accustomed to a particular style of practice that they are unlikely to accept a technology unless it is perceived to be compatible with their practice style or preferences (Chau & Hu 2002a). The described effect is also supported by existing literature and DOI theory (Chau & Hu 2002a; Xue et al. 2012). Therefore, the direct influence of Compatibility on Intention is also proposed in the initial conceptual framework.

Age and Gender have a moderating effect on Compatibility. Generally, elderly people are resistant towards the use of technology, but if technology is compatible with their work processes then it may change their mind-set towards technology adoption (Xue et al. 2012). In the healthcare environment, HCPs' technology choices depends on their clinical role, the nature of clinical tasks and the degree of mobility (Andersen et al. 2009). For example, HCPs may require mental rotation ability to explain a patient's condition. Roberts and Bell (2000, p. 200) defines the mental rotation task as the ability to reposition 2D or 3D objects on screen. Young males have been found to be more efficient performers of mental rotation tasks than their female counterparts. Therefore, it is considered that Age and Gender have a moderating effect on Compatibility with the clinical process for adoption of mobile devices.

H6: The influence of Compatibility on Intention to adopt mobile devices in healthcare will be moderated by Age and Gender such that the effect will be stronger for older women.

9. Functional features

In this study, Functional features refer to:

> *'The general features of mobile devices which can influence an individual's Intention to adopt them in the healthcare environment' (Source: developed for this research)*.

Existing literature mentions that technology characteristics such as screen size, file format and layout influence the adoption of technology in healthcare settings (Coiera & Magrabi 2015; Gagnon et al. 2016; Kim & Shyam 2014). It is important to study the impact of Functional features of mobile devices because, if the features of technology are supportive and favourable to the individual HCP's needs, the Intention to adopt will be positive.

Functional features of technology should be tailored according to the target groups, indicating that this factor is moderated by Demographic factors. Young people consider themselves more tech savvy (Lyzwinski et al. 2017). Besides Age, Gender differences also play an important role in adopting technology. Generally, men are more tasks oriented and, if the technology used has favourable features capable of helping users achieve their goals, they can be encouraged to use the technology in the work place. In contrast, women in some cultures are considered less dominant, as they are less involved with the technical or office work which consequently affects their interaction with technology. Thus, it can be inferred that the moderating effect of Age and Gender on mobile devices' Functional features may impact more on older women compared to older men.

H7: The influence of Functional features on the Intention to adopt mobile devices in healthcare will be moderated by Age and Gender such that the effect will be stronger for older women.

10. Other factors

Other factors refers to:

> *'Additional factors that can be included in the conceptual framework after qualitative data analysis' (Source: developed for this research).*

Other factors will represent those factors which are considered insignificant or left out while developing the initial conceptual framework. These factors are hidden factors, which are not yet known at this stage of the research but will be explored, as the research progresses.

These factors will be included after conducting the Qualitative Phase in the refined conceptual framework and represented in the qualitative data analysis in Chapter 5. They will be validated in Quantitative Phase 2 and presented in Quantitative data analysis in Chapter 7.

2.11 Conclusion

In this chapter, an in-depth analysis of the literature was conducted to explore the gaps in the literature regarding the adoption of technology in healthcare and an initial conceptual framework is proposed. The in-depth analysis of the HIT literature revealed a number of gaps. Based on these gaps, a research question and an initial conceptual framework have been developed. In the initial conceptual framework, nine factors have been proposed to explain the adoption of mobile devices. These nine factors are: 1. Intention, 2. Technology readiness, 3. Self-efficacy, 4. Social influences, 5. Demographic factors (Age, Gender and Experience), 6. Relative advantages, 7. Complexity, 8. Compatibility, and 9. Functional features. These factors have been developed after reviewing the HIT adoption literature and are further confirmed and tested using the Qualitative and Quantitative Phases discussed in Chapters 5 and 7. In the next chapter, the research methods and suitability of Qualitative and Quantitative Phases and their implementation is explained.

Chapter 3

Research Methodology

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

In the previous chapter, the gaps in the literature were explored. This chapter explains the research methodology used to fill those gaps and is divided into nine main sections as shown in Figure 3.1.

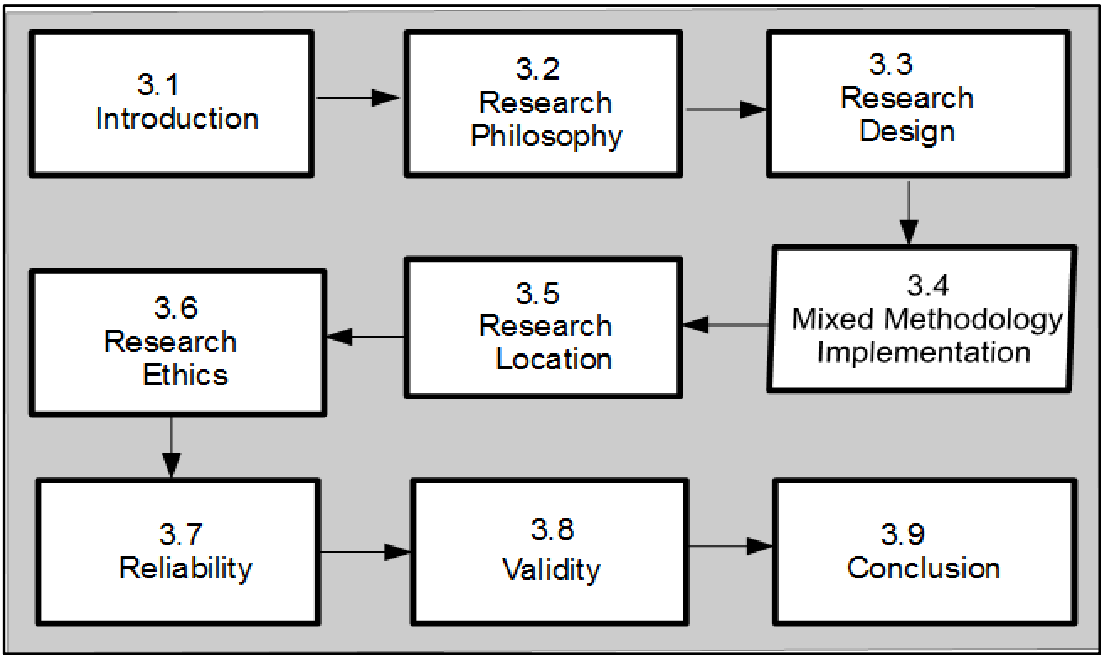

Figure 3. 1: The outline of Chapter 3 on research methodology

Source: Developed for this research

Section 3.1 introduces the chapter. Section 3.2 explains the research philosophy used in this research. Justification for the research design and its implementation is presented in Sections 3.3 and 3.4 respectively. Sections 3.5 and 3.6 describe the research location and research ethics. Sections 3.7 and 3.8 address research reliability and validity. Finally, the chapter's conclusion is presented in Section 3.9.

3.2 Research Philosophy

Research philosophy is an approach used to discover answers for research problems based on researchers' understandings of truth. These truths come from a combination of worldviews such as epistemological stances, shared beliefs among members of a speciality area and a model representative of the research (Morgan 2007; Guba & Lincoln 1982). The relevant disciplines, research advisors and past experiences influence worldviews. Research philosophy guides researchers to conduct research in the real world, using one's own knowledge and experiences, and the knowledge and experiences of others (Creswell 2008; Saunders, Lewis & Thornhill 2012; Morgan 2007; Collis 2009). In other words, research philosophy helps researchers decide on qualitative, quantitative or mixed method research design (Creswell 2008).

The Information System (IS) literature offers three main types of research philosophies:

1. Pragmatism
2. Positivism (Objectivism)
    a. Positivism
    b. Post positivism
3. Subjectivism
    a. Critical realism
    b. Interpretivism.

A detailed explanation of each philosophy is given in Table 3.1.

Pragmatists believe that truth is constructed in the mind of individuals as well as the external world independent of individuals (Saunders, Lewis & Thornhill 2012; Collis 2009). It always occurs in social, historical and other contexts (Creswell 2008). Pragmatist researchers try to use the best possible methods for the solution of problems instead of focussing on subjective or objective truth.

Table 3. 1: Comparison of various research philosophies

Assumptions	Pragmatism	Objectivistic (Positivism)	Subjectivistic	
			(Critical Realism)	(Interpretivism)
Epistemology	Research is either or both subjective and objective phenomena. Research is focussed on adductive approach (Feilzer 2010)	Research is pure observational (subjective), a phenomena that is free from researchers own values, interest, purpose and psychological schemata (Howe 1988). Research is focussed on prior formal propositions, quantifiable measures, hypothesis testing and drawing of inferences and thus uses inductive approach (Klein and Myers 1999)	Research is based upon the social critiques which leads to insufficient and misunderstanding of data (Saunders, Lewis & Thornhill 2012; Klein & Myers 1999).	Research is subjective observation and social phenomena (Ngwenyama & Lee 1997). Here researcher tries to understand phenomena through the meaning that people assign to them (deductive approach) (Orlikowski and Baroudi 1991)
Ontology	The nature of reality in research can be both single (objective) or multiple (subjective) realities that are used to answer research question(s) (Saunders, Lewis & Thornhill 2012).	Here reality is single (objective) and independent of social factors.	Reality is single (objective) and constructed through our senses when we experience reality and critically analyse in our mind.	Realities are multiple (subjective) and socially constructed.
Axiology	Research is both value free and value laden and both biased and unbiased (Collis 2009).	Research is value free and unbiased (Collis 2009). Researcher is independent of data and using objective view.	Research is value bound. Researcher is part of what is being researched.	Research is value laden and biased. Researcher is biased by world, culture and upbringing.
Methods used	Mixture of qualitative and quantitative approach (Denscombe 2008).	Generally used with quantitative approach but not compulsory (Onwuegbuzie & Leech 2005).	Both qualitative and quantitative methodology can be used according to the suitability of the subject.	Small sample, in-depth investigation and qualitative methodology is used (Saunders, Lewis & Thornhill 2012; Howe 1988)
Rhetoric (What is the language of research?)	Here researcher uses both formal style and informal style of writing, passive voice and active voice accepted, quantitative word and set definition accepted, and qualitative style and limited definitions are also accepted.	Researcher writes in a formal style and uses the passive voice, accepted quantitative words, and set definitions (Collis 2009).	Here researcher uses critical language of writing style. It can be both formal and informal writing style.	Researcher uses informal style of writing and uses the personal voice, accepted qualitative terms and limited definitions (Collis 2009).

Objectivists believe that there is one truth, which comes from direct or indirect observation. Objectivists have two viewpoints: Positivism and Post positivism. Positivists believe that whatever knowledge is needed to solve a research problem comes from observation and is ‘the truth’. Positivism focuses on prior formal propositions, quantifiable measures, hypothesis testing and the drawing of inferences (Klein & Myers 1999). On the other hand, post positivist researchers believe that as we learn more we come closer to ‘the truth’. Hence, post positivists remain uncertain about the reality.

Subjectivists try to understand phenomena through the meaning that people assign to the phenomenon (a deductive approach) (Orlikowski & Baroudi 1991). Subjectivism is further divided into two categories: Critical realism and Interpretivism. Interpretivists believe that the truth is constructed in the mind of the individual. People who follow the critical theories believe that truth is under the control of powerful people.

Research philosophy choice should be based upon the research question(s), philosophical assumptions and the researchers’ understanding of the research process (Saunders, Lewis & Thornhill 2012). In philosophical assumptions, researchers should understand ontology (the nature of knowledge used to solve research problems), epistemology (from where that knowledge is coming) and axiology (the role and values of the researcher in selecting a suitable research philosophy) (Singh 2015). A detailed discussion of the three components of the research philosophy, epistemology, ontology, and axiology and how they support the selection of a suitable research philosophy in this research study is provided below.

Epistemology

Epistemology deals with questions on how the researcher understands what he/she knows and how this knowledge can be used to solve research problems. The literature indicates that this knowledge can be understood in four different ways (Ethridge 2004; Saunders, Lewis & Thornhill 2012). These are:

1. Traditionalism

2. Subjectivism
3. Objectivism
4. Pragmatism.

Traditionalists believe in already established knowledge as a basis for understanding research problems and their solutions. Traditionalists think the solution can be obtained by understanding previous literature reviews because this is established knowledge. The adoption of mobile devices in healthcare is a new concept, so understanding previous knowledge about the adoption of various kinds of technology in the healthcare domain can provide an initial conceptual framework but may not reveal all the true factors. Therefore, this research study cannot be completely understood depending only on the literature (traditional knowledge).

Subjectivists believe that the knowledge required to solve research problems is socially constructed and comes from the individual's interpretation of mind (Saunders, Lewis & Thornhill 2012). In this research, it appears that subjectivistic epistemology can be partially applied because the factors considered for the development of the initial conceptual framework can be confirmed from the participants, analysed/interpreted by the researcher using his/her own senses, and based on analysis and the interpretations of participants' responses, the initial conceptual framework can be refined. Even though the factors considered in the initial conceptual framework can be confirmed using subjectivistic epistemology, they cannot be validated at this point due to the need for further quantifiable data, which can be supported in objectivistic epistemology.

Objectivists believe that truth is one, and that it is objective in nature (Saunders, Lewis & Thornhill 2012). In this research, objectivistic epistemology can be used to validate the factors considered after the Qualitative Phase.

Pragmatists believe that truth is constructed in the mind of the researcher as well as in the external world, which is independent of the researcher. Pragmatists believe that research always occurs in social, historical and other contexts (Creswell 2008). Thus, there are many ways to interpret the truth (Saunders, Lewis & Thornhill 2012). Pragmatists' knowledge appears to be more suitable in this research study compared to objectivism and subjectivism as with the help of pragmatism, the truth can be understood from various dimensions such as technical, HCPs and the health environment, and can be analysed and interpreted by the researcher based on the participants' views.

Ontology

The suitability of the pragmatic research philosophy for this research study is also supported from the researcher's ontological belief. Ontology refers to the belief concerning the nature of reality. Ontology can be understood in three different ways: subjectivism, positivistic and pragmatic (Saunders, Lewis & Thornhill 2012).

Using only one type of belief, either subjective or objective, is not fully satisfactory for this research study. Subjectivists believe that there are many realities which are constructed socially. If the adoption of mobile device factors is investigated using only a subjective belief then the real factors may not be revealed as some introverted participants may not express their views (Collis 2009). On the other hand, if only the objectivists' beliefs is used to investigate factors in this research, real factors may remain hidden because different individuals have different perceptions and experiences about the adoption of mobile devices in healthcare. Thus, objectivistic ontology restricts this research study to the Quantitative Phase and subjectivistic ontology restricts it to the qualitative Phase. Pragmatists believe in both observational and subjective truth, which seems suitable to this study and leads to selection of a mixed methodology (Feilzer 2010).

Axiology

Axiology refers to belief in the values of research: what is good, right and important. Axiology is concerned with the role of value (Collis 2009). Positivists believe that the process of research is value free (Saunders, Lewis & Thornhill 2012). Positivists believe they are independent from the research they are doing. Subjectivists think that research is value laden and that they are part of the research. Pragmatists think they can be value free or value bound depending upon the research situation.

In this research, the researcher holds both value free and value bound thoughts. In the qualitative Phase, the researcher is a part of the research because there is a need to be actively involved in the research process to collect subjective responses from the participants. In the quantitative Phase, the researcher is value free and not a part of the research because the participants can complete the survey without the researcher's intervention. Therefore, this research study employs both active and passive researcher' roles thus supporting a pragmatic research philosophy.

As mentioned above the suitability of the pragmatic research philosophy in this research study can be justified on the basis of epistemological, ontological and axiological stances. Further to achieve the aim of this research study the initial conceptual framework has to be designed from the literature and refined further. Developing the initial conceptual framework from the literature and further refining it is called framework synthesis/analysis (Rabiee 2004; Houghton et al. 2017), and pragmatic philosophy supports framework synthesis (Houghton et al. 2017). This research philosophy also a favours mixed method research design. In the next section, detailed explanations concerning the suitable research design for this research are given.

3.3 Research Design

Research design is the plan for solving a research problem. It specifies and plans for data collection, analysis, results interpretation, challenges and ethical issues (Saunders, Lewis & Thornhill 2012). In the IS, three main types of research design are used. These are:

1. Qualitative
2. Quantitative
3. Mixed method.

Qualitative research is often useful for exploring people's individual experiences (Andrew & Halcomb 2007), whereas, quantitative research design is useful for the generalisation of the findings (Andrew & Halcomb 2007).

Mixed method research is a combination of both qualitative and quantitative research designs.

The selection of a suitable research design is important as it impacts on the nature of the study and its results (Joslin & Müller 2016). Many authors have suggested that the selection of the research design depends upon the purpose of the research study/question/problem (Venkatesh et al. 2003; Venkatesh, Brown & Bala 2013; Andrew & Halcomb 2007). Saunders, Lewis and Thornhill (2012) note that philosophical assumptions, research approaches, time horizon, data collection and analysis strategies are all parameters to be used in the selection of a suitable research design, as shown in Figure 3.2.

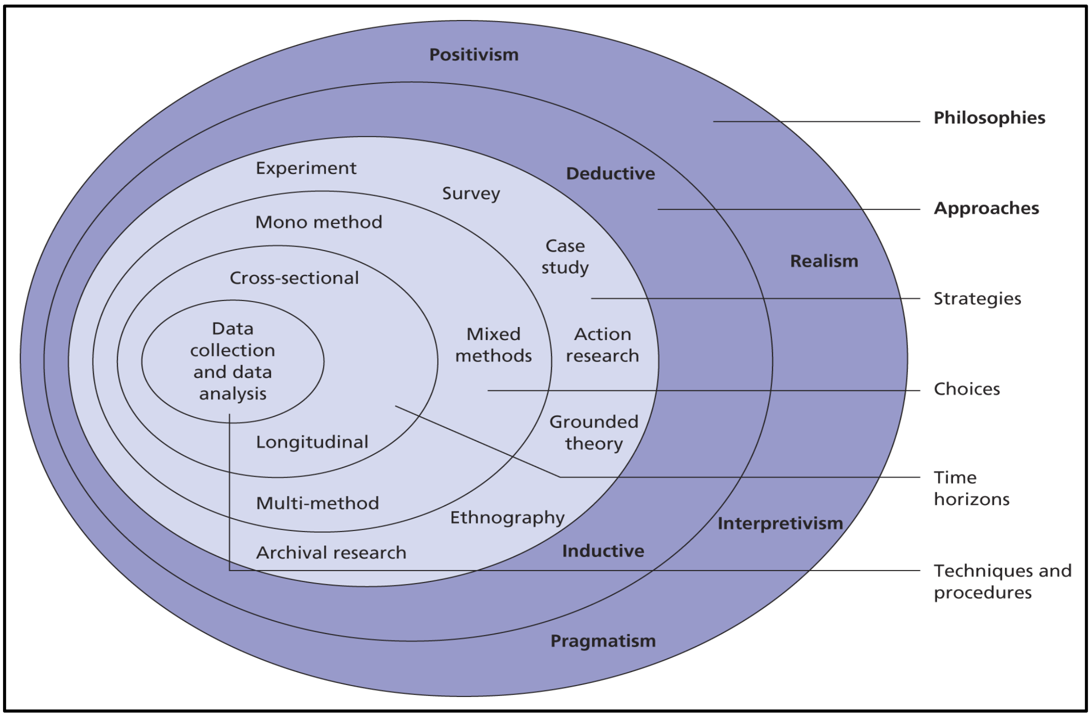

Figure 3. 2: Research onion to select a research design

Source: Adapted from Saunders, Lewis & Thornhill (2009)

Joslin and Müller (2016) indicated that usually, researchers adjust research questions or problems to the research design with which they are familiar, reducing the chances of obtaining variance in results. This leads to predictable results. Therefore, the research design should be selected to fit with the research questions /problem and not vice-versa.

Research Design in Healthcare

In various HIT adoption research studies, researchers have used qualitative, quantitative and mixed methodology research designs as shown in Appendix 3.1 on Page 332 (Holtz 2011; Gururajan et al. 2014; Gururajan et al. 2013; Bhattacherjee et al. 2007; Creswell et al. 2011; Mun et al. 2006; Karahanna, Straub & Chervany 1999; Deng, Mo & Liu 2013; Singh et al. 2010; Peddle 2007; Tiong et al. 2006; Bradford & Rickwood 2014; Zinszer et al. 2013; Lyzwinski et al. 2017).

Bradford et al. (2014) used semi-structured interviews to explore clinicians' perceptions of technology adoption. Singh et al. (2010) considered Telehealth as an innovation and conducted 25 interviews to investigate the factors influencing the adoption of Telehealth in Georgia from the manager's perspective. Deng, Mo and Liu (2013) used the survey method to explore the factors influencing middle aged and older users' adoption of m-health. The concept of understanding adoption of mobile devices in healthcare is an emerging concept. Therefore, the researcher may gain some insight into the factors influencing adoption of this technology in the healthcare environment using the qualitative research design. However, there is a further need to confirm such factors using a quantitative research design.

Many researchers in the HIT adoption literature have also used the quantitative research design (Wu, Li & Fu 2011; Wu, Wang & Lin 2007; Deng, Mo & Liu 2013; Karahanna, Straub & Chervany 1999; Kim & Garrison 2008; Singh et al. 2012; Thomas, Yao & Guo 2014; Sofaer 1999). However, quantification of the research is only possible if prior work on conceptualisation and operationalization of the concepts is available (Sofaer 1999), making it incomplete in this research study.

Various health domain researchers have also preferred a mixed methodology. Heidarian and Mason (2013) used mixed methodology to analyse the adoption of HIT in New Zealand. Furthermore, in the same year Daim, Basoglu and Topacan (2013) and Saad, Alias and Ismail (2013) used the mixed method research design for understanding the adoption of HIT in Turkey and Malaysia respectively. In the Australian healthcare domain, few researchers have used a mixed method research design to understand the adoption of various technologies (Hafeez-Baig & Gururajan 2010).

The concept of understanding the adoption of mobile devices in healthcare is a new concept. Although, the adoption of mobile devices in healthcare is an emerging concept, the researcher may gain some (but insufficient) understanding of the factors influencing adoption of this technology in the healthcare environment using the quantitative research design. As a result, further study is required to explain the adoption of mobile devices in the Australian healthcare context due to the newness of this research topic, which can be fairly understood using a mixed methodology. The detailed justification for the suitability of the mixed method research design is provided in the next section.

Research Design in this Research

The suitability of a mixed method research design in this study can be justified on the basis of philosophical assumptions, its suitability to the study's aim, and reliability and validity of the research.

The first reason for the selection of a mixed method research design is the philosophical assumptions. The philosophical assumptions say that generally qualitative research design is suitable for the subjectivistic epistemology, quantitative research design is suitable for the objectivist philosopher and a mixed method research design is suitable for pragmatists (Cameron 2011; Mkansi & Acheampong 2012). This research study is using pragmatic research philosophy therefore mixed method research design is a suitable research design in this research.

Secondly, a mixed method research design is suitable for achieving the research aim. The aim of this research study is to investigate factors influencing adoption of mobile devices in healthcare and to develop a conceptual framework. To achieve this aim, the researcher initially understands the factors from the previous literature, which is called initiation process (Teddlie & Tashakkori 2012). The breadth and depth of understanding of the HCPs' perceptions and experiences of the use of mobile devices can be achieved through the use of qualitative research design. The information obtained from the HCPs in the qualitative research design can help to provide rich descriptions of the phenomenon (Andrew & Halcomb 2007; Sofaer 1999). This rich information can be used to refine the initial conceptual framework developed from the literature and this process can be called a developmental process of the conceptual framework. This rich information can also help to provide meaningful quantities when designing the survey questionnaire/s which are used in the Quantitative Phase to validate the factors (Sofaer 1999). As the joint use of both qualitative and quantitative research designs are suitable for achieving the aim of this research, a mixed method research design appears to be suited to the production of reliable and valid research results (Greene, Caracelli & Graham 1989; Klassen et al. 2012; Onwuegbuzie & Johnson 2006).

Thirdly, due to the limited amount of literature available on this research topic, it is considered appropriate to understand this research using mixed method research design. This is because new concepts require rich and in-depth information for better understanding of the topic. Studying a new concept using only one research design may jeopardise a complete understanding of the subject matter and research validity and reliability may suffer. The mixing of methods and use of both qualitative and quantitative research design can overcome the drawbacks of the sole application (Venkatesh, Brown & Bala 2013).

Further, the researcher also agrees with Teddlie and Tashakkori's (2012) perspective where nine core characteristics[4] of the mixed method gives the freedom to choose various qualitative and quantitative research design techniques which enhances the reliability and validity of the research. Teddlie and Tashakkori (2012) Eclecticism, Iterative cyclical approach and Paradigm pluralism provides flexibility to the

[4] 1) Methodological eclecticism 2) Paradigm pluralism, 3) Iterative, cyclical approach to research, 4) Set of basic "signature" research designs and analytical processes 5) Focus on the research question (or research problem) in determining the methods employed within any given study 6) Emphasis on continua rather than a set of dichotomies 7) Emphasis on diversity at all levels of the research enterprise 8) Tendency toward balance and compromise that is implicit within the "third methodological community" and 9) Reliance on visual representations (e.g., figures, diagrams) and a common notational system Attended scientific writing workshop.

researcher. The first core characteristic offers the freedom to choose appropriate techniques for data collection, data analysis and results interpretation. The second characteristic allows the researcher to use both approaches (inductive and deductive) and the researcher can start from either theory building to hypothesise testing or vice-versa. The third characteristic also gives the flexibility to use both qualitative and quantitative approaches.

From the above justifications, based on philosophical assumptions, suitability to the research topic and objectives, it appears that a mixed method research design is suitable for use in this study as it provides flexibility to the researcher and increases the validity and reliability of the research. A detailed discussion on how validity and reliability is ensured in this research study design is provided in Sections 3.7 and 3.8.

3.4 Mixed Methodology Implementation

Mixed method research designs can be implemented using one of the following strategies:

1. Conversion
2. Parallel/concurrent
3. Sequential
4. Fully mixed method.

In the conversion strategy, data conversion occurs either by transforming qualitative data into numerical form or converting quantitative data that can be analysed qualitatively (Onwuegbuzie & Johnson 2006). In this research, the conversion of data does not occur, therefore this strategy is not suitable for the implementation of a mixed method research design.

In the concurrent strategy both the quantitative and qualitative data are collected separately at approximately the same point in time and neither the qualitative data analysis nor the quantitative data analysis builds on each other during the data analysis phases. Also, the results from each type of analysis are not consolidated at the data interpretation stages until both the qualitative and quantitative data have been analysed separately. Further, Meta inferences are drawn which integrates the inferences made from the separate qualitative and quantitative data findings (Onwuegbuzie & Johnson 2006). A concurrent mixed method research design strategy is not suitable in this research study because the findings of the Qualitative Phase are used in the Quantitative Phase.

In a sequential mixed method research design strategy, data collected from one Phase of the study is used to inform the other Phase of the study and data analysis begins before all the data is collected. Also in sequential design, multiple approaches to data collection, analysis and inferences are employed in a sequence (Onwuegbuzie & Johnson 2006; Gelo, Braakmann & Benetka 2008; Venkatesh, Brown & Bala 2013; Creswell 2008).

> *'If the objective of a research effort is to understand employees' reactions toward a new type of IS and the researcher expects to develop a set of new factors, the researcher can take a sequential approach'* Venkatesh, Brown and Bala (2013, p. 38).

In this research, the objective is to understand mobile devices adoption in healthcare, which is a new type of IS concept. To understand this concept the researcher has to develop an initial conceptual framework by reviewing the literature, which is then refined using Qualitative Phase as there are chances of discovering additional factors (Dubé & Paré 2003). The results of Quantitative Phase helps to further validate the refined conceptual framework by providing a deeper understanding of the factors. Thus, a sequential mixed method research design is suitable in this research.

A fully mixed method research design strategy requires a mixing of qualitative and quantitative approaches in an interactive way at all stages (Onwuegbuzie & Johnson 2006), which may increase the complexity of this research study.

In this research, a sequential mixed method design is implemented in two Phases. The first Phase is Qualitative and second Phase is Quantitative.

3.4.1 Phase 1: Qualitative

The main objectives of the Qualitative Phase are to refine the initial conceptual framework developed from literature, and to obtain meaningful constructs to design the survey questionnaire (Sofaer 1999). To achieve these aims various parameters considered in this Phase are explained further.

Phase 1 Data Collection Techniques

A variety of qualitative data collection techniques can be observed in the literature. These techniques are conversations, word association, sentence completion, observation, focus group discussions and individual interviews.

The conversation technique can produce only a little information about the topic of research (Creswell 2013). Semi-structured types of conversation usually come in a written form and can put extra stress on the participants and may not bring enough information to develop an understanding of the use of mobile devices in this study as many people find it difficult to give their responses in written form.

Free association, like word association, sentence completion and collages techniques are often used in combination with certain other techniques (Creswell 2013). These techniques lack a probing quality and may not give participants sufficient time to think and express their experiences and perceptions as required in this research study context. The observation technique of qualitative data collection is not suitable because the researcher is not observing HCPs while they are using mobile devices in the real environment.

Focus group discussion is an unstructured interview technique where a small group of participants discuss the topic of research (Zikmund & Zikmund 2013a). In focus group discussion more and more information can be obtained on a research topic (Nahar et al. 2017). As little information is available in the literature on this research topic, the focus group discussion technique appears to be suitable. However, in focus group discussions, in-depth experiences of HCPs' mobile device use may not be obtained, as some people may not wish to express their real experiences in front of their colleagues.

Interview technique is the fully structured technique, which has the capacity to bring out in-depth experiences of health professionals. Interviews provide privacy and are helpful in bringing out the information from those participants who do not like to express themselves in the presence of others. However, it is difficult to get rich information using this technique.

After considering the merits and demerits of qualitative data collection techniques, a joint interview and focus group discussion appears suitable for the collection of the qualitative data in this research study. The interviews technique is less superficial, and used to generate in-depth information from individual respondents, whereas the focus group discussion technique is used to obtain rich information (Rabiee 2004; Kai-Wen 2014). Collecting rich information is important in this research study because understanding the adoption of mobile devices in healthcare is a new concept and the focus group discussion technique can provide more and more information on this research topic. Focus group discussions have been used to examine a wide range of health and medical-related issues, including people’s attitudes toward smoking, second-hand smoking, professional responses to change management arrangements and developing ways to improve medical education and professional development (Glantz & Jamieson 2000; Ivanoff et al. 1996; Wong 2008; Randle, Mackay & Dudley 2014).

Although the environment in the focus group discussion remains very relaxed and may provide rich information on the research topic, it may bring only surface information as some of the participants may not wish to share their complex experiences in a group. In comparison to the focus group discussions, interviews are fully structured and help bring out the in-depth experiences of the health professionals as they allow the researcher to probe for more information and clarification (Louise Barriball & While 1994). In the health literature, interviews are conducted for various purposes such as identification of barriers for successful implementation of electronic psychological assessment tools (Starr et al. 2013). For collecting qualitative data, joint focus group discussions and interviews are also supported by previous researchers (Turner III 2010; Powell & Single 1996). Both techniques are considered suitable for qualitative data collection in the health domain (Sofaer 1999; Gill et al. 2008). Interview is a more structured technique for qualitative data collection while focus group discussion is a naturalistic and flexible technique for data collection (Hirsch et al. 2013; Kai-Wen 2014; Randle, Mackay & Dudley 2014). Therefore, considering the comparative advantages of both focus group discussion and interview techniques, using them together is considered an ideal data collection technique in the Qualitative Phase of this research study.

Phase 1 Data Collection Format

An examination of the HIT adoption literature reveals that interview and focus group data is usually collected in audio and video format. This data may take the form of photographs, art objects, videotapes, or any form of sound (Creswell 2008; Zikmund 2010).

In this study, the researcher seeks to understand participants' responses for the use of mobile devices by conducting interviews and group discussion sessions which can be recorded using the audio recorder, so video recording is not required. Video recording may make participants self-conscious and limit their willingness to share their real experiences.

Phase 1 Sample and Sample Size

A research sample is a representative of the target population. From the target population, a sample of participants is selected as representatives of the target population. To understand any research problem a careful selection of a research sample is necessary as selection of irrelevant sample may challenge the research results. In this research, the target population is HCPs which includes, but is not limited to, general practitioners, physicians, nurses, oral health practitioners, speech pathologists and occupational therapists who are working in or are familiar with the Telehealth environment and have some knowledge and experience of mobile device use in healthcare.

The criteria for the selection of participants in this research study are given in Table 3.2.

Table 3. 2: Participants inclusion and exclusion criteria

Participants inclusion criteria	Participants exclusion criteria
HCPs who are working in or are familiar with the Telehealth environment are included in this research.	HCPs who are not working in or are not familiar with the Telehealth environment are excluded from this research.
English speaking participants are included in this research.	Non-English speaking participants are excluded in this research.

Planning for the sample size is a thoughtful decision as too few participants may challenge the depth and breadth of the research and too many participants may produce superficial results (Saunders, Lewis & Thornhill 2009; Cavana, Delahaye & Sekaran 2001). The sample size selection for a Qualitative Phase depends upon the quality of data, the scope of the study, the nature of the topic, the amount of useful data obtained from each participant, the observed data and its use (Morse 2000; Sandelowski 1995; Dworkin 2012). Often, a diverse range of participants necessitates a large number of sessions but time, cost and availability of participants may limit the number of sessions that can be held (Wong 2008). One of the criteria for ensuring an adequate sample size in qualitative data collection is saturation point, which is recommended for qualitative researchers (Wong 2008; Mason 2010; Trotter 2012; Cleary, Horsfall & Hayter 2014; Bowen 2008). Saturation point is a point after which no new information comes from the participants and data starts repeating itself.

In this research, depending upon the quality of data obtained and saturation point achieved, a maximum of ten sessions including focus group discussions and interviews is considered adequate. The literature indicates that 1-10 discussion sessions and 5-50 interviews are generally sufficient for most studies. Since at some juncture participants' responses start repeating, after this point conducting further sessions may be considered unnecessary (Powell & Single 1996; Dworkin 2012).

Focus Group Size

In qualitative research design, the use of a small focus group of well-selected participants is preferred as it can produce highly relevant data for analysis (Cleary, Horsfall & Hayter 2014; Johnson & Christensen 2010). Some authors have recommended sample sizes of 4-8, 6-8, 6-9, 6-10, 6-12 and 8-12 participants for focus group discussions (Creswell 2013; Morgan 1997; Randle, Mackay & Dudley 2014; Christensen & Remler 2009; Johnson & Christensen 2010; Kitzinger 1995).

In this research, a small group size is considered suitable, as participants in a small group feel more confident to express their views and such a group is easier to manage. In this research, a group size of 6-8 participants is considered adequate.

Phase 1 Sampling Techniques

A sample can be selected using two sampling techniques: probability and non-probability. In probability sampling, the chances of the selection of participants from the target population remains equal (Saunders, Lewis & Thornhill 2009). In this research study probability sampling is not considered suitable because, before involving participants from the target population, ethics approval is required. Also, some HCPs may not participate due to their work commitments or unforeseen events.

Another technique to select a sample from the target population is non-probability sampling. In this technique, the chances of selection from the target population remain unknown. The use of the non-probability sampling technique makes it difficult to answer research questions that require statistical inferences. However, the researcher can generalise the research findings for the target population, though not on statistical grounds (Saunders, Lewis & Thornhill 2009). In the healthcare domain, not all the HCPs can participate in this research study due to their workload and the ethical clearance policy. Therefore, non-probability sampling is considered suitable for this research.

Non-probability sampling has four types (Zikmund 2010):

1. Quota sampling
2. Purposive sampling
3. Snowball sampling
4. Convenience sampling**.**

Quota sampling is used when the researcher identifies sample categories that are important to include in the study and divide them into subgroups (Zikmund 2010). In this research, the researcher is not creating any sample categories and is not dividing the participants into subgroups. Therefore, quota sampling is not considered suitable for this research.

In purposive sampling, participants are generally selected based on a certain criteria according to the suitability of the research topic (Zikmund 2010). In this research study the criteria for being a participant is familiarity with the Telehealth environment and English language competency. Therefore, purposive sampling can be used in this research.

In snowball sampling, few participants are initially selected using the non-probability method and the additional respondents are obtained through the contacts of initial respondents (Zikmund 2010). This sampling method is suitable in this research study for quick data collection if HCPs are happy to provide the contact details of their colleagues.

In convenience sampling, the researcher samples the participants who are conveniently available. This type of non-probability sampling seems suitable to this research study because the researcher is looking to include those HCPs who are conveniently available and are interested in participating in this research.

Purposive, convenience and snowball techniques of non-probability sampling are considered suitable in this research study because, through these techniques, the researcher can deliberately select participants based on certain criteria, suitability to the research topic and availability (Cavana, Delahaye & Sekaran 2001; Guarte & Barrios 2006; Teddlie & Yu 2007). Also, by using these techniques, the researcher can conveniently adapt the study according to the situations, boundaries and limits created by ethical guidelines and unforeseen events.

Phase 1 Data Analysis Techniques

Selection of suitable data analysis techniques is important to achieve the desired aim from the collected data. In the literature, several software packages are used to analyse qualitative data. These are QSR NUD*IST, ATLAS.ti, N-vivo and Laximencer (Pope, Ziebland & Mays 2000; Gururajan et al. 2014; Houghton et al. 2017). These software packages are used for systematically organising the data, ensuring the reliability of the data and for conducting text analysis (Gururajan et al. 2014; Pope, Ziebland & Mays 2000). Although computer assisted software packages provide a single location for storing data and handling large amounts of data (Bazeley & Jackson 2013). Such software packages are incapable of understanding qualitative data (Houghton et al. 2017; Pope, Ziebland & Mays 2000). To overcome this limitation, manual analysis of qualitative data becomes necessary.

In this research, the use of both manual analysis and N-vivo software analysis are considered appropriate. Joint use of these techniques is suitable for text analysis, thematic analysis, and ensuring the reliability and transparency of participants' responses (Pope, Ziebland & Mays 2000; Rabiee 2004; Gururajan et al. 2014), and can also be used to refine the initial conceptual framework. A detailed explanation on manual and N-vivo analysis of qualitative data is given in Chapter 5.

Phase 1 Results Interpretations

Interpretation of research results addresses the research problem in an organised way. In the literature, the Qualitative Phase results are interpreted using the researcher's description supported by quotations from the participants (Krueger 2014). Participants' quotations with the researcher's interpretation determine the reliability and validity of results (Pope, Ziebland & Mays 2000; Sim 1998). Consistent with the previous literature, this study's results can be interpreted using the researcher's description supported by the participants' quotations.

3.4.2 Phase 2: Quantitative

The objective of the second Phase is to validate the factors obtained in the first Phase. To achieve this aim various parameters considered in the Quantitative Phase from data collection to result interpretation are explained further.

Phase 2 Data Collection Techniques

Quantitative data can be collected using experiments and surveys (Saunders, Lewis & Thornhill 2012; Creswell 2013, 2008). The experimental technique is generally used to test the impact of an intervention on treatment. This research study is not dealing with any intervention or treatment therefore an experimental technique is not considered suitable for quantitative data collection. Another technique used for quantitative data collection is the survey. Survey provides a quick, inexpensive, efficient and accurate means of accessing data from participants. In the HIT literature, surveys are used to explain health professionals' technology adoption behaviour, and data collected using this technique is mainly examined for construct validity and hypotheses testing (Chau & Hu 2002b; Yangil & Chen 2007; Wu, Li & Fu 2011).

In this study, a survey can be used for quantitative data collection because it is a technique suited to gain an understanding of knowledge, facts and opinions/attitudes of respondents (Collis 2009), and to confirm and quantify the findings of qualitative research (Newsted, Huff & Munro 1998; Zikmund 2010); the goal of the Quantitative Phase of this research.

<u>Survey methods</u>

The literature provides a variety of survey methods for communication with participants. These are drop-off, door-to-door personal interview, telephone and mobile interview, computer assisted telephone interviews, mail survey and email and web based survey (Zikmund 2010).

In the drop-off method the survey questionnaire is inserted into the respondents' personal mailbox. The challenge with this method is that the HCPs may consider them as junk mail and throw them away. Furthermore, it is a time-consuming and expensive method and therefore not suitable for this research study.

The alternative to the drop-off method is the door-to door interview. Door-to-door interviews can be conducted at the participants' house, office or any other place. It eliminates the possibility of survey disposal and survey question misinterpretation because both the researcher and respondents can clarify questions and answers. The main disadvantage of this survey method is that the researcher and respondents are not usually familiar with each other which may cause respondents to feel nervous and to hide information (Zikmund 2010). Also, this survey method is time consuming. In this research study, door-to-door interviews can only be used in rare cases because they may consume a lot of time.

The alternative to door-to door interviews can be telephone or mobile interviews as these are fast methods of survey data collection. In interviews conducted through telephone and mobile phones, respondents usually remain more willing to provide detailed and reliable information (Creswell 2013). Compared to door-to-door interviews, phone interviews, (telephone and mobile phone) save both time and cost (Creswell 2013). However, some people may refuse to participate in telephone or mobile phones interviews (Creswell 2013), thus, this technique is not considered suitable in this research.

An alternative to telephone and mobile phone interviews can be computerized voice activated telephone interviews. In computerised voice activated telephone interviews, the questions are pre-recorded for the respondents to hear and answer. If a respondent does not answer the question, the call is automatically disconnected and the researcher telephone dials the next respondent (Zikmund 2010). These types of interviews are suitable only for short and simple answers such as yes/no or true/false. In this research study, the chances of including such types of questions are rare. Therefore, a computerised voice activated survey method is unsuitable for this study. Also although computerised voice activated telephone interviews are a fast method of data collection, they are not considered suitable for this study as they require the management of hardware and software infrastructure which is too costly. Furthermore, with these techniques, if respondents do not reply in the particular format designed for answering survey questionnaires, the call is rejected. This drawback of voice activated telephone interviews can be overcome using an interactive kiosk.

In the interactive kiosk, participant responses are obtained in a kiosk at a trade show or professional conference, or in a high traffic location. A fieldworker is appointed to help people use the kiosk which is a disadvantage for kiosk based surveys (Creswell 2013). The kiosk method can be implemented at healthcare conferences but data collection may be delayed until a suitable conference is held. Such delays may be costly as well as time consuming. In this research study, this method of survey can be used if a suitable conference at the time of data collection is held.

In the mail survey technique, a self-administered questionnaire is sent to the respondents through the mail. The advantages of mail surveys include geographic flexibility, cost-effectiveness and respondent convenience. The disadvantages of using mail surveys include low response rates and reliance on postal services in the different locations. Mail survey can be suitable in this research for the participants' convenience.

The online survey is another survey method in which questions are posted on a website or sent through email. Respondents can answer the questions by highlighting a phrase, clicking an icon or keying in an answer. Respondents can complete this type of survey whenever they have time. In an email survey, an email containing information in the form of a cover letter along with a link to access the survey is sent to the email addresses of the participants. These emails can be accessed by potential participants at their convenience (Creswell 2013). Online surveys are fast, cost effective, interactive, personalised, provide real-time data capture and offer a flexible data collection technique (Creswell 2013). However, the researcher may face the problem of sample and geographic coverage bias as not everyone can access the Internet (Fan & Yan 2010). The loss of participants who do not have Internet access results in a low response rate. Security concerns are also a drawback of the online survey (Creswell 2013; Fan & Yan 2010; Nulty 2008). In this research, an email survey method can be suitable for the participants because they can complete the survey at any time they like which may increase the response rate.

The consideration of the various survey methods suggests that online and mail survey methods seem the most suitable for the convenience of the participants and the likelihood of receiving a good response rate. In this research, mail surveys can be used to collect quantitative data because Australian postal services are reliable and accurate, and some participants find it easy to complete a paper based survey. However, some participants may not return the completed survey questionnaire back to the researcher due to cost, pre-occupation with other things or they may misplace the survey. These eventualities may result in a low response rate. Attaching a self-addressed postal envelope and using an online survey can increase the response rate. Participants who do not like to complete online surveys due to concerns such as security and anonymity can be provided with printed surveys. Therefore, mail and online surveys are considered suitable strategies for data collection in this research. In addition, the health domain has its own research data collection ethics policy and the researcher must follow the procedure as directed by this policy.

Administering Data Collection

Survey questionnaires are either self-administered or interviewer-administered. In the self-administered survey, the questionnaire is either sent through online link, posted or delivered by hand to the respondents and collected later (Saunders, Lewis & Thornhill 2009). Whereas, in the interviewer-administered survey, responses are recorded by the interviewer on the basis of each respondent’s answer (Saunders, Lewis & Thornhill 2009). In HIT adoption literature, self-administered surveys are preferred because researchers may not directly communicate with the respondents and responses are collected through a responsible person (Chau & Hu 2002b; Yangil & Chen 2007; Wu, Li & Fu 2011). Also, the researcher has to follow the guidelines, processes, policies and procedure of the health facilities which may or may not allow the researcher to connect with the participants for survey data collection. Therefore, a self-administrated survey questionnaire is suitable for this study.

Phase 2 Data Collection Format

Collection of data using mail and online surveys can be performed using paper or electronic formats (Zikmund 2010). In paper based surveys, the questionnaire can be provided to the participants in the form of hardcopy. The challenges with the paper-based survey are printing costs, difficulty of distributing the surveys, low response rate and their time consuming nature. Also, some participants may not prefer a paper based survey. To avoid these challenges an electronic survey can be used as an alternative to the paper format.

The electronic survey is a fast method for quantitative data collection. Fan and Yan (2010) state that a web survey (a form of electronic survey) is a cost effective method of collecting information in a short duration of time. However, some participants may not like to use electronic gadgets or may not check their email in time, thus lowering the response rate of the electronic survey. The above discussion indicates that both the paper and electronic survey formats can be used so that time, cost, response rate, participant convenience and privacy issues can be addressed.

Phase 2 Sample and Sampling Technique

As mentioned in Phase 1, the potential participants of this study are HCPs, which include but are not limited to, general practitioners, physicians, nurses, oral health practitioners, speech pathologists and occupational therapists who are working in, or are familiar with, the Telehealth environment and have some knowledge or experience of mobile device use in healthcare.

Purposive, convenience and snowball techniques of non-probability sampling are considered suitable in this research study because with these techniques the researcher can select participants deliberately based on certain criteria, suitability to the research topic and the availability of participants (Cavana, Delahaye & Sekaran 2001; Guarte & Barrios 2006; Teddlie & Yu 2007). Also, by using these techniques the researcher can conveniently adapt the study according to the situation, boundaries and limits created by ethical guidelines and unforeseen events.

Phase 2 Sample Size

In the literature, there is always a debate on adequate sample size selection. Too few participants in a study may challenge the depth and breadth of the research and too many participants may produce superficial results. Beginner researchers may require more participants compared with experienced researchers. For example, Sandelowski (1995, p. 180) has noticed that new quantitative researchers often require more sampling units than more experienced researchers. However, the Sandelowski's (1995) recommendations cannot be useful where researchers are conducting certain statistical tests/analysis. For example, to conduct Exploratory Factor Analysis (EFA), sample size considerations may be misleading and often do not considere into account many complex dynamics of factor analysis assumptions (Williams, Onsman & Brown 2010). Henson and Roberts (2006, p. 402) have pointed out that when communalities are higher (greater than 0.60) and several items define each factor, sample size can be small for EFA. Guadagnoli and Velicer (1988) stipulated that if the correlation coefficient is >0.80 then smaller sample size can be adequate for EFA. To conduct regression analysis, sample size can be caluculated based on a power analysis concept (Green 1991). Power analysis calculates the sample size as the function of effect size and number of predictors. A detailed explanation of this concept is given in Chapter 7.

Onwuegbuzie and Collins (2007) suggest that sample size depends upon the research design. In quantitative research design a large sample is needed to generalise the results. Kershaw et al. (1942) think that if the researcher has some data from existing studies and wants to subdivide the results into two subgroups then the recommended sample size for a survey questionnaire could be 300-500, which is not planned in this research. Further, Roscope (cited in Hafeez-Baig 2010) clarifies that in the quantitative research, if data is divided into different themes then a sample of 30 responses are enough for each theme. Researchers have also mentioned a minimum ratio of the sample size to the number of variables, ranging from 3:1, 6:1, 10:1, 15:1, 20:10 or 5-10 (Pearson 2008; Williams, Onsman & Brown 2010). Thus, there are two groups of researchers for sample size determination. One group of researchers believe that the absolute number of cases (*N*) is important, while another says that the subject-to-variable ratio (*p*) is important (Mundfrom, Shaw & Ke 2005).

In this research, at this stage, the researcher understands that the sample size in quantitative research depends upon the types of statistical tests to be performed. In EFA, sample size considerations may be misleading and may not bring about true results. In regression analysis, power analysis can be used to calculate the sample size based on the number of constructs and effect size considered in the research (Green 1991).

Phase 2 Data Analysis

An examination of the literature reveals the analysis of quantitative data can be carried out using various software such as STARA, SAS and SPSS. In this research, SPSS IBM 23 software is considered suitable for analysing quantitative data because it is generally well regarded as a tool for undertaking quantitative data analysis and it is provided by the researcher’s university. SPSS is also considered suitable for the purpose of conducting descriptive, EFA and regression analysis. Descriptive information should always be reported in any statistical analysis and EFA is useful to ensure construct validity and to reduce the number of variables (Kerr, Hall & Kozub 2002). EFA extracts those factors that best reproduce the variables under the maximum likelihood conditions (Henson & Roberts 2006). Regression analysis is considered to be a check of the overall fit of the final conceptual framework with the EFA extracted factors in this research study.

Phase 2 Results Interpretation

Quantitative findings can be interpreted using factor analysis, regression analysis and structural equation modelling for various purposes such as hypotheses testing and conceptual framework testing (Nair & Dreyfus 2018).

In this research, the Quantitative Phase aims to validate the factors obtained in the Qualitative Phase which can be interpreted using EFA and regression analysis. The interpretation of the results in the Quantitative Phase of this research study can be presented in various forms such as frequency tables, variance tables, data outliers, inter-item correlation, normal distribution, multicollinearity, linear relationship and homoscedasticity. A detailed explanation of the interpretation of the Quantitative Phase results is provided in Chapter 7.

3.5 Research Location

The research location is regional Queensland, Australia. Currently, Queensland has one of the largest managed Telehealth networks in Australia; over 2000 systems in over 200 hospitals and community facilities in the state. The Telehealth support unit provides Telehealth services to the people by working collaboratively with the health department (Queensland Health), hospital and health services, the Royal Flying Doctor Services, Medicare locals and general practices.

The Telehealth services in this state operate in both modes: 1. Real time and 2. Store and forward. In real time Telehealth, live, audio and or video links are used for clinical consultations and education purposes. In the store and forward mode of Telehealth, digital images, video, audio and clinical data is captured on the client's computer and forwarded at a convenient time to another location.

3.6 Research Ethics

In any research study, ethical clearance is important and is mandatory if the research involves humans. This research study involves HCPs, therefore ethical approval from the USQ Ethics Committee, Queensland Health and the Darling Downs Hospitals and Health Services has been sought and received.

Participants in both Phases of this research study are informed about their voluntary participation and anonymity and the confidentiality of the data in this research. In the Qualitative Phase, written consent was taken from the participants. In online and paper-based surveys, survey completion was considered to mean that participants have given their consent to participate in the research.

3.7 Reliability

Reliability means the measured outcome should remain consistent while repeating the same experiment many times (Neuman 2003; Cavana, Delahaye & Sekaran 2001). In the literature, the concept of reliability in mixed methods is discussed in two separate components: reliability in qualitative research and reliability in quantitative research.

Stenbacka (2001) states that reliability has no relevance in qualitative research. The researcher in this research study agreed with this view because the Qualitative Phase is a subjective Phase and it is difficult to obtain the same responses each time the test is repeated with the same individual (Bashir, Afzal & Azeem 2008). Therefore, the idea of reliability in the Qualitative Phase should be about the credibility of the research rather than obtaining the same results each time the experiment is repeated (Bashir, Afzal & Azeem 2008). By following various processes such as asking the same set of questions, providing procedural details and member checking, the credibility of the qualitative research can be ensured (Bashir, Afzal & Azeem 2008). In this research, the credibility of the Qualitative Phase can be ensured using various techniques such as asking the same set of questions and providing procedural details as mentioned in the literature. Chapter 5 provides a detailed explanation of credibility ensured in the Qualitative Phase at data collection, analysis and result interpretation stages in this research.

Reliability in quantitative studies means that the measurement or questionnaire, should be accurate and similar/consistent each time the test is repeated (Bashir, Afzal & Azeem 2008; Winter 2000; Stenbacka 2001; Zikmund 2010). The reliability of the questionnaire can be determined by various methods such as split half, test-retest, parallel form and Coefficient alpha method (Bashir, Afzal & Azeem 2008).

In this research, the Cronbach's alpha test is considered suitable to measure the reliability of the survey questionnaire, because it is also used to measure reliability in previous research studies (Gao, Krogstie & Siau 2011). Chapter 6 explains, in detail, how questionnaire reliability is ensured using Cronbach Alpha.

3.8 Validity

Validity in the mixed method is described as 'legitimation' or 'inference quality' by previous researchers (Onwuegbuzie & Johnson 2006; Teddlie & Tashakkori 2003). Dellinger and Leech (2007) provide a validation framework for the mixed method by representing the four fundamental elements of design, quality, legitimation and interpretive rigor for validation in mixed methods. Onwuegbuzie and Johnson (2006) provide validity in mixed methods using the legitimation model.

In this research, validity is represented using the Onwuegbuzie and Johnson (2006) legitimation model and by triangulating the research. The elements of legitimation model are:

1. Sample integration
2. Inside outside
3. Weakness minimizing
4. Multiple validities
5. Paradigmatic mixing
6. Political legitimation
7. Conversion
8. Sequential
9. Commensurability.

In sample integration, the relationship between the quantitative and qualitative sampling designs should yield quality meta-inferences (Onwuegbuzie & Johnson 2006). In this research, to maintain the quality of the data, the participants in the focus group discussions and in-depth interviews rarely participated in the survey so the results obtained remain unbiased.

Inside-outside legitimation means that the researcher accurately represents and utilizes the participants' (insiders') and experts' views (Onwuegbuzie & Johnson 2006). In this research, during the Qualitative Phase, the researcher represented the participants' views with some direct quotes. Further, in order to obtain outsiders' views, peer review of the items was conducted with the researcher's supervisors and with the HCPs. In the Quantitative Phase the participants' views are represented in the form of various statistical results. Thus, accuracy of utilizing participants' views in both Phases is ensured in this research.

Weakness minimisation is a legitimation process where the researcher neutralizes the dominance of the qualitative or quantitative methods (Onwuegbuzie & Johnson 2006). In this research both the qualitative and quantitative method are used to strengthen the findings of this research study and neither method has been favoured.

Conversion legitimation asserts transformation wherein one data form is converted to another (Onwuegbuzie & Johnson 2006). In this research, in the Qualitative Phase, conversion legitimation can be achieved by obtaining counts of the frequency of factors. However, in observation counting there is a possibility of errors due to misleading counting, over counting and contextual counting. To overcome these problems, N-vivo software is considered suitable in the Qualitative Phase. In the Quantitative Phase, with the use of SPSS software, data can be represented in text as well as in numbers.

Multiple validities means that a variety of validities should be used employing different strategies such as qualitative and quantitative and mixed method validity (Onwuegbuzie & Johnson 2006). In this research, credibility of the Qualitative Phase is ensured at data collection, data analysis and data interpretation stages and in the Quantitative Phases validity of questionnaire is ensured using pretesting and pilot testing and is explained in detail in Chapters 5 and 6 respectively.

Paradigmatic mixing means the extent to which the researcher's epistemological, ontological, axiological, methodological, and rhetorical beliefs underlying the qualitative and quantitative approaches are successfully (a) combined or (b) blended into a usable package. In this research, the researcher has justified in Sections 3.2 and 3.3 that, by using pragmatism and sequential mixed method techniques, the true factors and a credible and rigorous conceptual framework explaining the HCPs' perceptions can be obtained.

Political legitimation refers to the challenge of the 'control' of research findings which arises due to qualitative and quantitative methods (Onwuegbuzie & Johnson 2006). Other researchers, health managers, policy makers and ICT developers can use the results obtained in this research study. Hence, this research study is free from the political legitimation challenges.

The remaining two elements of sequential and commensurability legitimation cannot be used in this research study due to time constraints. The researcher cannot change the sequence and go back and forth, again and again to repeat the experiment to ensure these two validities (Onwuegbuzie & Johnson 2006).

Validity in this research study is also ensured through triangulation. The term triangulation stems from trigonometry and describes the process of identifying a person's position by measuring the person's angles to two other known positions (Joslin & Müller 2016). Person's angles in research are research data, methodology, investigator, theories, philosophies, and these help to reduce bias in data sources, methods and investigators (Collis 2009). Triangulation also overcomes the weakness or intrinsic biases due to a single method, single observer or single theory and enhances the generalisability of the study (Collis 2009; Duffy 1987).

In this research, four types of triangulation are used to validate a theoretical basis for the study and verification of the research results, as mentioned in Table 3.3 below.

Table 3. 3: Four types of triangulation used in this research

No	Type of triangulation	Aim	How various triangulation is achieved in this research
1.	Theoretical	To validate initial conceptual framework	Using the DOI and the TPB.
2.	Philosophical	To provide a comprehensive understanding and a philosophical base for this research study.	Using pragmatic philosophy which contains both subjective and objective philosophies.
3.	Methodological	To provide completeness and contingency of this research study.	Using mixed methods which provide completeness to this research study.
4.	Data	To cross check the findings of this research study.	Using Qualitative and Quantitative Phases.
5.	Investigator	Not conducted in this research because this is a PhD research study and only one principal investigator is involved in this study.	

1. Theory Triangulation

Theory triangulation helps to reduce the risk of premature acceptance of explanations and helps to develop concepts or constructs by using various theories (Joslin & Müller 2016). In this research study theory triangulation is followed to develop a valid initial conceptual framework which is developed by reviewing previous literature on technology adoption in healthcare and various technology adoption theories.

2. Philosophical Triangulation

Philosophical triangulation provides a more comprehensive understanding of the phenomenon (Joslin & Müller 2016). Philosophical triangulation is rarely mentioned in the literature. In this research, it is ensured by using a pragmatic philosophy, which supports two philosophies: subjectivism and objectivism. In the Qualitative Phase subjective research philosophy is used and in the Quantitative Phase objective research philosophy is used to understand the adoption of mobile device behaviour in the health domain.

3. Methodology Triangulation

In methodology triangulation the researcher combines more than one qualitative or quantitative data source or method in a single study and these are used for the completeness and contingency of study (Jack & Raturi 2006). Methodology triangulation is the most commonly used type of triangulation where the researcher uses multiple methods to study a research problem (Joslin & Müller 2016). In this research, collectively both the qualitative and quantitative methods are considered suitable to obtain research objectives.

4. Data Triangulation

In data triangulation, data for the same phenomenon is studied from different sources, locations, people or time (Collis 2009; Joslin & Müller 2016). In this research, data triangulation is ensured by collecting and analysis data through different methods and sources. Data triangulation helps with the validation and cross checking of research findings (Barnes & Vidgen 2006), as collecting different kinds of data by different methods from different sources provides wider coverage that results in a fuller picture of the research study (Kaplan & Duchon 1988).

In the investigator triangulation, different researchers independently collect, code and analyse data on the same concept and compare results (Collis 2009; Joslin & Müller 2016; Decrop 1999). Investigator triangulation is not conducted in this research study because only one researcher is collecting, analysing and interpreting the data.

3.9 Conclusion

This chapter focussed on the selection and implementation of a mixed methodology. In this chapter, suitability of the pragmatic research philosophy created a foundation for the selection of the mixed methodology research design. Information concerning the mixed methods research design procedure was also presented. Finally, this chapter concluded with an explanation of types of reliability and validity as per the context of this research. The next chapter provides a detailed procedure of qualitative data collection.

Chapter 4

Qualitative Data Collection

CHAPTER 4: QUALITATIVE DATA COLLECTION

4.1 Introduction

In the previous chapter, the choice of the sequential mixed methodology, Qualitative Phase followed by Quantitative Phase was explained. This chapter describes the collection of qualitative data and is organised into four sections as shown in Figure 4.1.

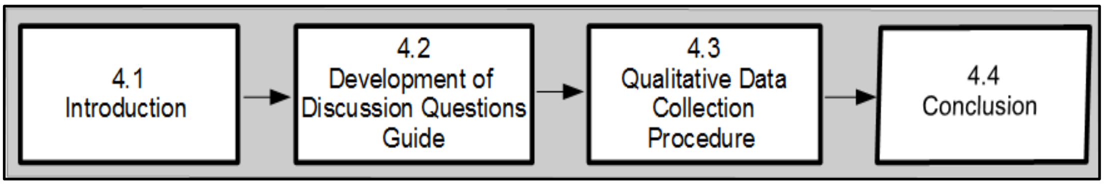

Figure 4. 1: The outline of Chapter 4 on qualitative data collection

Source: Developed for this research

Section 4.1 introduces the chapter. Section 4.2 explains the development of the Discussion Questions Guide used for the qualitative data collection. Section 4.3 discusses the qualitative data collection procedure, and the chapter's conclusion is presented in Section 4.4.

4.2 Development of Discussion Guide

A Discussion Questions Guide for qualitative data collection was developed from the nine factors considered in the initial conceptual framework. These nine factors were selected from the HIT adoption literature explaining technology adoption from the individual's perspective. The justification for the selection of these nine factors is given in the literature review chapter. These nine factors were converted into nine questions and presented in the Discussion Question guide. A sample of the Discussion Question guide is given in Appendix 4.1 on Page.324. These nine questions were simple, open-ended and clearly phrased (Kai-Wen 2014; Saunders, Lewis & Thornhill 2009). No sensitive questions were included in the Discussion Questions Guide, which was pretested and pilot tested with lay people[5] and HCPs for the clarity, simplicity and adequacy of the questions (Powell & Single 1996).

4.2.1 Pretesting

Pretesting was mainly conducted to ensure that participants understood and responded well to the discussion questions (Kai-Wen 2014; Saunders, Lewis & Thornhill 2009; Brown, Lindenberger & Bryant 2008; Van Teijlingen et al. 2001).

Another pretesting aim was to obtain some practical experience of activities to be performed in the qualitative data collection (Brown, Lindenberger & Bryant 2008; Hurst et al. 2015). Pretesting was conducted using focus group discussions and individual interviews with 14 lay people in the month of December 2015 at the University of Southern Queensland. Lay people in pre-testing refers to participants excluding HCPs and were as follows: two Statistical professors, two Information System professors, one Mechanical Engineering professor, four people competent in English and five PhD candidates. They were called as lay people because they do not have any experience in the health domain. Pretesting participants were recruited as per their willingness to participate in this research.

In pretesting the participants' suggestions, comments and feedback for the questions given in the Discussion Questions Guide were obtained. These inputs helped to bring greater clarity and simplicity to the questions given in the Discussion Questions Guide.

Initially, pretesting was conducted with two participants to ensure face validity of the Discussion Questions Guide. These two participants were competent in English. Their comments included reference to a few grammatical mistakes, layout issues and rephrasing the questions. An example comment is as follows:

> *'Instead of asking direct questions from the participants, rephrase your questions like: Do you want to use mobile*

[5] Two statistical professors, two information system professors, one mechanical professor, four people competent in English and five PhD candidates

devices in healthcare? Are you ready to use them'? (Source: Pretesting Comments)

After their comments the Discussion Questions Guide was revised accordingly.

Further, the researcher discussed the revised Discussion Questions Guide with two supervisors and three other university professors, individually. The two supervisors (male) were from the Information System domain, another two university professors (one male and one female) were from the Statistics domain and the last professor (male) was from the Engineering domain. Comments on the layout, use of English, sequence and content of the questions were received from them. Some of the comments received were as follows:

'Use a fixed scale for job experience variable'

'It is good to use 'other' option with some of the questions.'

'Try to follow a logical sequence for the demographic questions so that if question A is not applicable to a participant then he/she need not browse through the other questions which are linked with question A.'

These comments helped to ensure the reliability and face validity of the Discussion Questions Guide. After their comments the content was revised to make the questions open-ended (so that additional information from participants could be obtained) and the questions were rearranged accordingly.

After feedback from the supervisors and university professors, the revised Discussion Questions Guide was tested with two lay people, who were competent in English, to check any grammatical and spelling mistakes. The Discussion Questions Guide was revised again for some minor grammatical errors after their feedback.

Finally, after revising the questions as per the feedback received from supervisors, university professors and participants who were competent in English, the Discussion Questions Guide was tested with a group of five PhD candidates.

An example of the suggestions received from these participants is as follows:

'The researcher should not express her views and should not nod her head during the discussion sessions'.

The researcher carefully considered this and other comments.

Thus, pretesting helped the researcher refine the questions guide, obtain some experience in running focus group discussions and ensured the reliability and face validity of the Discussion Questions Guide (Van Teijlingen et al. 2001). To further refine the Discussion Questions Guide, pilot testing was conducted.

4.2.2 Pilot Testing

A pilot testing discussion session was organised to avoid a last minute rush, to ensure the feasibility of the Discussion Questions Guide and data collection techniques, and to acquire some experience in conducting group discussions. Pilot testing was conducted in January 2016 in a convenient place for the participants (Van Teijlingen et al. 2001; Thabane et al. 2010). It was conducted with twelve HCPs divided into two groups. There were five members in Group One and seven members in Group Two. These group sizes were considered adequate for the assessment of the objectives of the pilot study (Thabane et al. 2010; Morgan 1997). The participants included in the pilot study had similar characteristics as the main qualitative data collection participants (Thabane et al. 2010; Hurst et al. 2015). These participants were familiar with the Telehealth environment and with the meaning of mobile devices in the healthcare domain (Hurst et al. 2015).

After acquiring approval from the University of Southern Queensland Ethics Committee, a number of nurses and nurse managers were contacted (personally by visiting their offices or by telephone) to ask them to participate in the pilot study. Information concerning the date, time and venue of the pilot testing was sent to the interested participants by SMS, telephone or a personal visit.

The pilot testing sessions started with the introductory session where the researcher introduced herself and discussed the aim of the pilot testing. Participants were also requested to introduce themselves. Subsequent to this, the questions given in the

Discussion Questions Guide were discussed one by one. The participants were asked to give feedback on the appropriateness and clarity of each question. An environment conducive to relaxation was provided (Krueger 2014). The room used was well ventilated and had good lighting. During the discussion, refreshments were provided to enable participants to mingle with one another (Powell & Single 1996).

Various activities planned to be part of the qualitative data collection day were pilot tested:

- The Discussion Questions Guide, Participants' Information Sheet and Consent Forms were printed and organised in a folder in advance and were distributed before starting the pilot study sessions
- To facilitate communication, name tags were prepared in advance and were placed on the table in front of the each participants (Creswell 2013), so that the researcher could engage participants in the discussion by name whenever necessary.

Data obtained from the pilot study was analysed by the researcher with the supervisors' guidance and by reviewing previous literature. The feedback obtained from the two pilot testing sessions including improvements considered after participant feedback, are explained further.

In the first pilot testing, comments on the activities performed during the session were obtained. Some of these comments are as follows:

> *'Using nametags was a good idea'*
>
> *'Providing an introduction on the aim of the discussion was also a good idea'*.

These comments ensured the feasibility of activities to be performed and confirmed resources needed during qualitative data collection. Also, besides the factors given in the Discussion Questions Guide, the participants in the first pilot testing session explored some new concepts such as funding, privacy, security and training issues, and concluded that these issues were important for the use of mobile devices in

Telehealth. These concepts were used as probes in the last question of the Discussion Questions Guide which was further tested with the second pilot testing group.

In the second pilot study, an experienced PhD researcher acted as a moderator of the group discussion. The new concepts of training, funding, privacy and security were also discussed in this session. The participants of the second pilot test confirmed these new concepts which were discussed further with both supervisors, and an experienced researcher, reviewed in the literature and then kept in the Discussion Questions Guide as an open question. These concepts were also kept as probes to elicit information from participants in the Qualitative Phase. This ensured clarity, appropriateness, completeness of content, reliability and content validity of the Discussion Questions Guide. Also, the moderator advised the researcher to be less involved in the discussion as indicated:

> *'Avoid agreeing with the participants' views as it may create bias in the research results'.*

The moderator also provided valuable feedback on how to handle dominant members in the group. It helped to achieve some experience to organise the focus group discussions.

Thus, the pilot study helped to ensure the appropriateness, completeness, reliability and content validity of the Discussion Questions Guide and provided experience in conducting group discussions for qualitative data collection.

After the pilot study, the Discussion Questions Guide was complete and ready for further qualitative data collection.

4.3 Data Collection

A clearly documented process of qualitative data collection was provided to establish rigour of this study (Rabiee 2004). Qualitative data was collected from April-July 2016 in the various health facilities in Queensland.

The qualitative data was collected using two techniques: focus group discussions and interviews. Eight sessions including six focus group discussions and two interviews were conducted. These sessions were considered sufficient to collect rich, in-depth information and reach saturation point.

First, an interview was conducted, then six focus group discussions, and finally another interview. The first interview gave an idea of the kinds of responses that could be expected in the qualitative data collection. The second interview was conducted at the end of data collection, ensuring that the in-depth experiences of the participants for the use of mobile devices were gathered which also ensured that saturation point in the qualitative data collection was reached. Six focus group discussions provided rich information explaining the adoption of mobile devices in Telehealth. The information in the focus group discussions and interviews were audiotape recorded and the researcher also took some notes during the discussion sessions (Kitzinger 1995).

The participants in this research study were health care professionals working in the Australian healthcare system and were familiar with the concept of using mobile devices in the Telehealth environment. For each of the focus group's data collection, 6-8 participants were invited. However, due to the occurrence of an emergency or urgent work, one or two participants did not appear on the day of the focus group discussions. Therefore, 4-7 respondents participated in each focus group discussion which was considered sufficiently large according to the HIT adoption literature (Tay et al. 2017). Each focus group discussion ran for 25-35 minutes and the two individual interviews were conducted with two participants for 15-20 minutes each.

4.3.1 Recruitment Procedure

Potential participants were contacted with the help of the appropriate authorities such as a Telehealth coordinator and a health manager from the health facilities, and with the help of personal contacts. The Discussion Questions Guide, Participants Information Sheet and Consent forms were also sent to all appropriate authorities to explain this research study to the potential participants.

The Discussion Questions Guide and other communication materials were provided to the interested participants in advance, via email or by personally visiting the participants. This ensured that the participants could have enough time to decide whether to participate or not. Other communication material used with the Discussion Questions Guide were the Consent Form and Participants Information Sheet. The Participants' Information Sheet contained detailed information concerning the research project such as description and benefits of the research. It also contained information about the voluntary participation of the participants and what would happen in the discussion session. The aim of the Participant Information Sheet was to make potential participants familiar with the research and to explain the process and outcome of the participation. The Consent Form was provided in advance to inform participants that on the day of discussion, written Consent would be obtained from the participants.

Groups were formed according to the participants' suitability of time. Information on the venue, day and time for the focus group discussions and interviews, were sent to the interested participants though email, text messages or personal visits. On the day of interviews and focus group discussions, all the activities were performed in the same sequence and facilitated by the researcher, as explained in the next section.

4.3.2 Introductory Session

Before starting the focus group discussions or interview sessions, the signed Consent Forms were collected from the participants. Each interview and focus group discussion session started with an introductory segment which was designed to make the participants feel relaxed. In each session, the researcher greeted all the participants, introduced herself, and gave a brief introduction concerning the research topic. Participants were also made familiar with the objective of the session, their role and contribution, activities to be performed, and the rules and duration of the discussion session (Bradford & Rickwood 2014). Before beginning each session, all the participants were informed that the session would be very relaxed, open-ended and organised to allow them to express their experiences and perceptions of mobile device use in Telehealth. They were also informed of the audio recording of the sessions and the anonymity of their responses, and were requested to give their brief introduction and sign the Consent Form. The researcher also explained her role as a facilitator in each session as is explained in the next section. The sequence for each activity performed on the day of discussion is given in Table 4.1 below.

Table 4. 1: Sequence and time allocated for each activity performed on the day of discussion

No	Activity during discussion session	Time scheduled
1	Welcome speech and researcher introduction to participants	2-3 minutes
2	Each participants introduction and signing consent form	30 sec to 1 minute
3	Main discussion questions	5-7 minutes for each
4	Final question and summarisation of discussion	3-4 minutes

4.3.3 Role of Facilitator

A facilitator is needed in the focus group discussion to keep the sessions within appropriate boundaries (Saunders, Lewis & Thornhill 2009). During the session the researcher acted as a facilitator to provide the opening statement to start the session and encourage participants to be involved in discussions and give their view points (Sim 1998). The researcher was unbiased, respectful and listened to participants' responses carefully, did not pass judgment, was not too actively involved in the discussion except to guide it and to keep it focused (Powell & Single 1996). During the session the researcher used probing questions and various phrases to obtain information on the research topic (Saunders, Lewis & Thornhill 2009). To obtain additional information during the discussion, the researcher used phrases as follows:

> *'Could you further elaborate what you have said?' 'Can you tell me more?' or 'Would you give me an example?'*

To encourage in-depth exploration of a particular issue, the researcher provided some ideas by probing participants and, each time before moving from one topic to another, summarised the topic. For example:

> *'Before moving on to the next topic, let me see if I have understood your point-of-view correctly, that is, HCPs agree that training should be provided to them for using new technology in hospitals'.*

To curb a dominant participant, the following phrase was helpful:

> *'There are a few people who wish to add to this point, we will come back to that idea if we have time'.*

To encourage a quiet participant the researcher also used some phrases such as

> *'Do you have anything you would like to add to this issue'?*

At the end of the session, the researcher summarised all the important points to ensure correct interpretation, as well as to allow the participants to further elaborate on their comments. Thus, the researcher facilitated the process for smooth functioning of the discussion.

4.3.4 Room Conditions

In a discussion session it is important to provide an environment that promotes healthy discussion (Kitzinger 1995; Wong 2008). Careful consideration was given to the physical setting such as the selection of the venue according to the convenience of the participants, and having the room airy and with proper lighting (Powell & Single 1996). The discussion room was free from outside distractions such as background noises. A round table sitting arrangement was used for participants so all the participants could be treated equally (Wong 2008). The room was equipped with a digital recorder as per the demand of the research, and refreshments were also provided to create a relaxed environment. Thus, special consideration was given to the environment for healthy discussion on this research study topic.

4.3.5 Audio Recording

Audio recording was conducted to ensure accuracy, completeness, reliability and validity of the qualitative data (Tuckett 2005; Louise Barriball & While 1994). Audio recording also allowed verbatim analysis of qualitative data (Sim 1998).

The digital audio recorder or the researcher's laptop was used to record all the sessions so that no information was lost. The focus group discussion sessions lasted for 25-35 minutes and the interview sessions lasted for 15-20 minutes. Written notes were also taken during the sessions and this is explained in the next section.

4.3.6 Note Taking

The literature suggests that written notes are advisable to help avoid problems recognising individual voices (Sim 1998). However, recognising individual voices was not permitted in this research study because it could violate participant anonymity. The objective of the note taking in this research study was to note participants' views if a particular concept/idea was over emphasised, or if new concepts/ideas not covered in the Discussion Questions Guide were raised. These notes were considered important as such information may influence the findings of a Qualitative Phase. In this research, there were few written notes because the discussion went smoothly and the participants' information was clear, as there was enough time for each participant to state their views.

4.3.7 Administering Data Collection

The researcher was responsible to run, facilitate, record and take notes during the discussions and administered the process of data collection. Probing was also used in the interviews and focus group discussion sessions for clarity and to raise relevant information (Louise Barriball & While 1994). Probing increased the opportunity of interaction between the participants and the researcher. Relevant probing words were identified from the literature. The probing words were chosen to keep the topic on track and to elicit further information.

4.4 Conclusion

In this chapter, the process of the development of the Discussion Questions Guide used in qualitative data collection and the procedure for qualitative data collection were explained. The Discussion Questions Guide was developed from the factors considered in the initial conceptual framework and was refined with the help of Pretesting and pilot testing. The refined guide was used for qualitative data collection. The data collected was further analysed using N-vivo software, and manually. The analysis of the data is explained in the next chapter.

Chapter 5
Qualitative Data Analysis

CHAPTER 5: QUALITATIVE DATA ANALYSIS

5.1 Introduction

The previous chapter discussed qualitative data collection in this research study.

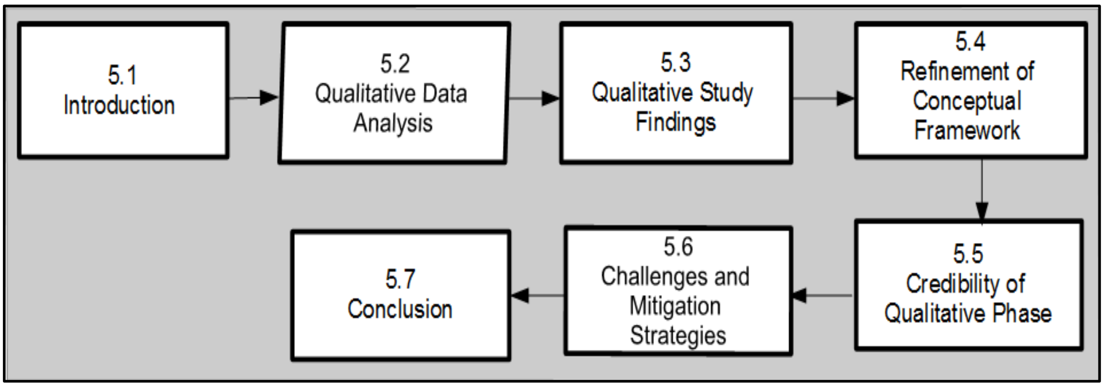

Figure 5. 1: The outline of Chapter 5 on qualitative data analysis

Source: Developed for this research

This chapter explains qualitative data analysis and presents the results for qualitative data. The chapter is divided into seven sections as shown in Figure 5.1. Section 5.1 introduces the chapter. Section 5.2 explains the qualitative data analysis conducted in this research. Section 5.3 presents the Qualitative study findings. Section 5.4 deals with the refinement of the initial conceptual framework and the conclusion of hypotheses developed in the literature review chapter. Sections 5.5 and 5.6 discuss the credibility of Qualitative Phase along with its challenges and mitigation strategies respectively. Finally, in Section 5.7 the chapter is concluded.

5.2 Qualitative Data Analysis

In this research study, a systematic, sequential, and continuous process of qualitative data analysis is followed to maintain the consistency, reliability and validity of the study (Guba & Lincoln 1989; Rabiee 2004). The qualitative data analysis process started with the transcription of the audio recordings. The data collected in the form of audio recordings was transcribed by the researcher. Supervisors were also engaged in the transcription process to ensure the reliability of transcription. Each focus group discussion recording lasted for 25-35 minutes and was transcribed in 6-11 pages. Each interview recording lasted for 15-20 minutes and was transcribed in 3-5 pages.

The transcribed files were further analysed to extract the themes for refining the initial conceptual framework and to obtain quantities/items to design the survey questionnaire (Bradford & Rickwood 2014; Palmier-Claus et al. 2013; Starr et al. 2013; Sofaer 1999). These transcribed files were analysed using two techniques: 1.Manual analysis and 2. N-vivo software.

5.2.1 Manual Analysis

Manual analysis helped to rigorously and systematically develop themes and identify main words/phrases which could be further used to develop factors (Pope, Ziebland & Mays 2000; Palmier-Claus et al. 2013; Starr et al. 2013). The process of manual data analysis is divided into two Phases.

In the first Phase, the researcher read the transcribed files several times to understand the content and categorize it into three themes considered in the initial conceptual framework. Some of the content regarding training, resource issues and management support could not be placed appropriately within the three themes upon which the initial conceptual framework was based. Therefore, a new theme, Organisational context, was developed and the content which could not be placed in the initial three themes, was placed into it.

In the second Phase, the content placed under four themes was read again line by line and the possible meanings of each line were interpreted by writing main words/phrases/small sentences (Rabiee 2004; Pope, Ziebland & Mays 2000).

The researcher also went through the written notes taken during the discussion sessions. From the written notes, no vital information was found. All the information obtained from the written notes was already covered in the transcripts. Thus, the manual analysis assisted in categorizing transcribed data into four themes and extracting main words/phrases/sentences. Further, the main words/phrases/sentences were also searched using N-vivo software.

5.2.2 N-vivo Analysis

In the N-vivo software the transcribed files were uploaded to search main words/phrases/sentences. The use of N-vivo software also helped to ensure the reliability and transparency of participants' responses (Gururajan et al. 2014; Houghton et al. 2017).

With the N-vivo software, the qualitative data was analysed in four steps. In the first step, the main words/phrases/sentences were extracted using a word cloud [6]. Word cloud gathers the words most frequently used by participants. The word cloud analysis is presented in Figure 5.2.

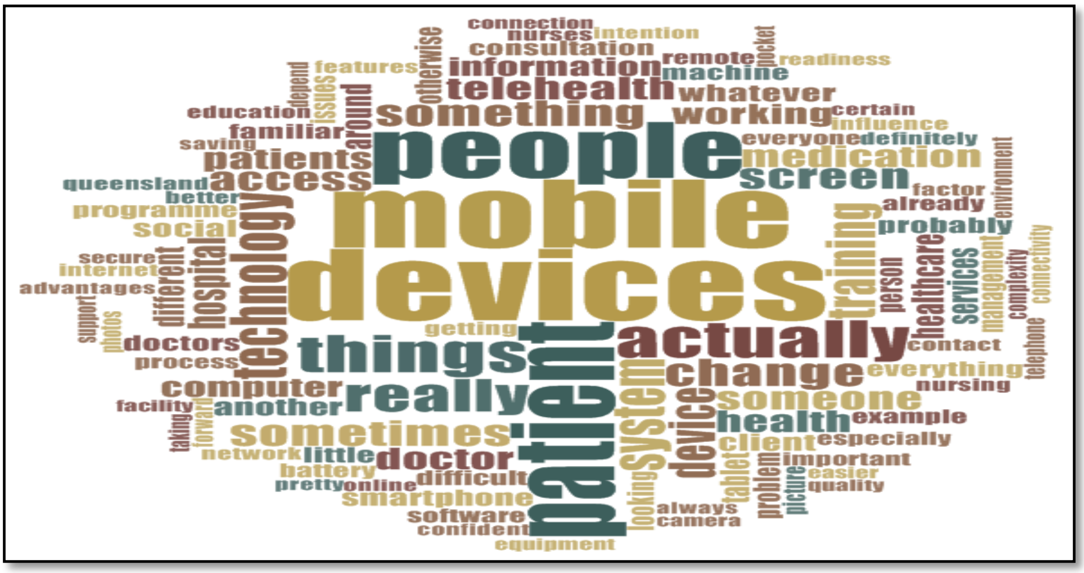

Figure 5. 2: Word cloud representing most frequently used words by participants during discussions

Source: Developed for this research study

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[6] Word cloud is a technique in N-vivo that documents the most frequently used words in a transcript. Word frequency techniques is used by previous researchers for qualitative data analysis. Gururajan, R, Clark, K, Moller, S, Sankaran, P, Hafeez-Baig, A, Wickramasinghe, N & Gururajan, R 2014, 'Reliability of qualitative data using text analysis: a Queensland Health case study', *Proceedings of 3rd International Conference on Eco-friendly Computing and Communication Systems*, 18-21 December, Mangalore, India, pp. 1-13, Bazeley, P & Jackson, K 2013, Qualitative data analysis with N-Vivo, 2nd edn, Sage Publications, London.

Word cloud also ensures the reliability of qualitative data (Gururajan et al. 2014), and presents some words which could be the main words/phrases/sentences and could be further used to develop factors. The size of the words in the word cloud indicates their frequency of appearance in the qualitative data. The bigger the size of the word, the more frequently participants used it.

In the step phase, the main words/phrases/sentences obtained in the manual analysis and N-vivo analysis were combined. In this process of analysis, 26 keywords, which could be further mapped into factors, were obtained. These 26 keywords were represented as 26 nodes in N-vivo and are given in Table 5.1.

Table 5. 1: List of initial 26 keywords obtained from N-vivo and Manual analysis

No.	Key concepts	Frequency of keywords
1.	Age	37
2.	Compatibility with healthcare processes	41
3.	Complexity	30
4.	Experience	4
5.	Functional features	50
6.	Individual readiness	23
7.	Self-efficacy	6
8.	Intention	23
9.	Other factors	3
10.	Management support	21
11.	Network	12
12.	Other challenges	56
13.	Alternative mobile devices	1
14.	Cost	3
15.	Current usages	2
16.	Financial issues	3
17.	Gender	2
18.	Misuse	1
19.	Policies	1
20.	Privacy and security	16
21.	Resource availability	3
22.	Training	29
23.	Readiness	18
24.	Relative advantage	57
25.	Cost saving	56
26.	Social influences	31

In the third step, factors from these 26 keywords represented as nodes in N-vivo software were developed. In this process all the keywords matching with the factors proposed in the initial conceptual framework were extracted first (Palmier-Claus et al. 2013; Rabiee 2004; Starr et al. 2013; O'Connor & Gibbson 2003; Bradford & Rickwood 2014), after which the following assumptions were considered to develop the factors:

1. If a keyword has a frequency of occurrence of four or more than four, then it is considered for developing as a factor (Bradford & Rickwood 2014)
2. If a keyword has a frequency of occurrence of two or three, then it is considered rare and is combined with another key concept to develop factors
3. If a keyword has a frequency of occurrence of one, then it is ignored for the developing a factor (Bradford & Rickwood 2014).

Through this process of factor development, a further six additional factors were added to the proposed initial conceptual framework. All fourteen factors considered in this process were also represented as nodes in the N-vivo software and represented in the refined conceptual framework.

In the fourth step, participants' quotations for all factors, including those proposed in the initial conceptual framework, were extracted and organised into their relevant nodes (Rabiee 2004), using N-vivo's text search query [7]option and by manually reading the transcribed files. In the text search query, the labels of the relevant nodes were searched. For example, if a node was labelled as 'nurse', then in the text search query string, a following query was run.

Search in: all sources, Search for: Nurse, Find: Exact matches.

[7]Query tools allow researchers to ask questions of the data. Text search queries allow searching for words or phrases in the data. Text Search queries can be used to search for concepts that include similar words. For example, if you search for sport, N-vivo can find words with similar meanings: recreation, play, and fun. Bazeley, P & Jackson, K 2013, *Qualitative data analysis with NVivo*, 2nd edn, Sage Publications, London.

The results obtained for this text search query are represented in Figure 5.3.

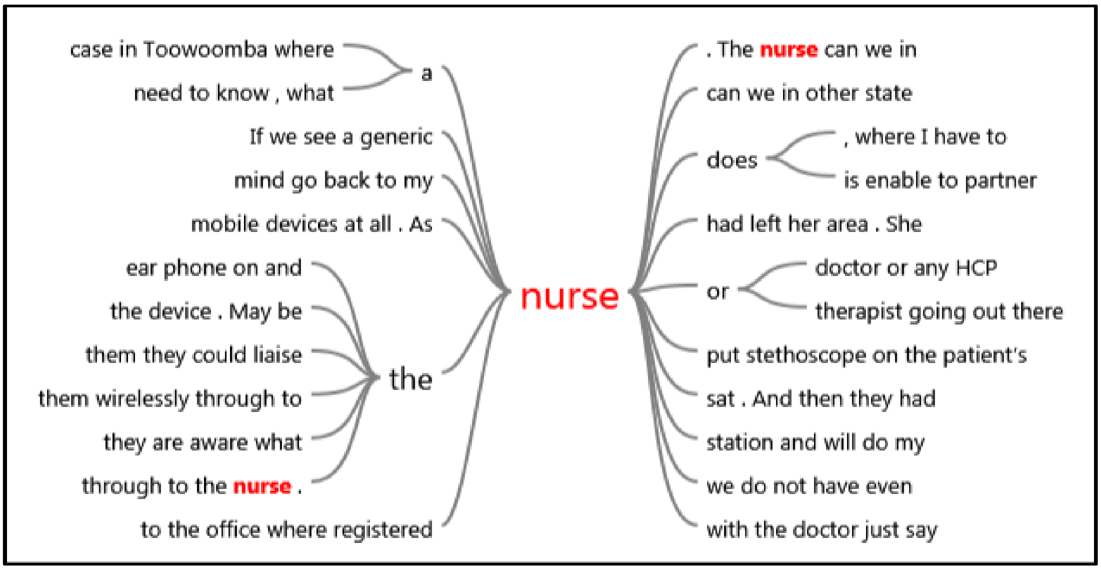

Figure 5. 3: Text search query obtained for the 'Nurse' keyword (N-vivo output)

Source: Developed for this research

However, the results of a text search query may not be able to provide all the relevant data related to a particular node because sometimes participants use different words to explain the same idea. Therefore, the transcripts were also manually analysed (read) by the researcher to see if any data remained available for coding into an appropriate node. In the manual analysis, the remaining matching data was placed into the relevant node. Thus the output of the qualitative data was fourteen factors categorized into four themes and participants' views for these fourteen factors.

In the next section, participants' views and the researcher's interpretation of all fourteen factors proposed in the initial conceptual framework and new factors obtained in the Qualitative Phase are explained.

5.3 Qualitative study Findings

The Qualitative Data was collected from Queensland Health regional areas. There were thirty-two participants with a minimum of four and a maximum of seven participants in each focus group discussion. In total, six group discussions and two interviews were conducted. Among the 32 participants, 78% (25 participants) were females and 22% (7 participants) were males. The participants involved in this Phase were HCPs including general practitioners, nurse unit managers, nurses, psychologists, occupational therapists (OT), physiotherapists, dieticians and oral health practitioners from various health domains who were also involved in Telehealth.

The Qualitative Phase findings for each factor were represented using N-vivo's text search query option. The results of the text search query run are represented diagrammatically for each of the fourteen factors. The Qualitative Phase findings were also represented using Participants' quotations with the researcher's interpretation. While stating the quotations, sometimes the text was written in parenthesis. This is done to make the quotations clearer and more meaningful and understandable. Furthermore, to identify the 'place' from which quotations were coming, certain codes were used. These codes are: FG [Number] P [Number] and IR [number].

FG [Number] stands for focus group discussion number. P [Number] stands for focus group respondent number. IR [number] stands for interview respondent number.

After explaining each factor, a summary of the items obtained for the factor were represented in a tabular form and tracked back to the technology adoption literature. If items obtained in the Qualitative Phase were not given in the technology adoption literature, these were considered as new items and were represented as bold. The explanation for each factor is given one by one in the following sections.

5.3.1 Relevance of Intention

Intention refers to:

> *'The measure of the likelihood to perform the behaviour which further leads to behaviour performance' (Ajzen 1988, p. 42).*
>
> *'Intention is a person's subjective probability to perform a specified behaviour' (Mun et al. 2006, p. 354)*

Intention in this research study is operationalised as:

> *'The measure of the likelihood to use mobile devices in the healthcare environment' (Source: Developed for this research).*

The first question discussed in the Qualitative Phase was about understanding the intention of HCPs as indicated below.

> *Q1: Can you please tell me your intention in regard to the use/ adoption of mobile devices in Telehealth? Do you want to use mobile devices such as smartphone and tablets in the Telehealth event, for example remote monitoring and consultation with patients?*

Probes used were: if needed, to some extent, in the coming future (Wu, Li & Fu 2011; Yangil & Chen 2007).

The responses obtained for the factor Intention in the Qualitative Phase are given in Figure 5.4.

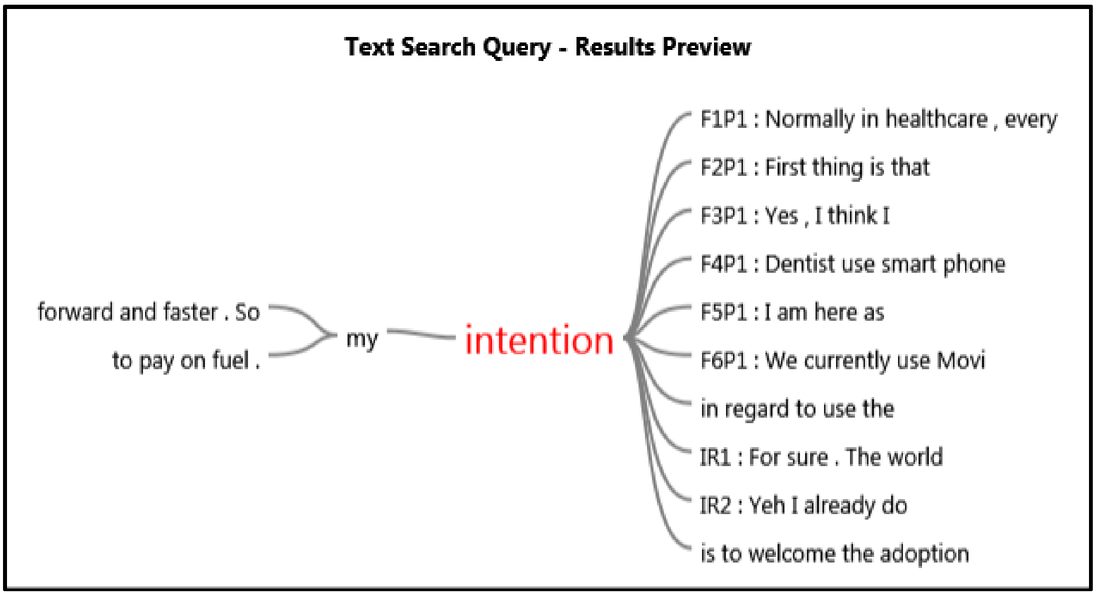

Figure 5. 4: Text search query results obtained for the Intention factor (N-vivo output)

Source: Developed for this research

The data obtained from interviews and FGDs showed that most of the HCPs were intending to use mobile devices. Participants gave various reasons for their intention to use mobile devices and their views about the use of mobile devices were the many benefits they could bring into the healthcare environment as indicated below:

> *'You can know what is happening with the patients when the patient is at home. Also it (the mobile device) minimises a lot of cost especially on the patient's side, the transport money to pay on fuel' (IR1).*

> *'I visit nursing homes to see people who are sick and cannot come to a doctor; so providing the services using mobile devices at the bedside would be great' (FG6P4).*

> *'My intention in regard to the use of mobile devices is great because it may help or it helps in different ways to get the job done accurately and on time' (IR1).*

Participants also indicated that they are already using mobile devices to some extent.

> *'We are using an array of applications on the iPad and using 'Ehab' for Telehealth. One of the applications we are using is 'Measures', which is an application of iPad and is used to take the pictures of the clients' home environment' (FG5P1).*

> *'We have an app system called 'Dosage' (which is used in the mobile devices). All the medications are done on this mobile device' (FG3P4).*

Further, a large percentage of HCPs who are currently not using any mobile device, intended to use them in the future to improve health processes and to more efficiently use their time, as indicated by various focus group participants:

> *'In X health facility we currently use the 'Movi' Cam but I am really interested to be able to carry something like an iPad to the ward' (FG6P1).*

> *'When you are in an Age care facility you going to do lot of footwork. I look after seventy patients. And in the night shift*

they are not sleeping they are waking and complaining and it's a big place and in hospital we got 6 patients in a big room and we just running around. Family ask questions then we say, I will go and check ------I would love that if we could do that in mobile devices' (FG3P3).

'We use the 'Lee care' system, which allows progress notes and everything in one system, I would love if it would be mobile like in a little pocket size' (FG3P4).

'I believe that I am interested in using mobile devices to explain the things to patients' (FG2P2).

The items obtained for the Intention factor from the participants' views in the Qualitative Phase are summarised below in Table 5.2.

Table 5. 2: Items summarised for the Intention factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	**General**
1.	Using mobile devices have various benefits. *(This item belongs to Relative advantages factor.)*	Yes	• Smartphone (Yangil & Chen 2007) • Telehealth (Castro, Miller & Nager 2014) • Wireless HIT (Daim, Basoglu & Topacan 2013) • Wireless technology (Tiong et al. 2006)	• Mobile services (Gao, Krogstie & Siau 2011) • Information Technology (IT) (Karahanna, Straub & Chervany 1999)
2.	Intended to improve health processes/work. *(This items indicates influence of Relative advantages on Intention.)*	Yes	• Smartphone (Yangil & Chen 2007)	• IT (Mun et al. 2006)
3.	Intended to use for efficient use my time. *(This item indicates influence of Relative advantages on Intention.)*	Yes	• Wireless technology (Tiong et al. 2006) • Smartphone (Yangil & Chen 2007)	• IT (Karahanna, Straub & Chervany 1999)
4.	Intended to use to some extent.	Yes	• Smartphone (Yangil & Chen 2007)	--------
5.	Intended to use in future.	Yes	• Smartphone (Yangil & Chen 2007) • Health Information System (HIS) (Bawack & Kala Kamdjoug 2018)	--------
6.	Intended to use if I have mobile devices.	Yes	• Smartphone (Yangil & Chen 2007)	--------

When items obtained for the Intention factor were compared with the HIT adoption literature, it was found that items numbered 1-3 as mentioned in Table 5.2 showed a direct relationship between Relative advantages and Intention, which is supported in the HIT adoption literature (Morilla et al. 2017). The remaining items 4-6 were representing the Intention factor and are also supported in the HIT adoption literature (Yangil & Chen 2007; Castro, Miller & Nager 2014). Thus, the findings of the Qualitative Phase for the Intention factor were consistent with the literature.

5.3.2 Relevance of Technology readiness

Technology readiness refers to:

> *'Individuals' ability to embrace and adopt new technology'*
> *(Caison et al. 2008, p. 283)*

Technology readiness in this research study is operationalised as:

> *'An individual health professional's ability to embrace and adopt mobile devices in the healthcare environment' (Source: developed for this research).*

The question used for Technology readiness was as follows:

> *Q2: What do you think about your readiness for the adoption of mobile devices in a healthcare event? If mobile devices are available to use in your hospital, do you think you are ready to use them in Telehealth?*

Probes used were: optimistic feeling, innovativeness, discomfort and insecurity (Chang & Kannan 2006; Parasuraman 2000; Gagnon et al. 2016).

The responses obtained for the Technology readiness concept are represented in Figure 5.5.

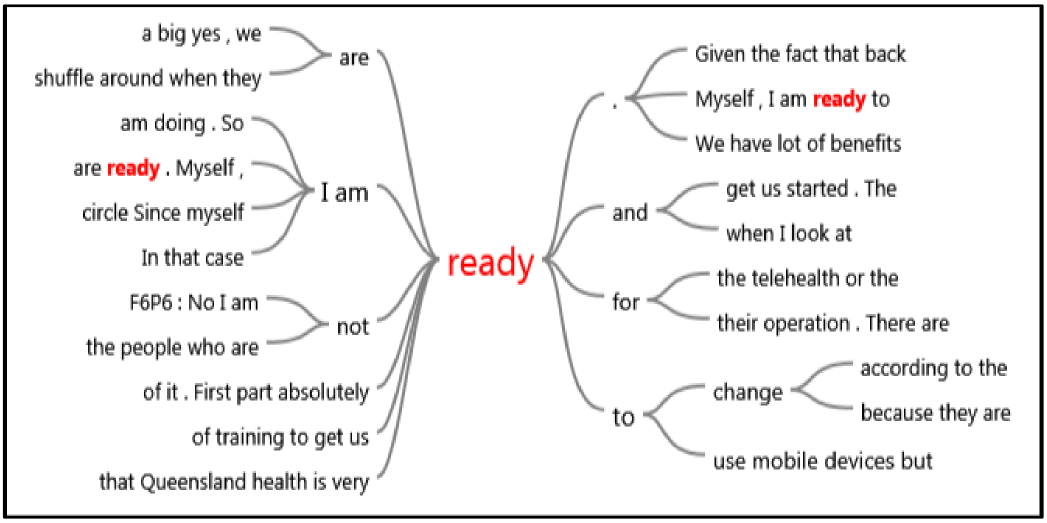

Figure 5. 5: Text search query results obtained for the Technology readiness factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Analysis of FGDs and interviews indicated that a significant number of the HCPs were ready to use mobile devices as evident from the statement below:

> *'I may say a big yes; we are ready because we are confident to use them (mobile devices)' (IR1).*

A significant number of the participants mentioned that using mobile devices has many benefits in healthcare, such as HCPs being able to communicate much more easier with each other using mobile devices:

> *'It's (mobile device) very handy for HCPs and they can keep in touch with other staff' (*FG1P3*).*

Another group of participants showed readiness to use mobile devices because these days most people are familiar with mobile technology, because they use them in their daily routine:

> *'Everybody knows how to use devices. I use them in everyday life.-- Most people have a smartphone and they use it in their daily life' (FG2P3).*

Further, participants expressed their consent to use mobile devices if training is provided to them as indicated:

> *'I think the management should provide some sort of training to get us ready (to use mobile devices) and get us started' (IR1).*

Furthermore, some of the participants indicated that it depends on the management:

> *'In the hospital when they say you are going to use this (mobile device) then we have to' (FG2P2).*

Some participants advocated a trial period before introducing mobile devices into the health facility. However, a small proportion of participants expressed a lack of consent as they have no experience in using the newest mobile devices:

> *'No I am not ready. ---I have never used the tablet in my life' (*FG6P6).

Further, some of the participants said that the Age (moderating variable) also influences HCPs' readiness to use mobile devices, and those who are close to retirement age are not ready to use them:

> *'Well, there are always people who are not ready to change because they have been doing things in the old way for so many years. They are close to retirement. They do not want to learn something new' (FG3P1).*

The explanations provided for the Technology readiness factors indicated that it is one of the significant factors explaining mobile device adoption in healthcare. A complete summary of the items obtained in the qualitative analysis for Technology readiness of HCPs to use mobile devices is given in Table 5.3.

Table 5. 3: Items summarised for the Technology readiness factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	**I am confident to use it.** *(This item belongs to Self-efficacy factor.)*	Self-efficacy is supported in previous literature but the direct influence of Confidence on technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007) • HIS (Bawack & Kala Kamdjoug 2018)	• New technologies (Parasuraman 2000)
2.	**I can see the benefits.** *(This item belongs to Relative advantages factor.)*	Relative advantages is supported in previous literature but the direct influence of Relative advantages on Technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007) • Telehealth (Castro, Miller & Nager 2014)	• New technologies (Parasuraman 2000) • Mobile services (Gao, Krogstie & Siau 2011)
3.	**I am familiar.** *(This item belongs to Complexity factor.)*	Complexity is supported in previous literature but the direct influence of Complexity on Technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007)	• New technologies (Parasuraman 2000)-
4.	**I have the knowledge.** *(This item belongs to Self-efficacy.)*	Self-efficacy is supported in previous literature but the direct influence of Self-efficacy on Technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007) • m-health (Wu, Li & Fu 2011)	• New technologies (Parasuraman 2000)
5.	**My management supports me.** *(This item belongs to Management support factor.)*	Management factor is supported in previous literature but the direct influence of Management support on technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007) • Electronic and mobile services (Tsai & Kong 2013)	---------
6.	**Training is provided to me.** *(This item belongs to Training factor.)*	Training is supported in previous literature but the direct influence of Training on Technology readiness is not indicated.	• m-health (Agarwal et al. 2015) • Implementing technology in healthcare (Morilla et al. 2017)	New technologies (Parasuraman 2000)
7.	**Depend upon experience.** *(This item belongs to Experience as one of the Demographic factors.)*	Experence is supported in previous literature but the direct influence of Experience on Technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007)	---------
8.	**Depend upon age.** *(This item belongs to Age as one of the Demographic factors.)*	Technology readiness is supported in previous literature but the direct influence of Age on Technology readiness is not indicated.	• Smartphone (Yangil & Chen 2007)	---------

As mentioned in Table 5.3, eight items in the Technology readiness factor were obtained. These items indicated the direct influence of seven factors: 1. Self-efficacy, 2. Relative advantages, 3. Complexity, 4. Management support, 5. Training 6. Age and 7. Experience on Technology readiness and are not supported in the Technology adoption literature. These items were placed in their relevant factors and this factor was merged with the Self-efficacy factor as all the items obtained for this factor were covered in the Self-efficacy factor. Thus, this factor is not represented in the refined conceptual framework. The explanations for Self-efficacy factor is provided further.

5.3.3 Relevance of Confidence/Self-efficacy

To keep the Self-efficacy concept understandable for the participants, the word 'Confidence' was used in place of 'Self-efficacy' in the qualitative discussions. Self-efficacy and Confidence have a similar meaning.

Confidence/Self-efficacy refers to:

> *'Judgement of capability to execute given type of performances' (Pajares & Urdan 2006, p. 309).*

Confidence/Self-efficacy in this research study is operationalised as:

> *'The individual's confidence in his own capabilities and strength to use mobile devices in the healthcare environment' (Source: developed for this research).*

The question used for the Confidence/Self-efficacy concept was as follows:

> *Q3: Do you think you would be confident to use mobile devices in Telehealth?*

Probes used were: I am confident, I am able, It is under my control, Knowledge, Resources and Ability (Durndell & Haag 2002; Wu, Li & Fu 2011).

The text search query in Figure 5.6 indicates that HCPs feel confident using mobile devices as they indicated that they are advanced in using technology and consider that using mobile devices in healthcare is under their control:

> *'We are all advanced in technology use so we are very confident to use these devices' (FG4P2).*

> *'I am pretty confident to use mobile devices in Telehealth. All is under my control'* (IR2).

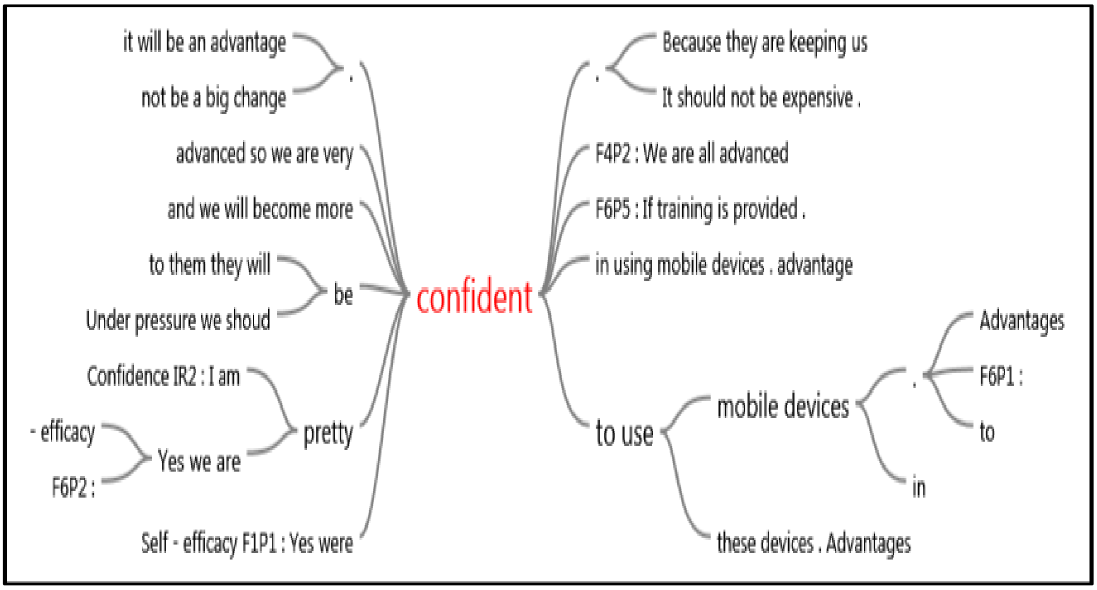

Figure 5. 6: Text search query results obtained for the Confidence factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Further, participants added that they are confident using mobile devices as they can see various advantages in using them in the health environment. Furthermore, they added that HCPs' confidence in using mobile devices will increase if training, a trial period and support is provided by their health facility and the software is uncomplicated:

> *'If plenty of training, good (easy to use) software and support from hierarchy is provided' (FG3P1).*

> *'If they (management) just say you have to do this but they do not support us then that change will be hard to manage' (FG3P1).*

> *'It needs to be simple to use and I guess if you are in a remote setting and tension is high then these things (mobile devices) should be simple (easy to use). Under pressure we should be confident to use mobile devices' (FG3P4).*

> *'If the organisation says this is now the policy we have in place for the usages of mobile devices, then why not use mobile devices' (FG6P2).*

> *'Training is most important. If education is provided and the mobile devices are given for a trial use for a few months, then the confidence level of the individual will increase and they will become more confident in using mobile devices' (IR1).*

Participants also indicated that their health facility supports them and provides them with continuous training regarding the use of mobile devices:

> *'Yes we are confident because they (management) are keeping us updated through seminars and other written material for using these (mobile) devices' (FG1P1).*

The confidence to use mobile devices also depends on the age of the HCPs. New staff feel more confident to use technology as indicated below:

> *'New staff know how to use the technology but there are some older staff, they do not know how to use it (mobile devices) so if training will be given to them, they will be confident' (FG1P4).*

The HCPs also indicated that if they have experience in the use of mobile devices in healthcare then they could share that experience with those less experienced and work more effectively as mentioned below:

> *'But if you have already learned, you can tell me or we can share the training on actually how to use it, we can work it out more effectively' (FG5P1).*

The items obtained from the Qualitative Phase for the Self-efficacy/confidence factor are summarised in Table 5.4 below.

Table 5. 4: Items summarised for the Self-efficacy factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	It is in my control to use mobile devices.	Yes	• m-health (Wu, Li & Fu 2011)	--------
2.	**Complexity of the software influences my confidence.** *(This item indicates influence of Complexity on Confidence.)*	Complexity factor for technology adoption is supported in previous literature but the direct influence of Complexity on Self-efficacy is not indicated.	• Mobile computing (Wu, Wang & Lin 2007)	--------
3.	**If I can see the benefits.** *(This item indicates influence of Relative advantages on Confidence.)*	Relative advantages factor for technology adoption is supported in previous literature but the direct influence of Relative advantages on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007) • Wireless technology (Tiong et al. 2006)	--------
4.	**If Management supports me.** *(This item indicates influence of Management support on Confidence.)*	Management support factor for technology adoption is supported in previous literature but the direct influence of Management support factor on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007) • Electronics and mobile services (Tsai & Kong 2013)	--------
5.	**Training is important to enhance Self-efficacy.** *(This item indicates influence of Training on Confidence.)*	Training factor for technology adoption is supported in previous literature but the direct influence of this factor on Self-efficacy is not indicated.	• m-health (Agarwal et al. 2015) • Implementing technology in healthcare (Morilla et al. 2017) • Mobile computing (Wu, Wang & Lin 2007)	--------
6.	**Age influences Confidence.** *(This item indicates influence of Age on Confidence.)*	Age factor for technology adoption is supported in previous literature but the direct influence of this factor on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007) • HIS (Bawack & Kala Kamdjoug 2018)	--------
7.	**Experience influences Confidence.** *(This item indicates influence of Experience on Confidence.)*	Experience factor for technology adoption is supported in previous literature but the direct influence of this factor on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007)	---------

As demonstrated in Table 5.4, seven items were obtained in the Self-efficacy factor. Surprisingly, it was found that the items obtained in the Self-efficacy factor covered all the items in the Technology readiness factor. Therefore, the items obtained in the Technology readiness factor were merged into the Self-efficacy factor item list and both factors were merged together and represented as the Self-efficacy factor. The final list of merged items obtained for the Self-efficacy factor is shown in Table 5.5 below.

Table 5. 5: Items summarised for the Self-efficacy factor after merging Technology readiness from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	**If I can see the benefits.** *(This item indicates the influence of Relative advantages on Confidence.)*	Relative advantages factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007) • Wireless technology (Tiong et al. 2006)	------------
2.	If I am Confident to use mobile devices.	Yes	• Smartphone (Yangil & Chen 2007) • m-health (Wu, Li & Fu 2011)	• Embracing new technology (Parasuraman 2000)
3.	If I have the knowledge.	Yes	• Smartphone (Yangil & Chen 2007) • m-health (Wu, Li & Fu 2011)	------------
4.	If I am familiar. *(This item indicates influence of Complexity on Confidence.)*	Yes	• Smartphone (Yangil & Chen 2007) • Wireless technology (Tiong et al. 2006)	• Technology readiness (Parasuraman 2000)
5.	**Complexity influences my confidence to use mobile devices.** *(This item indicates influence of Complexity on Confidence.)*	Complexity factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not indicated.	• Smartphone (Yangil & Chen 2007) • Electronic and mobile services (Tsai & Kong 2013)	----------
6.	**If Management support me.** *(This item indicates influence of Management support on Confidence.)*	Management support factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not supported.	• Smartphone (Yangil & Chen 2007)	---------
7.	**If Training is provided.** *(This item indicates influence of Training on Confidence.)*	Training factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not supported.	• Mobile computing (Wu, Wang & Lin 2007) • Electronics and mobile services (Tsai & Kong 2013)	----------
8.	**Depend upon Age.** *(This item indicates influence of Age on Confidence.)*	Age as moderating factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not explained.	• HIT (Bawack & Kala Kamdjoug 2018)	• Implementing technology in healthcare (Morilla et al. 2017)
9.	**Depend upon Experience.** *(This item indicates influence of Experience on Confidence.)*	Experience as moderating factor for technology adoption is supported in literature but the direct influence of this factor on Self-efficacy is not explained.	• Smartphone (Yangil & Chen 2007)	---------

After merging Technology readiness with Self-efficacy, the nine items shown in Table 5.5 were obtained. Among these nine items, six (items 1 and 5-9) indicated a direct relationship with 1. Relative advantages, 2. Complexity, 3. Management support, 4.

Training, 5. Age and 6. Experience on Self-efficacy, which is not supported in the HIT adoption literature, but was used to refine the initial conceptual framework.

5.3.4 Relevance of Social influences

Social influences refers to:

> *'An individual's perception of whether people important to the individual think the behaviour should be performed' (Source:https://is.theorizeit.org/wiki/Theory_of_planned_behavior).*

In this study, Social influences is operationalised as follows:

> *'The influence of Social influences on individuals' adoption of mobile devices in the healthcare environment' (Source: developed for this research).*

The question used for the Social influences factor is as follows:

> *Q7: Do you think you may be influenced by your social circle for adoption/use of mobile devices in Telehealth? Do you think you will use mobile devices in healthcare events such as remote monitoring and consultation if your friends will be using them?*

Probes used were: friends, relatives or colleagues (Wu, Li & Fu 2011).

The responses obtained for the Social influences are given in Figure 5.7.

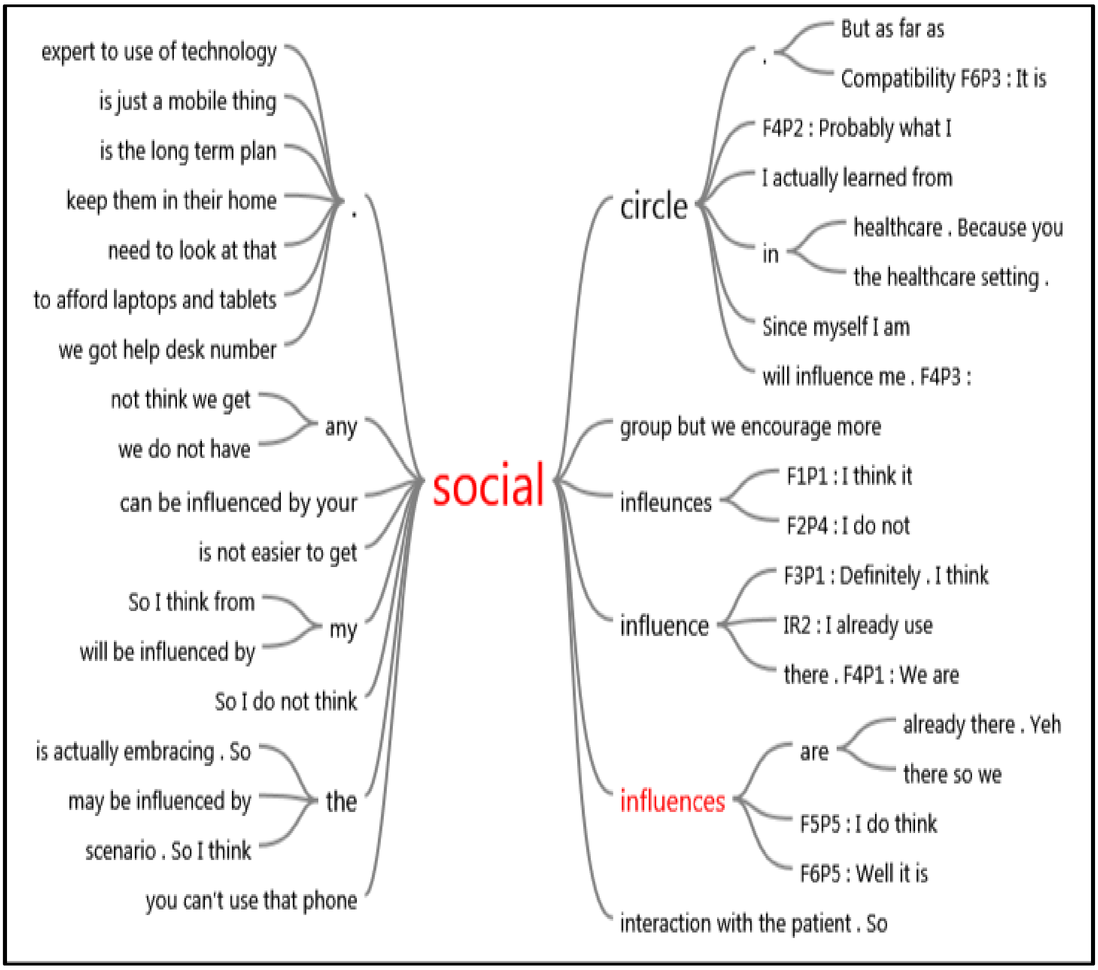

Figure 5. 7: Text search query results obtained for the Social influences factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Participants have conflicting views regarding the Social influences factor for using mobile devices in healthcare. A significant proportion of the participants accepted that Social influences do influence them, while they consider the use of mobile devices in healthcare as:

> *'Obviously, if your friends are working in the health area give their views saying 'oh it's (mobile device use) terrible, then that's going to give you a negative influence'* (FG3P1).

'We are all learning from each other and there is I think that influence to provide support to each other and to encourage each other too' (FG5P6).

On the other hand, some participants indicated that their social circle does not influence them because they are answerable to their supervisors in the health facility, as indicated by one of the participants:

'I do not think that so, you can be influenced by your social circle in healthcare because you are governed by the work you do and the person in charge. You cannot follow your friend because there is a boss above you' (FG2P4).

Participants also indicated that the Social influences factor is also influenced by age and experience and these influences are more prevalent in older people, especially in those who do not have experience in using technology:

'It might make it easier to use a mobile device if everybody else is using it, especially, for the older generation of workers who are not so familiar. They may feel that they have to use it to keep up. So I guess they (unexperienced older people) may be influenced by the social circle' (FG2P2).

The items summarised for the social influence factors are mentioned in Table 5.6.

Table 5. 6: Items summarised for the Social influences factor from qualitative data analysis

No	**Items**	**Literature support**	**Technology adoption**	
			Healthcare	**General**
1.	Do have social influences.	Yes	• IT (Wu, Li & Fu 2011)	• IT (Karahanna, Straub & Chervany 1999)
2.	Influenced by colleagues.	Yes	• Wireless technology (Tiong et al. 2006)	• IT (Mun et al. 2006)
3.	**Do not have social influences.**	No		--------
4.	Follow the supervisors.	Yes	----------	• IT (Mun et al. 2006)
5.	**Older people may have Social. Influences.** *(This item indicates the relationship of Age with Social influences.)*	The Influence of Age on Social-influences is not supported in the previous literature.	-----------	--------

In the Social influences factor, five items were summarised from participants' views. Among these items, three (items 1, 2 and 4) were consistent with the technology adoption literature in general and in healthcare (Wu, Li & Fu 2011; Mun et al. 2006; Karahanna, Straub & Chervany 1999; Ajzen 1988) and one of them (item 3) was inconsistent with the previous literature. One of the items (item 5) obtained in this factor explored a direct influence of Age on Social influences, which is not supported in the HIT adoption literature therefore, considered as a new influence and used to refined the initial conceptual framework.

5.3.5 Relevance of Demographic factors

In this study, Demographic factors is operationalised as follows:

> *'An individual health professional's age, gender and technical experience' (Source: developed for this research).*

No specific question was asked during the discussion sessions for the Demographic factors but the responses for age, gender and experience were obtained while other factors given in the questions guide were discussed with the participants. The respondents' views for Age, Gender and Experience factors obtained are explained below.

Relevance of Age

A large percentage of health professionals considered age to be an influential factor in the use of mobile devices in the health environment as mentioned in the text query results shown in Figure 5.8.

Participants explained that young people are more tech savvy and feel more comfortable using technology and enjoy the benefits of using technology. Participants also stated that their young children taught them about such technology which indicated that Age is an influential factor for using mobile devices:

'I think there is the role of the age because my children teach me now how to use this (mobile device) technology' (FG5P4).

Further, the influence of Age on Self-efficacy, Complexity, Functional features and Training, as explained earlier in their relevant factors, also indicates Age as an influential factor for understanding the adoption of mobile devices in healthcare.

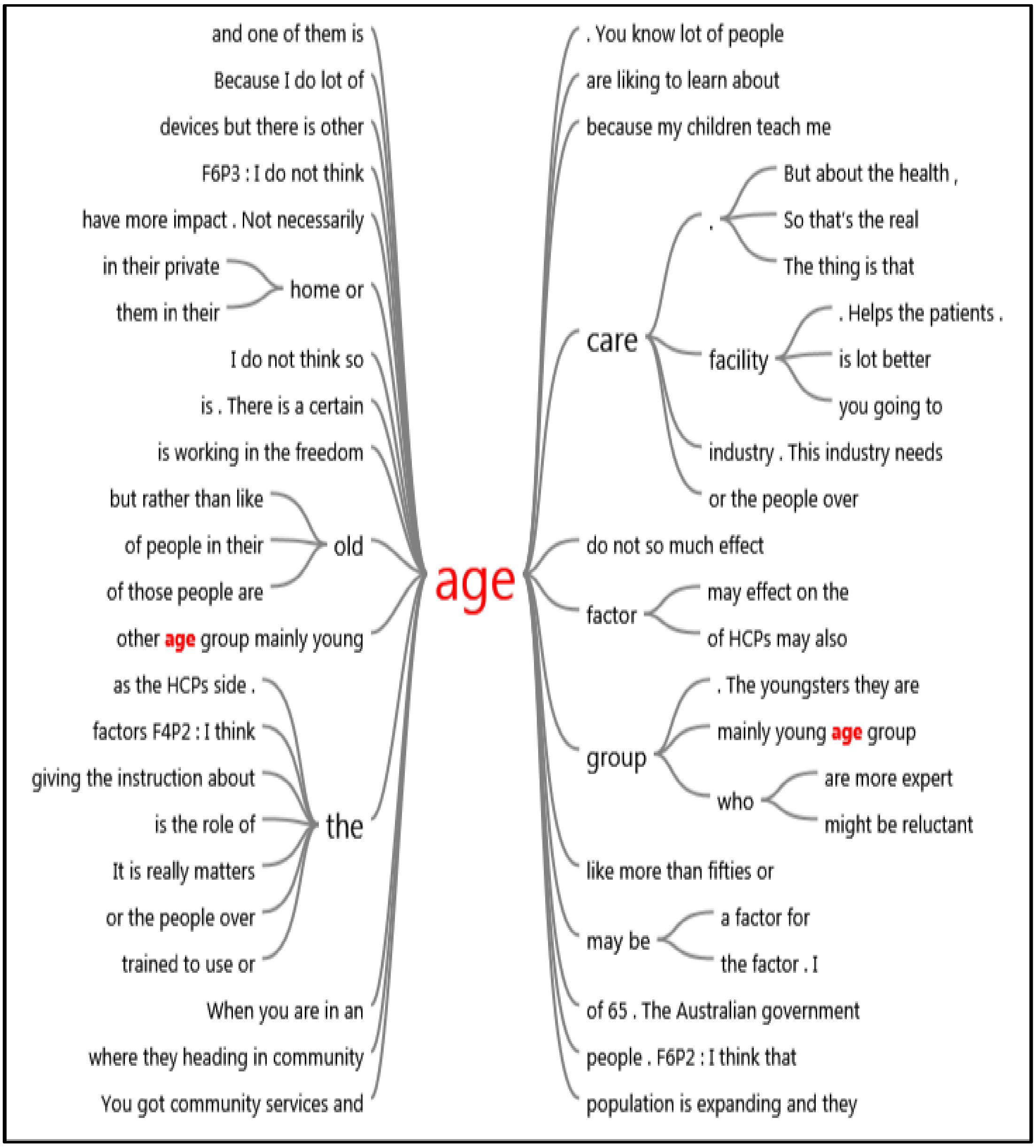

Figure 5. 8: Text search query results obtained for the Demographics factor: Age from qualitative data analysis (N-vivo output)

Source: Developed for this research

The following items mentioned in Table 5.7 with respect to age were obtained during the discussion.

Table 5. 7: Items summarised for the Demographic factor: Age from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Age affects usage of technology.	Yes	• Smartphone (Yangil & Chen 2007) • HIS (Bawack & Kala Kamdjoug 2018)	
2.	**Reluctant to use technology if close to retirement.**	No	-------------	-----------
3.	**The challenge is the generation gap.**	No	-------------	------------
4.	**Young age group is more expert in using technology.**	No	-------------	------------
5.	**Seniors hesitate to ask if they find any difficulty with using technology.**	No	-------------	------------
6.	**New staff know how to use technology.**	No	-------------	------------
7.	**Senior staff find it difficult to use technology.**	No	-------------	------------
8.	**Technology is harder for the older people.** *(This item indicates the influence of Age on Complexity.)*	The influence of Age on Complexity is not supported in the literature.	-------------	------------
9.	**After 50 years of age it is difficult to learn new systems.** *(This item indicates the influence of Age on Complexity.)*	The influence of Age on Complexity is not supported in the literature.	-------------	------------
10.	**Older people are less exposed to technology.** *(This item indicates the influence of Age on technology Experience.)*	The influence of technology Experience on Age is not supported in the literature.	-------------	------------
11.	**Older staff lack experience in using technology.** *(This item indicates the influence of Age on technology Experience.)*	The influence of technology Experience on Age is not supported in the literature.	-------------	------------
12.	**Older people are still struggling to use technology.**	No	-------------	------------

Age emerged as an influential factor in this research. In this factor, twelve items were summarised from participants' views. Of these, seven items (number 2-7 and 12) are not supported by the literature and considered as new items for the Age factor, and are therefore indicated in bold in Table 5.7. Items 8 and 9 obtained for this factor indicated the direct influence of Complexity and Experience on the Age factor, which is not supported in the previous literature. The remaining two items (10 and 11) indicated the direct influence of Experience on Age and are not supported in the previous literature and therefore considered as new. All the influences obtained in this factor are represented in the refined conceptual framework.

The Age factor is considered one of the moderating[8] factors in the HIT adoption literature (Bawack & Kala Kamdjoug 2018). However, in this Phase it was difficult to analyse the moderating influence of Age. Therefore, the moderating influence of Age proposed in the refined conceptual framework was left as it was in the initial conceptual framework and the direct influence of Age on Intention and other factors was also considered in the refined conceptual framework.

Non-relevance of Gender

The Demographic factor, Gender, proposed as a moderating factor in the initial conceptual framework turned out to be an insignificant factor in the Qualitative Phase. Very little data was obtained for the Gender factor. As shown in the text search query results Figure 5.9 obtained through N-vivo analysis, participants mentioned that there is no gender difference associated with mobile device use in the Telehealth environment.

Figure 5. 9: Text search query results obtained for Demographics factor: Gender from qualitative data analysis (N-vivo output)

Source: Developed for this research

Both male and female are equally good at using mobile devices as shown below in the quotes obtained from participants:

[8] A moderator is a variable that affects the strength of relationship between an independent and dependent variables Akter, S, D'Ambra, J, Ray, P & Hani, U 2013, 'Modelling the impact of mHealth service quality on satisfaction, continuance and quality of life', *Behaviour & Information Technology*, vol. 32, no. 12, pp. 1225-1241.

'There will not be any gender difference for using mobile devices' (FG4P2).

'I do not think there may be gender difference for the use of technology' (IR2).

Thus, the findings for Gender as one of the moderating factors proposed in the initial conceptual framework was inconsistent with technology adoption in general (Venkatesh, Morris & Ackerman 2000; Weber 2000; Zhang et al. 2017; Tsourela & Roumeliotis 2015).

Relevance of Experience

Experience was another moderating factor proposed in the initial conceptual framework which turned out to be a significant factor in the Qualitative Phase. The responses obtained for this factor in the form of the text search query are represented in Figure 5.10.

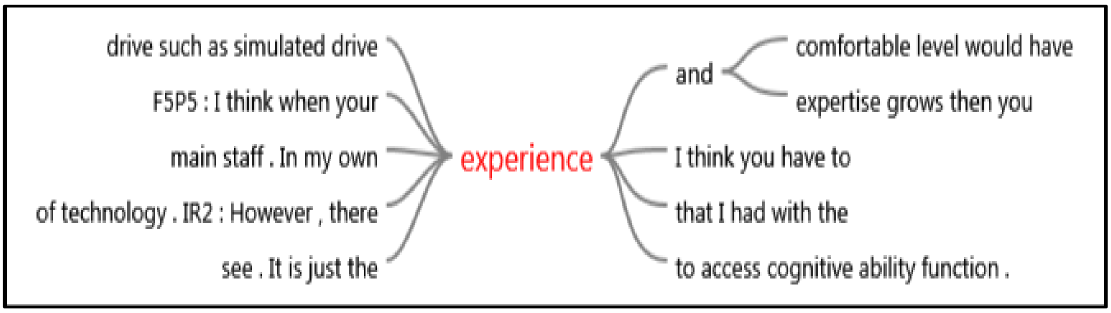

Figure 5. 10: Text search query results obtained for the Demographics factor: Experience from qualitative data analysis (N-vivo output)

Source: Developed for this research

Participants indicated that familiarity with technology and experience has its impact on the use of mobile devices as stated:

'Their (HCPs) experience and comfortable level would have some impact for the use of technology' (IR2).

Participants indicated that the more they use technology, the more they become familiar with it. This involvement increases their knowledge and experience and they will be able to troubleshoot the problems they face:

> *'I think when your experience and expertise grows then you try to trouble shoot the problem. The more we use it (technology) the more knowledge we gain' (FG5P5).*

One of the focus group participants also added that senior staff working in the health domain for many years find it difficult to use technology because they lack experience in the use of technology:

> *'They (senior staff) need someone to help them. Sometimes they hesitate to ask because they are senior and do not know how to do that (lack of experience)' (FG1P5).*

Participants also indicated that the Experience factor also influences 1. Self-efficacy, 2. Social influences and 3. Training, which also reveals that Experience is an influential factor for the use of mobile devices in healthcare. The influence of Experience on Self-efficacy, Complexity and Training is explained in their respective factors and is represented in the refined conceptual framework.

The items summarised for Experience in using technology are given below in Table 5.8.

Table 5. 8: Items summarised for the Demographic factor: Experience from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Experience to use technology impacts its usage.	Yes	• Smartphone (Yangil & Chen 2007)	------
2.	**Experience helps to use technology.** *(This item indicates influence of Experience on Complexity.)*	The influence of Experience on Complexity factor is not mentioned in the HIT adoption literature.	-------	------
3.	**Experience helps to troubleshoot the problems with technology use.**	No	-------	------
4.	**Senior staff need some assistance to use technology because they lack experience.** *(This item indicates the influence of Age on Experience.)*	The influence of Age and Experience on Complexity factor is not supported in the previous literature.	--------	-----

Table 5.8: Continued from previous Page 131

No	Items	Literature support	Technology adoption	
			Healthcare	General
5.	**People can gain experience from others who are more experienced.** *(This item indicates influence of Social influences on Experience.)*	Influence of Social influences on Experience is not mentioned in the previous literature.	--------	-------
6.	**Experience to use technology reduces complexity.** *(This item indicates influence of Experience on Complexity.)*	Influence of Experience on Complexity is not mentioned in the previous literature.	--------	-------

Experience also emerged as an influential factor in the Qualitative Phase. As summarised in Table 5.8 six items were obtained for this factor. Among these, one item (1) is supported in the HIT adoption literature and one item (3) is considered new. Two items (2 and 6) reveal the direct influence of Experience on Complexity, and one item (4) indicates the influence of Age on Experience. These influences are not supported in the previous literature. Therefore, all the influences obtained in this factor are considered as new influences and used to refine the initial conceptual framework and represented in the refined conceptual framework.

Technical experience is considered one of the moderating factors for technology adoption in healthcare (Yangil & Chen 2007; Caison et al. 2008). However, it was difficult to analyse the moderating influence of Experience in the Qualitative Phase of this research study. Therefore, the moderating influence of Experience proposed in the initial conceptual framework was left as is in the refined conceptual framework.

5.3.6 Relevance of Relative advantages

Relative advantages refers to:

> *'The degree to which an innovation is perceived as being better than the idea it supersedes' (Rogers 2003, p. 229).*

Relative advantages in this research study is operationalised as follows:

> *'Benefits of using mobile devices in the healthcare environment' (Source: developed for this research).*

The question asked for the Relative advantages factor was as follows:

> *Q4: Do you think there are some advantages of using mobile devices in Telehealth?*

Probes used were: productivity, effective, fast (Wu, Li & Fu 2011).

The participants' views for Relative advantages factor are represented in Figure 5.11.

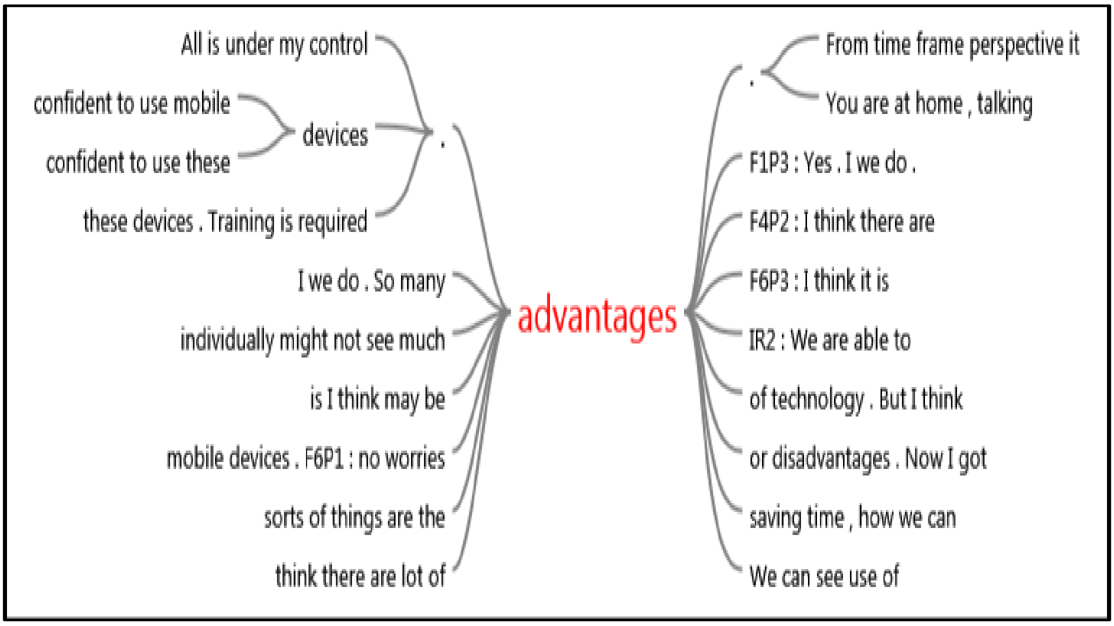

Figure 5. 11: Text search query results obtained for the Relative advantages factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

All participants accepted that there are a number of advantages associated with the use of mobile devices in the healthcare system, such as reduced costs associated with travelling to see the doctor, reduced need for creating additional infrastructure in the health facility, reduced distance between doctor and patients, and delivering accurate, on time and quality services:

> *'When you are at home, talking with the GP and getting the instructions, there it (mobile device) will definitely save your time. Money will be saved on fuel also (FG2P1).*

Mrs X is not well today. -------- Can we speak for five minutes? And they (Doctor and patient) speak through video link up. That's where they are heading in community age care. That's the real plus for those people who are stuck at home, cannot get out in a certain time but need to see a doctor quite quickly' (FG2P2).

'People don't like to go to the hospital. So these sorts of systems are merging to keep them (patients) in their home' (FG2P4).

'When you are in hurry especially when the patient is declining and we have to look what medication they (patient) have had. Then got to look at what they had in the operation theatre and what do they have in recovery time in that situation mobile devices can be useful' (FG3P1).

'We do not actually sit with the patient, which is more important. We bulked down with too much paper work and documentation. So if the documentation will done with the help of mobile devices it could save your quite a bit of time' (FG3P1).

'It (mobile device) helps in different ways to get the job done accurately and on time' (IR1).

'The cost will go down on the side of organisation. Organisation might be buying more equipment to do the work or might be recruiting more people but with the use of mobile devices one person can manage more patients and productivity will be high' (IR1).

'Its (mobile device) very handy for her (HCP) and she can keep in touch with other staff' (FG1P3).

The Relative advantage factor is influenced by Age. Participants explained that young people are more tech savvy and feel more comfortable using technology:

> *'It (use of mobile devices) really matters when it comes to the age group. The youngsters are taking more opportunities; they have lot of benefits from this telecommunication' (FG3P1).*

All the items summarised for the Relative advantage factors are listed in Table 5.9 below.

Table 5. 9: Items summarised for the Relative advantages factor from qualitative data analysis

No	Items	Literature Support	Technology adoption	
			Healthcare	General
1.	Save HCPs time/ Job done on time.	Yes	• Smartphone (Yangil & Chen 2007)	• Information technology (Karahanna, Straub & Chervany 1999)
2.	Easy access to HCPs.	Yes	• Smartphone (Yangil & Chen 2007)	---------------
3.	Can provide health services at the home environment/convenience.	Yes	• Telehealth services(Castro, Miller & Nager 2014)	---------------
4.	**Can avoid repetition of information.**	No	---------------	---------------
5.	**Can avoid writing errors.**	No	---------------	---------------
6.	**Everything can be in one system.**	No	---------------	---------------
7.	**Keep in touch with other staff/ Communication with staff is easy.**	No	---------------	---------------
8.	**Useful in emergency situation.**	No	---------------	---------------
9.	**Job done accurately.**	No	---------------	---------------
10.	Job done on time/quickly.	Yes	• Wireless (Tiong et al. 2006) • HIS (Bawack & Kala Kamdjoug 2018)	• IT(Karahanna, Straub & Chervany 1999)
11.	Save patient travelling cost.	Yes	• Smartphone (Yangil & Chen 2007) • m-health (Gao, Krogstie & Siau 2011) • Telehealth services (Castro, Miller & Nager 2014)	• ---------------
12.	High productivity.	Yes	• Smartphone (Yangil & Chen 2007)	• ---------------
13.	Ubiquitous.	Yes	• m-health (Wu, Li & Fu 2011)	• ---------------
14.	**Avoid lots of paper flicking.**	No	• ---------------	• ---------------

Table 5.9: Continued from previous Page 135

No	Items	Literature Support	Technology adoption	
			Healthcare	General
15.	**Can spend time with patients.**	No	---------------	---------------
16.	**Explaining things to patients is easier.**	No	---------------	---------------
17.	Reduce organisation cost.	Yes	• Telehealth services (Castro, Miller & Nager 2014)	---------------
18.	Quicker to access information.	Yes	• Smartphone (Yangil & Chen 2007) • Wireless HIT (Daim, Basoglu & Topacan 2013)	• IT (Karahanna, Straub & Chervany 1999)
19.	**Send data wirelessly.**	No	---------------	---------------
20.	**Using mobile devices makes HCPs tension free.**	No	---------------	---------------
21.	**Face -to -face communication is possible or Speaking through the video link is possible.**	No	---------------	---------------
22.	**Save nurses health.**	No	---------------	---------------
23.	**Can store information in patient room.**	No	---------------	---------------
24.	**Younger people take more advantages from technology.** *(This item indicates direct influence of Age on Relative advantage.)*	Moderating influence of age factor is supported in literature but direct influence of Age on Relative advantages is not supported in literature.	• HIT (Bawack & Kala Kamdjoug 2018)	---------------

Twenty-four items extracted from participants' responses in the Relative advantages factor indicate that this factor is one of the significant factors in this research. Among these items, sixteen items were found to be new and are presented in bold in Table 5.6. One of these items (24) also indicated the direct influence of Age on Relative advantages, which is not supported in the HIT adoption literature but was used to refine the initial conceptual framework.

5.3.7 Relevance of Complexity

Complexity refers to:

> *'The degree to which an innovation is perceived as relatively difficult to understand and use' (Rogers 2003, p. 257).*

Complexity in this research study is operationalised as follows:

'The degree of difficulty in using mobile devices in the healthcare environment' (Source: developed for this research)'.

The question and probes used for the Complexity factor are as follows:

Q6: What is your perception on the complexity level for the use of mobile devices in Telehealth? Do you think mobile devices are too difficult to use in Telehealth events such as remote monitoring and consultation with patients?

Probes used were: unclear, not understandable, need a lot of mental effort, frustrating (Gagnon et al. 2016; Venkatesh et al. 2003).

The responses obtained for Complexity associated with the use of mobile devices in healthcare are given in Figure 5.12.

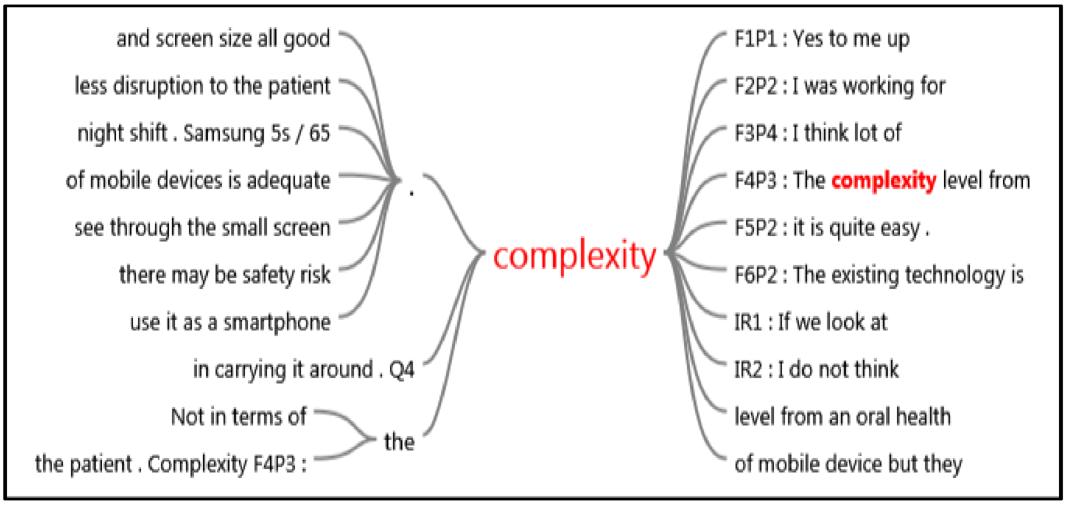

Figure 5. 12: Text search results obtained for the Complexity factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Participants have conflicting views regarding complexity in using mobile devices in healthcare. A significant proportion of the participants indicated that it is easy to use mobile devices in the health environment. HCPs also added that if they find any difficulty using any technology they can ring the help desk to get assistance.

> *'I do not need to put a lot of mental pressure to use mobile devices. If we are providing Telehealth then it is a simple process. So I do not think it will be complex' (IR2).*

Some health professionals were of the opinion that using mobile devices in Telehealth is difficult as HCPs have to make sure that each and every piece of equipment is interconnected and then connected with the Internet. They have to understand the various technical aspects related to the technology, which makes mobile device use more complex in an environment where someone is being treated. Further, there are a number of options available for operating a particular application which sometimes creates confusion and makes the use of mobile devices more complex:

> *'The complexity level from an oral health dentist, connecting every piece of equipment together can sometimes be difficult' (FG4P3).*

> *'It (use of mobile devices) is quite easy as long as there is a good network connection' (FG5P2).*

> *'If we look at the remote environment, I must say it might be difficult (to use mobile devices) because in remote areas phones are limited in services. Network coverage might be a big issue in the remote areas' (IR1).*

Some of the participants specified that use of mobile devices in healthcare is influenced by the age of the individual health professional as stated:

> *'It (use of mobile devices) really matters when it comes to the age group. The youngsters are taking more opportunities; they have lot of benefits from this telecommunication' (FG3P1).*

> *'I think it is an issue of generation (to use mobile devices). We always use mobile devices for Facebook and 'What's app' so we can handle a system easily' (FG3P4).*

Participants also indicated that Training, previous Experience using technology and Social influences help to reduce the Complexity associated with the use of mobile devices.

> *'I think if everyone have training and have used mobile devices before then it is not difficult for them to use it. ----And you can ring help desk if you are having trouble with it' (FG4P3).*
>
> *'I think we get the education for that (using mobile devices)' (FG6P1).*
>
> *'We use software called 'Cisco Zebra'. Once you get used to it, it is quite easy to log into it' (FG3P4).*
>
> *'Many people in the remote areas are not expert in using technology' (IR1).*
>
> *'It might make it easier to use it (mobile devices) if everybody else is using it, especially, for the older generation of workers who are not so familiar (with the mobile devices)' (FG2P4).*

The number of items summarised for the Complexity factor are shown in Table 5.10.

Table 5. 10: Items summarised for the Complexity factor from qualitative data analysis

No	**Items**	**Literature support**	**Technology adoption**	
			Healthcare	**General**
1.	Easy to use.	Yes	• Smartphone (Yangil & Chen 2007) • Mobile services (Gao, Krogstie & Siau 2011) • m-health (Lin & Bautista 2017) • HIS (Bawack & Kala Kamdjoug 2018)	• IT (Karahanna, Straub & Chervany 1999) • Personal computing (Igbaria et al. 1997)
2.	Difficult to use.	Yes	• m-health (Lin & Bautista 2017)	------------
3.	Training can reduce difficulty to use. *(This item indicates direct influence of Training on Complexity.)*	Yes	• m-health (Agarwal et al. 2015) • Implementing technology in healthcare (Morilla et al. 2017)	------------

Table 5.10: Continued from previous Page 139

No	Items	Literature support	Technology adoption	
			Healthcare	General
4.	**Social influences reduce Complexity.** *(This item indicates direct influence of Social influences on Complexity.)*	Complexity factor in relation to Social influences factor is not supported in previous literature.	• IT (Mun et al. 2006) • Wireless technology (Tiong et al. 2006)	------------
5.	**Previous experience with technology use can reduce the difficulty.** *(This item indicates direct influence of Experience on Complexity.)*	Complexity factor in relation to technology Experiences factor is not supported in previous literature.	• Smartphone (Yangil & Chen 2007)	------------
6.	**Complexity to use mobile devices depends upon age.** *(This item indicates direct influence of Age on Complexity.)*	Complexity factor in relation to Age factor is not supported in previous literature.	• Smartphone (Yangil & Chen 2007)	------------
7.	**Good network connection reduces complexity.** *(This item indicates direct influence of Network coverage on Complexity)*	Network factor in relation to Complexity factor is not supported in previous literature.	• Telehealth services (Parliamentary Committees 2014)	------------

The items summarised for the Complexity factor in Table 5.10 indicated that Complexity is one of the significant factors in understanding mobile device adoption in Telehealth. Seven items were extracted from participants' views in this factor. Of these, two items (1 and 2) were supported in the HIT adoption literature. All remaining items (3-7) indicated a direct influence of five factors: 1. Training, 2. Social influence, 3. Network coverage, 4. Age and 5. Experience on Complexity. In the HIT adoption literature, only the influence of Training on Complexity is supported (Morilla et al. 2017), while the other influences on the Complexity factor are not supported therefore, are considered as new influences. All the influences obtained in this factor were represented in the refined conceptual framework.

5.3.8 Relevance of Compatibility

Compatibility refers to:

> *'The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters' (Rogers 2003, p. 240).*

Compatibility in this research study is operationalised as follows:

> *'The alignment of mobile devices with HCPs' practice style and clinical processes' (Source: developed for this research).*

The question used for the Compatibility factor was as follows:

> *Q8: Do you think the use of mobile devices will be compatible with the ways you used to work with in the Telehealth environment? Do you think there will be a drastic change in your style of working by using mobile devices in Telehealth?*

Probes used were: current work process, all work process, my style of working (Karahanna, Straub & Chervany 1999).

The responses obtained for the Compatibility constructs are given in the Figure 5.13.

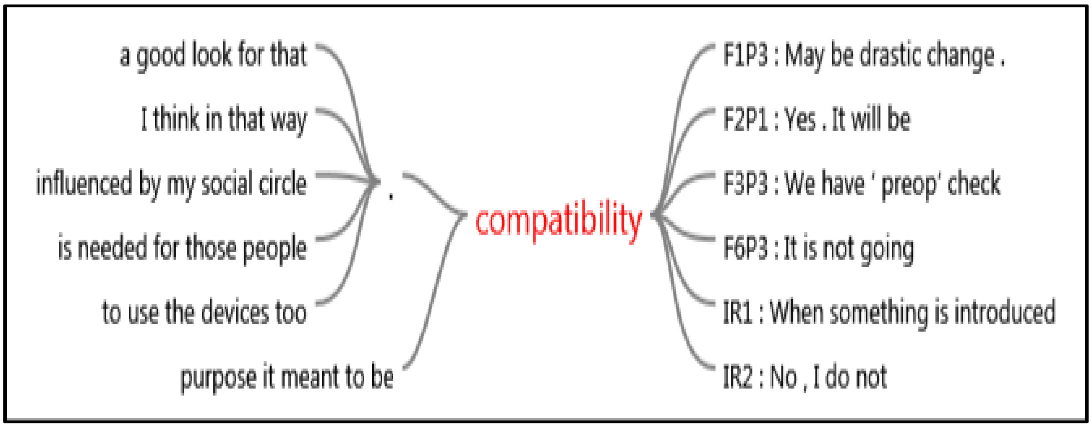

Figure 5. 13: Text search query results obtained for the Compatibility factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Respondents have different views regarding the Compatibility factor. A significant number of participants considered that mobile devices used in health care are not compatible with the previous style of working or with all the clinical work processes.

However, participants also admitted that the introduction of mobile devices will be beneficial in Telehealth:

'Yes, there will be a drastic change in my style of working if we could get to a point where we could use it (mobile devices)'. It would change the team and the structure. Potentially it could make a lot of change to our style of working but this change will be beneficial' (FG5P7).

'It (mobile devices) will not be suitable for all the healthcare processes. Some health professionals hate to see people on screen. They want face-to-face consultation. Physiotherapists need to have hands-on evaluation. Dietitians may be ok but occupational therapists also need to do hands-on evaluation. A psychologist also prefers face-to-face consultation because they have to look at nonverbal (body language) as well (FG6P1).

On the other hand, some participants indicated that mobile devices are compatible with their style of work:

'I do not think there will be a drastic change to the style of working, it will just make things a bit quicker and at your fingertips' (FG2P2).

Further, some participants indicated that there may not be any major change in the process of treatment (a clinical process) but that change could be in their style of work and that could be beneficial for them:

'I think there will not be any drastic change. I think it (the clinical work) will go nicely. I am hoping to reduce my workload' (FG6P1).

'I do not think that there will be a drastic change (by using mobile devices) as long as there is access. The device needs to be portable and situated in each room. I already do a lot of telephone therapy now without seeing anyone, so it would be

better in Telehealth if we could send documents back and forth on the screen' (IR2).

'You can take photos and that could be transferred to a physician for him to review at any time' (FG5P7).

Participants also indicated that compatibility is influenced by Trialability and Experience. In the trial time HCPs will obtain some experience using mobile devices and this will help to make the system compatible with the clinical processes:

'When something is introduced, it needs a certain transition time. For example, if it is introduced today it cannot get implemented tomorrow. Everyone may say, it is not in the system, but if the system (technology) is given for the certain period of time where everyone in the work place is having more time to use it then after sometime they may say, yes now this is the system we are going to move forward with' (IR1).

The items summarised for the Compatibility factor are given below in Table 5.11.

Table 5. 11: Items summarised for the Compatibility factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	**General**
1.	Compatible with the HCPs style of work.	Yes	• Smartphone (Yangil & Chen 2007)	• IT (Karahanna, Straub & Chervany 1999)
2.	**Not compatible with their style of work.**	No	--------------	------------
3.	Compatible with the clinical processes/work process.	Yes	• m-health (Gagnon et al. 2016)	------------
4.	**Trial time may help to make mobile devices compatible with the**	The influence of Trialability on Compatibility is not	------------	------------
5.	Use of mobile devices is beneficial.	Yes	• Smartphone (Yangil & Chen 2007)	• IT(Karahanna, Straub & Chervany 1999)
6.	**Experience to use technology helps to make technology**	Compatibility factor in relation with technology Experience factor is not	-------------	-----------

In the Compatibility factor, six items were obtained. Among these items three (items 1, 3 and 5) are supported by the technology adoption literature, while one (item 2) is not supported. The remaining two items (4 and 6) indicated a direct influence of 1.

Trialability and 2. Experiences on Compatibility, which is also not supported in the HIT adoption literature and therefore used to refine the initial conceptual framework.

5.3.9 Relevance of Functional features

Functional features, for this research, is operationalised as follows:

> *'The general features of mobile devices which can influence an individual's intention to adopt mobile devices in the healthcare environment' (Source: developed for this research).*

The question asked for the Functional features was as follows:

> *Q5: What features of mobile devices do you think may affect their use/adoption in Telehealth?*

Probes used were: weight, image quality, screen size and battery life (Gagnon et al. 2016; Kargin & Basoglu 2006).

The responses obtained for Functional features are given in Figure 5.14.

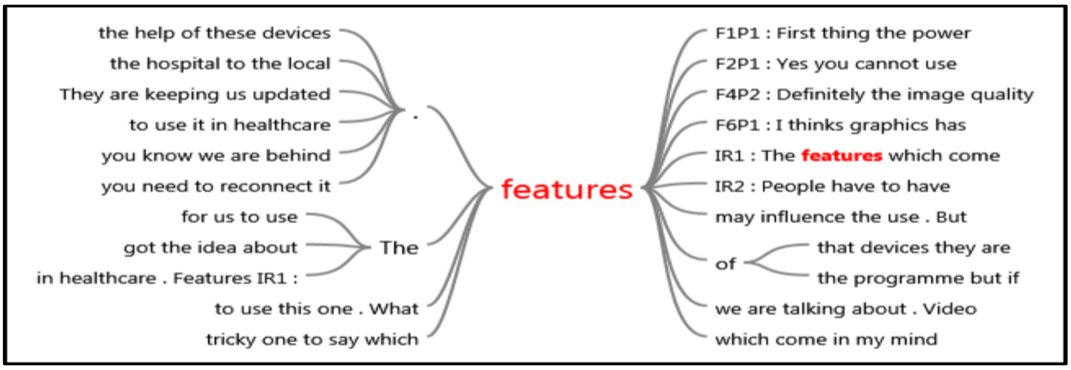

Figure 5. 14: Text search query results obtained for the Functional features factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Findings of the FGDs and interviews indicated that the image quality, sound quality, screen size, battery life, weight and memory storage are some of the most important

Functional features that mobile devices should have when used in the Telehealth environment, as indicated below:

> *'Definitely the image quality is important when you are doing things like Tele dentistry, Tele dermatology and the colour of the screen is important as well' (FG4P2).*

For the memory storage feature, participants said that it should be enough to store the work of at least one shift, as indicated below:

> *'I do not have any idea about memory size but it should be good enough to at least store the work of one shift' (FG1P1).*

Another important Functional feature that participants raised in FGDs and interviews was the screen size. Many HCPs prefer a bigger screen size. However, participants have also indicated the inconvenience of keeping a bigger size mobile device in the pocket as mentioned below.

> *'A bigger screen is always better such as these mobile devices here (5.1 inch screen). The only difficulty I have is to handle it in my pocket. Otherwise I am happy with the bigger screen size (of the mobile device) in healthcare' (FG2P1).*

Participants also said that battery life is also important because it is convenient for them as well as for the patients to use the mobile devices for video conferencing and monitoring without charging or wires attached to the device when the patient is in bed. Further, it may also be risky to use the device and simultaneously charge it. The battery of the mobile device should last at least for one shift. The views of the participants on the battery life of the mobile devices are represented below:

> *'The battery life should be for whole one to two shifts and then charged for the night shift, which is 8-12 hours' (FG3P3).*
>
> *'If we have battery, we can work with it (mobile device)' (FG1P1).*

> *'Sometimes we have to wheel the patient in their bed to the video conferencing room. So if we have a wireless device with a good battery then we could set up the probe near the patients bed, and our job would be a lot easier and less disruption to the patient' (FG3P4).*

> *'The mobile phone should have a full battery because if you are using the mobile phone and it is charging then there may be a safety risk' (IR1).*

Participants also said that after using mobile devices everyone needs to put them on charge so that mobile devices do not run out of battery when another staff member on duty needs to use them:

> *'They (HCPs) usually plug (for charging) them (mobile device) every night or whenever they like'. (FG4P2).*

Further, participants were satisfied with the image quality, battery life and weight of the currently used mobile devices:

> *'Even in the smaller devices like this (indicated towards his mobile phone) I think graphic is quite good giving a really good picture' (FG6P1).*

> *'We have not had any issue with the battery life. If it is running out of battery somebody manages to charge it. We keep on checking, we have adequate battery before we leave the office' (FG5P7).*

> *'I think it weighs less than my diary therefore the weight of mobile devices is adequate' (FG1P1).*

However, HCPs have conflicting views regarding the sound quality of mobile devices. Some of the HCPs were satisfied with the sound quality of currently used mobile devices but others were not:

'There is no issue with weight (of the mobile devices), sound quality, battery life and screen size'--(IR2).

'I did two 'Ehab' last week and had basically to work as a translator because of the sound quality. I think the picture was good but sound quality was not good' (FG5P6).

Further, HCPs indicated that mobile devices should be easy to use. The ease of using mobile devices features indicate that the Functional features are also influenced by Complexity as mentioned in the quotations below:

'If you are in a remote setting and tensions are high then these things should be simple (to use)' (FG3P4).

Further, participants also claimed that the features of the mobile devices are influenced by network coverage:

'Sometimes we do not get a good image or picture but that problem is due to Internet connection and not with the device' (FG5P7).

'You have a best screen, best set up, the greatest angle but if you do not have good connectivity, then you have nothing' (FG6P2).

Participants also indicated the influence of Age on the Functional features of mobile devices as indicated below:

'Some people who work in Telehealth are more than fifty, they can't read properly (thorough the small screen size of the mobile devices)' (FG1P3).

'I ended up going back to my old phone because I like the bigger phone. The fact is that I am getting older, my eyes are getting weaker' (FG2P3).

The number of items for the factor Functional features, are summarised in Table 5.12.

Table 5. 12: Items summarised for the Functional features factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	**General**
1.	Good image quality.	Yes	• Information system(Coiera & Magrabi 2015)	Mobile services (Kargin & Basoglu 2006)
2.	**Sound quality sometimes not clear.**	No	-------------	-------------
3.	**Sound quality is clear.**	No	-------------	-------------
4.	Screen size influences individual's adoption of mobile devices/technology.	Yes	• Mobile devices (Boruff & Storie 2014) • Mobile health (Gagnon et al. 2016)	Smartphone (Kim & Shyam 2014)
5.	Health professionals preferred bigger screen size.	Yes	• Mobile devices (Boruff & Storie 2014)	-------------
6.	Difficult to see the small screen.	Yes	• Mobile devices (Boruff & Storie 2014)	-------------
7.	Pocket size/ small mobile devices are not appropriate.	Yes	• Mobile devices (Boruff & Storie 2014)	-------------
8.	**Battery should last at least one shift (8-12 hour).**	No	--------------	-------------
9.	**Weight of current mobile devices is appropriate.**	No	-------------	-------------
10.	**Memory should be able to store one shift data.**	No	-------------	-------------
11.	**Application programme should be easy to use.** *(This item represents influence of Complexity on Functional feature factor).*	Influence of Complexity on Functional features is not mentioned in the previous literature.	-------------	-------------
12.	**Network connection influences image quality.** *(This item represents influence of Network coverage on Functional feature factor.)*	Influence of Network coverage on Functional features is not mentioned in the previous literature.	-------------	-------------
13.	**Older people can find it difficult to use.** *(This item represents influence of Age on Functional feature factor.)*	Influence of Age on Functional features is not mentioned in the previous literature.	----------------	--------------

In the Functional features factor, thirteen items were extracted from participants' responses. When these items were compared with the literature, it was found that the visual quality (Item 1) and screen size (Item 4-7) were mentioned in the literature exploring the adoption of technology in general and in healthcare (Gagnon et al. 2016; Kargin & Basoglu 2006; Kim & Shyam 2014). The information regarding battery life (item 8), sound quality (item 2-3), weight (item 9) and data storage capacity (item 10) explored in this research study, was limited in the literature. Some of the items (numbers 10-13) extracted in Functional features factor indicated the direct influence of 1. Complexity, 2. Network coverage and 3. Age on Functional features, were not supported in the HIT adoption literature and were therefore incorporated in the refined conceptual framework.

5.3.10 Emergence of Trialability

Trialability refers to:

> 'The degree to which an innovation may be experimented with on a daily basis' (Rogers 2003, p. 258)

No separate question was asked for the Trialability concept. However, responses for the Trialability were received during the discussion session as shown in Figure 5.15.

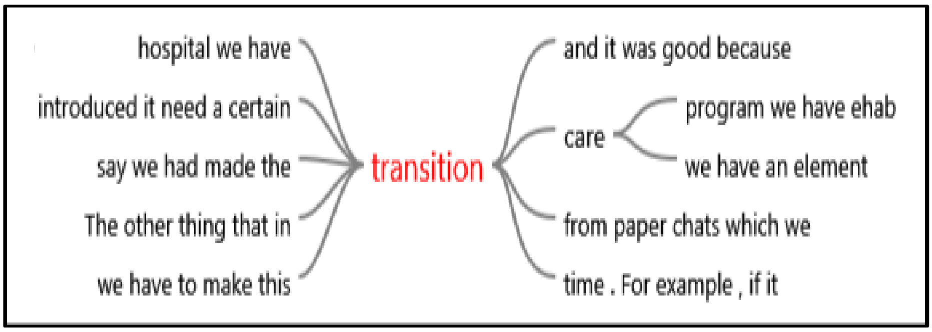

Figure 5. 15: Text search query results obtained for the Trialability factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

For the factor Trialability, participants indicated that a trial environment and trial time may help them to become familiar with the technology and increase their intention to use it:

> *'When something is introduced, it needs a certain transition time. For example, if it is introduced today it cannot get implemented tomorrow. Everyone may say, it is not in the system. But if the system/ technology is given for the certain period of time where everyone in the work place is having more time to use it then after sometime they may say, yes now this is the system and we are going to move forward' (IR1).*

In this Phase the influence of Trialability on Self-efficacy and Compatibility is also noted as mentioned below:

> *'If education is provided and mobile devices are given for a trial use for few months then the confidence level of an individual will increase' (IR1).*

The items obtained for the Trialability factors are summarised below in Table 5.13.

Table 5. 13: Items summarised for the Trialability factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	**Requires certain trial time prior to embed into normal clinical practices.**	No	----------	---------
2.	Requires trial time to become familiar with the use of mobile devices before their actual use.	Yes	• m-health (Lin & Bautista 2017)	• IT (Karahanna, Straub & Chervany 1999)
3.	Requires trial to understand how to use them.	Yes	• Smartphone (Yangil & Chen 2007)	--------
4.	**Requires trial environment to refresh the knowledge for using mobile devices.**	No	----------	--------

The four items extracted from participants' views indicated Trialability as one of the significant factors for mobile devices adoption in Telehealth. Of the four items, two (item 1 and 4) are not supported by the previous HIT adoption literature, therefore are considered as new items in this research study.

5.3.11 Emergence of Network Coverage

Another factor that emerged from the Qualitative Phase was Network coverage. A significant number of participants mentioned that Network coverage is a major challenge for the use of mobile devices in the health environment. The responses obtained for the Network coverage through text search query in N-vivo software are represented in Figure 5.16.

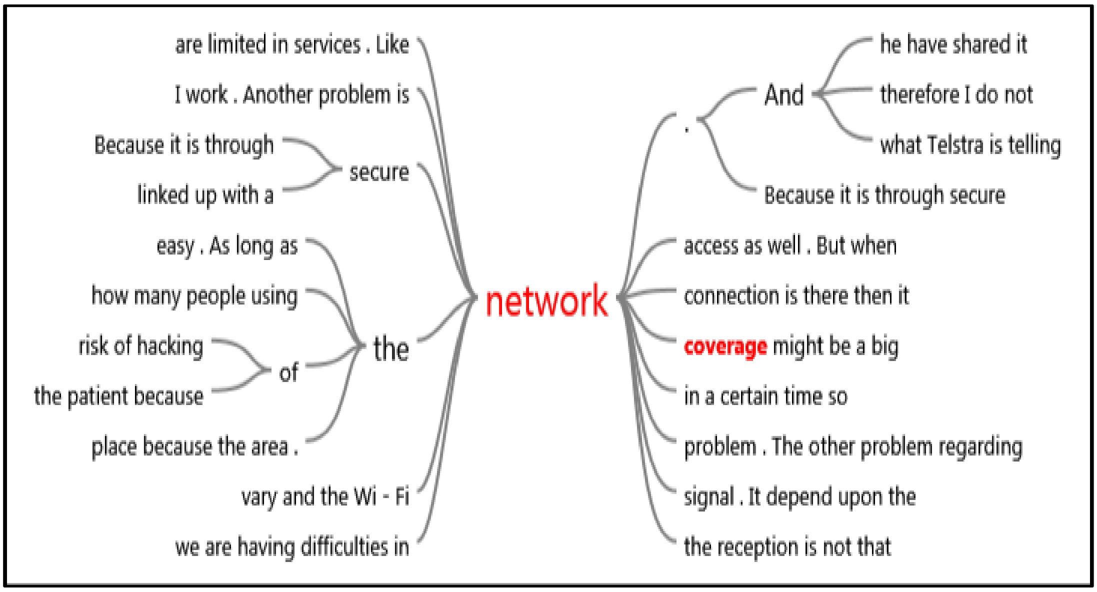

Figure 5. 16: Text search query results obtained for the Network coverage factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

An example of participants' comments regarding Network coverage:

> *'It (use of mobile devices) is quite easy as long as there is a good network connection' (FG5P2).*

Participants also indicated that sometimes poor Network coverage creates difficulty in the clinical processes:

> *'You may wish to contact the patient and you may have difficulty to reach the patient because of the network problem' (IR1).*

'When you taking iPad around the office and look at the strength of the signal, it does vary and the Wi-Fi network access as well' (FG5P2).

Furthermore, network coverage is a big issue in some hospitals situated at remote locations and, due to the poor coverage at such locations, there is always a risk of communications being cut off as indicated below:

'If we look at the remote environment, I must say it might be difficult (to use mobile devices) because in remote areas phones are limited in services. Network coverage might be a big issue in the remote areas' (IR1).

'Another problem is network signal. ----In X hospital we cannot use Wi-Fi (because of the poor signal)' (FG3P4).

Participants also pointed towards the influence of poor Internet signals on Functional features such as sound and image quality, making it difficult to view images, listen to audio and connect with others:

'You have a best screen, best set up, the greatest angle but if you do not have good connectivity, then you have nothing' (FG6P2).

A summary of all the items obtained for the Network coverage factor from qualitative data analysis is provided in Table 5.14 below.

Table 5. 14: Items summarised for the Network coverage factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Network reception is an issue.	Yes	• Information system (Coiera & Magrabi 2015) • Telehealth (Parliamentary Committees 2014)	------
2.	**Network signal is poor.**	No	----------	------
3.	**Limited services in remote areas.**	No	---------	------
4.	**Network coverage influence complexity.** *(This item indicates the influence of network coverage on complexity.)*	The influence of network coverage on complexity is not provided in the previous literature.	---------	------

The four items extracted from participants' views indicated Network coverage as one of the significant factors for mobile devices adoption in Telehealth, which is consistent with the HIT adoption literature (Parliamentary Committees 2014). Of these items, two item (numbers 2 and 3) obtained for Network coverage are new are and are represented in bold in Table 5.14. One of the items (number 4) indicated a direct influence of Network coverage on Complexity, which is not supported in the HIT adoption literature therefore is considered as a new influence and represented in the refined conceptual framework.

5.3.12 Emergence of Privacy and security

Privacy and security also emerged as a key factor in this research. The responses obtained for the Privacy and security factor through text search query in N-vivo software are represented in the Figure 5.17.

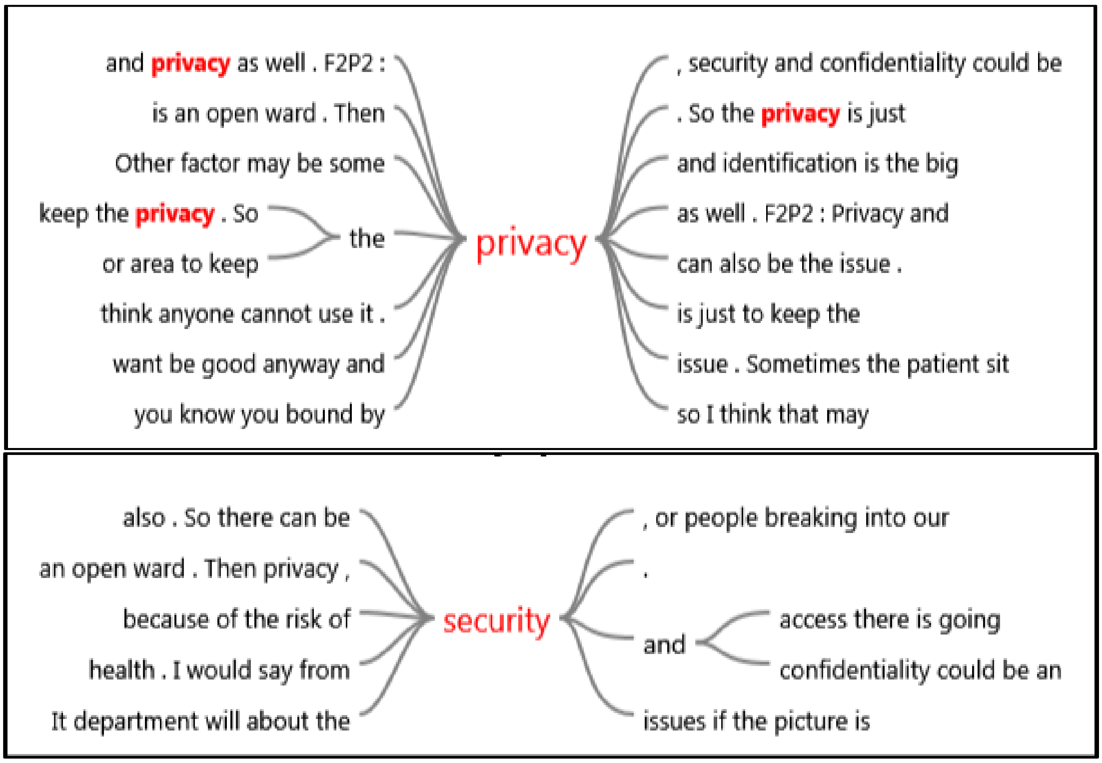

Figure 5. 17: Text search query results obtained for the Privacy and security factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Respondents agreed that privacy and security is vital issue for the use of mobile devices in Telehealth for reasons such as working in an open ward or sharing the personal information of patients as indicated in the below statements:

> *'I would say from security and access there is going to be barriers (to use mobile devices)' (FG6P6).*

> *'Yes, if it is an open ward then privacy, security and confidentiality could be an issue' (FG2P4).*

> *'In a public health we are slower to have the uptake because of security risk, or people breaking into our firewall or interrupting IT system' (FG4P2).*

Further, participants indicated that privacy is an important issue as information may get hacked if the network is not secured:

> *'They (hacker) may get into the system and can hack information' (FG3P4).*

Furthermore, they mentioned that to maintain the privacy of consultation, a separate room should be provided during the consultation:

> *'The privacy is just to keep the patient in a separate environment during the consultation' (FG4P2).*

Moreover, a significant number of participants added that Queensland Health's network is a secure network. Therefore, patients and doctors can have a secure consultation:

> *'I do not feel that there is any risk of hacking of the network' (FG5P6).*

> *'Queensland wide we got the new 'Pexip Portal' where people can download that portal and that is safe and secure portal' (FG4P2).*

The items obtained for the Privacy and security factors from qualitative data are summarised below in Table 5.15.

Table 5. 15: Items summarised for the Privacy and security factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Security of patient's information is important.	Yes	• Mobile health services (Premarathne et al. 2015)	-------
2.	Security of clinical processes is important.	Yes	• Mobile health services (Premarathne et al. 2015)	-------
3.	Security of network is important.	Yes	• Mobile health services (Premarathne et al. 2015) • Wireless technology (Tiong et al. 2006)	-------
4.	Security is important to avoid hacking.	Yes	• Mobile health services (Premarathne et al. 2015)	-------
5.	Privacy in patient care is important.	Yes	• Mobile health services (Premarathne et al. 2015)	-------
6.	Privacy of not sharing patient data is important.	Yes	• Mobile health (Premarathne et al. 2015) • Wireless technology (Tiong et al. 2006)	-------
7.	Privacy of patient information is important to avoid hacking.	Yes	• Mobile health services (Premarathne et al. 2015)	-------

The seven items summarized in this factor revealed that the Privacy and security of patient care, data, clinical processes and network is an extremely important aspect to be considered for the use of mobile devices in the healthcare environment. All the items obtained in this factor are consistent with the HIT adoption literature (Premarathne et al. 2015; Tiong et al. 2006).

5.3.13 Emergence of Training

Training was also found to be one of the prominent factors in the Qualitative Phase. A significant number of participants mentioned that training is important for the use of mobile devices in healthcare, as indicated in Figure 5.18 and by the statements below:

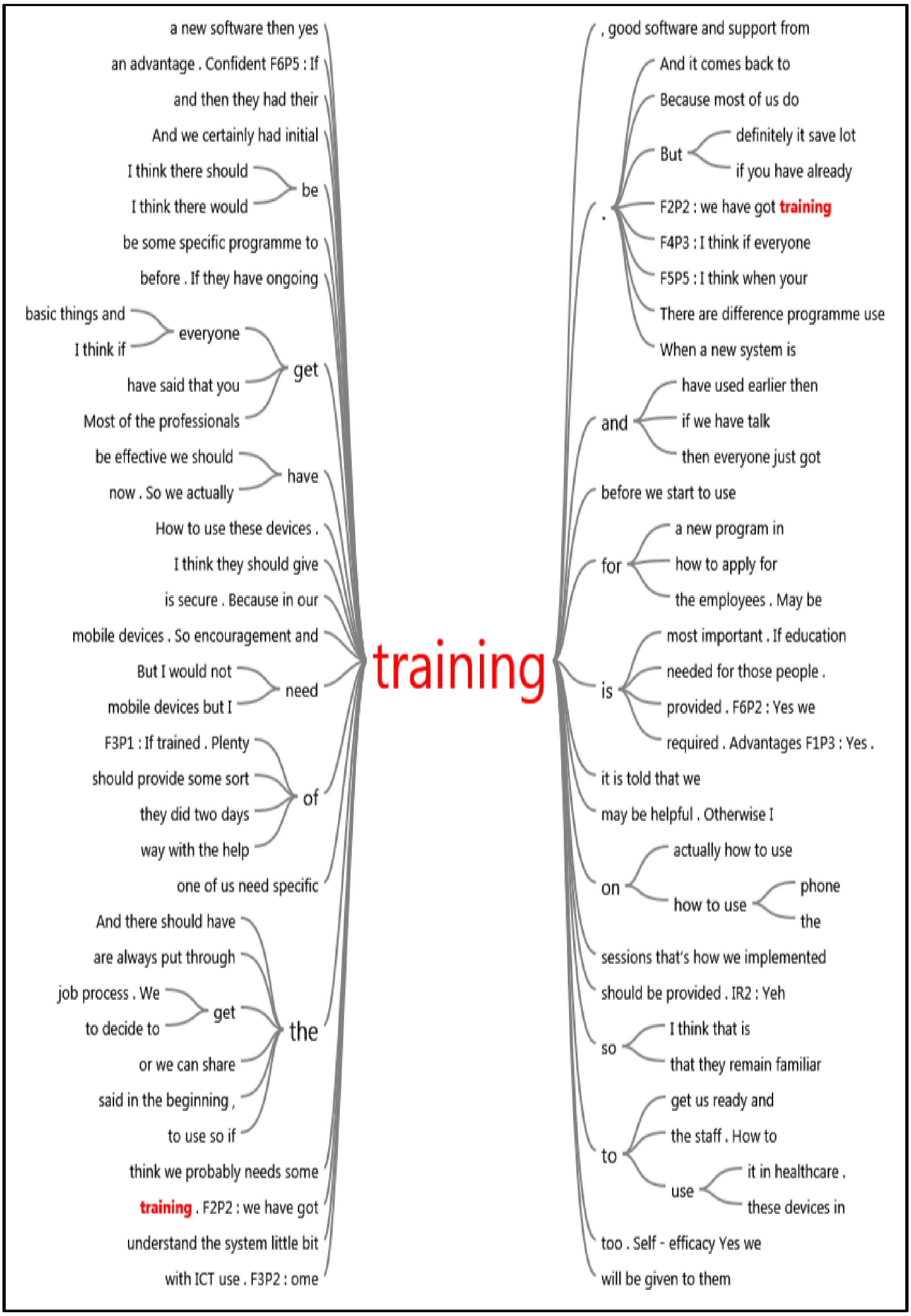

Figure 5. 18: Text search query results obtained for the Training factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

‘If it is new software then yes training should be provided’ (IR2).

The knowledge is already there because we already have mobile devices and we use them but using them in healthcare, there should be some specific training for the employees’ (IR1).

Participants said that they always receive training when new software is introduced into their health facility, indicating that training for the use of mobile device is necessary and is influenced by management support, as stated below:

‘Most of the professionals get training. When a new system is used, the staff members are always put through the training’ (FG2P1).

‘I think every month or within two weeks we have trainings. They (management) are keeping us updated’ (FG1P4)

‘They (management) are keeping us update through seminars and other written material and video clips on how to use these devices’ (FG1P1).

‘We actually have training on how to use the apps’ (FG2P2).

‘We have just changed to the Lee care system--and then they (management) did two days of training’ (FG3P2).

We get training before we start to use them (mobile devices) (FG5P5).

While considering the use of mobile devices in health care, HCPs indicated that training also influences Self-efficacy, Complexity, Age and Experience factors, as indicated by the statements below:

> *'New staff knows how to use the technology but there are some old staff that do not know how to use it so if training will be given to them (old staff), they will be confident' (FG1P4).*

> *'I am ready to use mobile devices but I need training to use it in healthcare' (IR1).*

> *'I think there should be training to use these devices in Telehealth. Majority of us do not have iPads at home and none of us have used the software at work' (FG5P3).*

> *'There are older people, who are not so much exposed to technology, they might be reluctant to use mobile devices. So encouragement and training is needed for them' (IR1).*

Further, participants added that for the effective use of mobile devices, training is important. Training also influences Relative advantages as mentioned in the statement below:

> *'I think in order to be effective we should have training. Because most of us do not have time to play around with it (mobile phone) and we do not want to waste Queensland's health money. So we can learn and play around the resources in an effective way with the help of training' (F5P1).*

Regarding influence of training on the Complexity factor, participants indicated that if training to use mobile devices is provided then the use of mobile devices in healthcare will be easy:

> *'I think they should give training to the staff on how to use this (mobile devices) ---so that it will be easy for the new as well as the old staff to use it' (FG1P4).*

> *'I think if everyone has training and have used it (mobile device) earlier then it is not difficult for them to use it' (FG4P3).*

The items summarised for the Training factor are mentioned below in Table 5.16.

Table 5. 16: Items summarised for the Training factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Training is important.	Yes	• m-health (Agarwal et al. 2015) • HIS (Bawack & Kala Kamdjoug 2018) • Implementing technology in healthcare (Morilla et al. 2017)	------------
2.	Health facility provides training when new technology/software is introduced. *(This item represents influence of Management support on Training.)*	Yes	• m-health (Agarwal et al. 2015) (Lyngstad et al. 2015)	------------
3.	**HCPs get update for the technology through seminars.**	No	---------------	--------------
4.	**HCPs receive updates for the technology through written material and videos.**	No	---------------	--------------
5.	**Inexperienced staff require plenty of Training.** *(This item represents influence of Experience on Training.)*	The influence of Experience on Training is not mentioned in the previous literature.	---------------	--------------
6.	**Older staff require more training.** *(This item represents influence of Age on Training.)*	The influence of Age on Training is not mentioned in the previous literature.	---------------	--------------
7.	**Training increases Self-efficacy to use mobile devices.** *(This item represents influence of Training on Self-efficacy.)*	The influence of Training on Self-efficacy is not mentioned in the previous literature.	---------------	--------------
8.	Training decreases Complexity of using mobile devices. *(This item represents influence of Training on Complexity.)*	Yes	• m-health (Agarwal et al. 2015)	--------------

The Training factor was not proposed in the initial conceptual framework but confirmed as a significant factor in the Qualitative Phase and is supported in the HIT adoption literature (Bennett-Levy, Singer, DuBois & Hyde 2017). Eight items were summarised in this factor. Among these, two items (numbers 1 and 2) were supported by previous literature and two items (numbers 3 and 4) were considered as new.

Items 5-7 summarised in the Training factor indicate a direct influence of 1. Self-efficacy, 2. Age and 3. Experience on Training, which is not supported in the HIT adoption literature and are therefore represented in the refined conceptual framework. One Item (8) indicates a direct influence of Training on Complexity which is supported in the HIT adoption literature (Agarwal et al. 2015) and represented in the refined conceptual framework.

5.3.14 Emergence of Management support

Management support appeared as a new factor explaining the use of mobile devices in this research study. The responses obtained for the Management support concept are represented in Figure 5.19 and participants' statements are explained further.

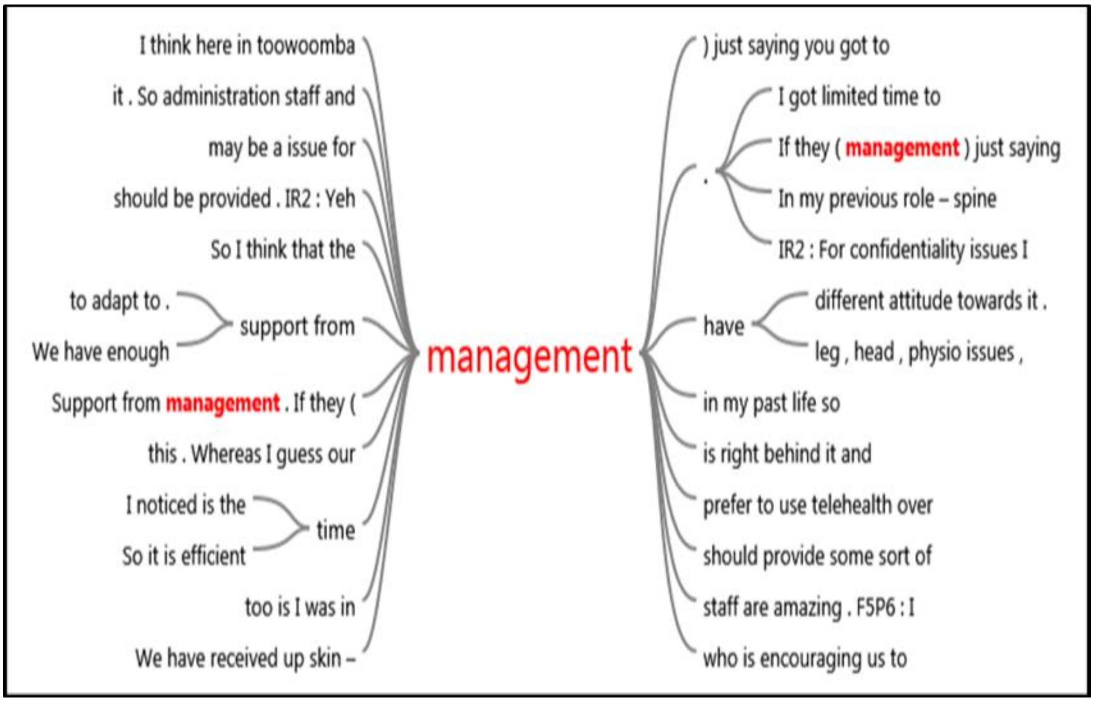

Figure 5. 19: Text search query results obtained for the Management support factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

Participants mentioned that they get enough support from management for using mobile devices in Telehealth.

> *'We have enough support from management who are encouraging us to use them (mobile devices)' (FG5P2).*

However, the cost of buying equipment and the implementation of wireless networks is a challenge for management as well as for the broader organisation:

'Yes management prefer to use Telehealth but the cost associated with Telehealth like buying equipment may be an issue for management' (IR2).

'I think here in X hospital management is right behind it (use of mobile devices) It (use of mobile device in the health facility) can happen if funding and resources are allocated' (FG4P1).

The cost and equipment issues are considered in the Resource issues factor, indicating that the Management support factor is influenced by the Resource issues factor and it is represented in the refined conceptual framework.

The overall summary of the items obtained for Management support is given below in Table 5.17.

Table 5. 17: Items summarised for the Management support factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Management support is important.	Yes	• Smartphone (Yangil & Chen 2007) • Electronic and mobile data services (Tsai & Kong 2013) • HIS (Bawack & Kala Kamdjoug 2018)	-----------
2.	**Permission of the organisation is important.**	No	----------	-----------
3.	Use of mobile devices depends on availability of resources. *(This item belongs to Resource issues factor.)*	Yes	• m-health (Gagnon et al. 2016)	-----------
4.	Financial situation of organisation. *(This item belongs to Resource issues factor.)*	Yes	• Implementing technology in healthcare (Morilla et al. 2017) • Telemedicine (Moffatt & Eley 2011)	-----------

This Phase revealed Management support as an influential factor for the adoption of mobile devices in Telehealth. Four items from participants' views were obtained in this factor. Of these items, one (item 1) is supported in the HIT adoption literature and another (item 2) is considered as new.

Two items (numbers 3 and 4) demonstrated a direct influence of Resource issues on Management support, which is supported in the HIT adoption literature (Gagnon et al.

2016). The HIT adoption literature indicated that management support is important for the adoption of technology in healthcare (Gagnon et al. 2016). Management support has a positive influence on the adoption of mobile devices as it provides the necessary infrastructure required for the technology adoption (Igbaria et al. 1997; Yangil & Chen 2007).

5.3.15 Emergence of Resource Issues

The Resource issues concept emerged as a new factor in this research. In the Resource issues concept participants mainly discussed funding and equipment as indicated in Figure 5.20.

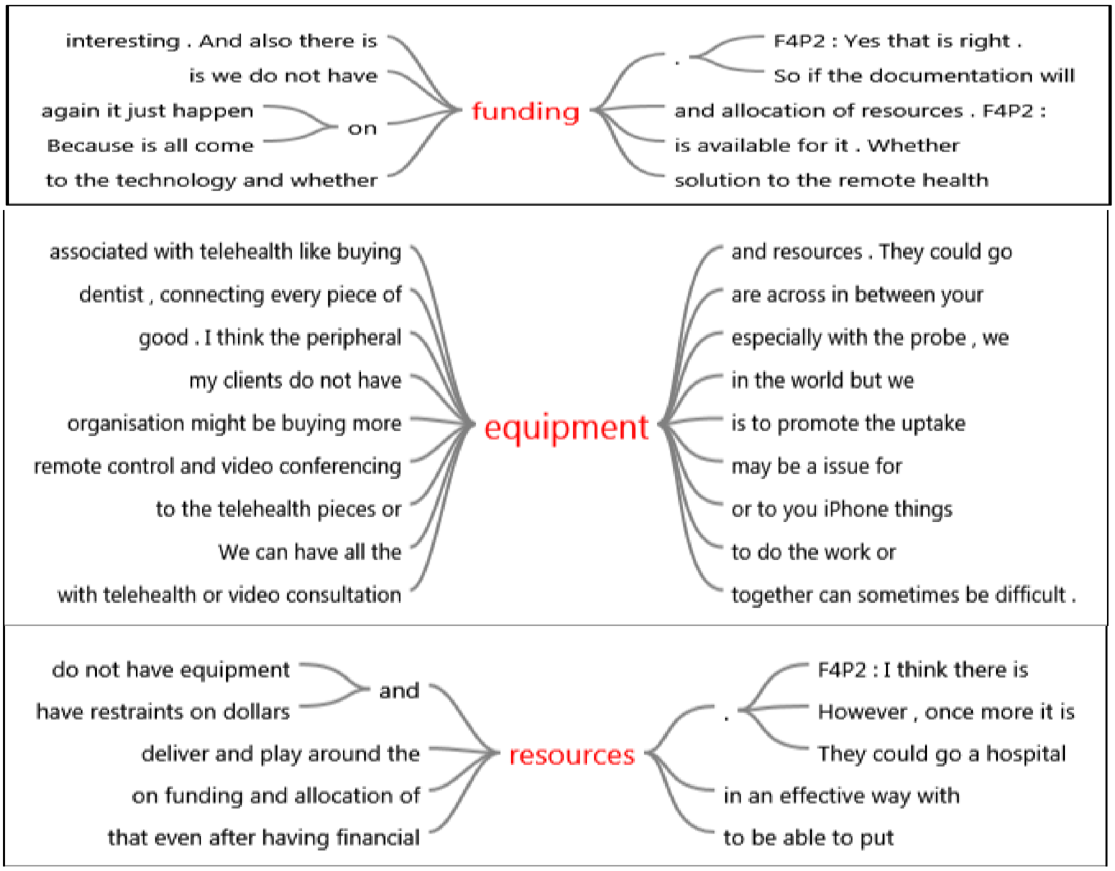

Figure 5. 20: Text search query results obtained for the Resource issues factor from qualitative data analysis (N-vivo output)

Source: Developed for this research

A lack of funds or insufficient funds and equipment are the main barriers to using mobile devices in healthcare. Funds for implementing mobile device use are either not available, or they are not sufficient:

> *'It (use of mobile devices) just depends upon funding and allocation of resources' (FG4P2).*
>
> *'We are in Telehealth system that has restraints on dollars and resources' (FG4P2).*
>
> *'We have mobile devices, which can be used in the tele dentistry but our biggest drawback is we do not have funding' (FG4P1).*
>
> *'I think it (use of mobile devices) depends upon access to the technology and whether funding is available for it' (FG6P4).*

The items summarised in the Resources issues factor are provided below in Table 5.18.

Table 5. 18: Items summarised for the Resource issues factor from qualitative data analysis

No	Items	Literature support	Technology adoption	
			Healthcare	General
1.	Availability of funding in the health facility.	Yes	• Implementing technology in healthcare (Morilla et al. 2017) • Telemedicine (Moffatt & Eley 2011)	-----------
2.	Availability of funding for implementation of wireless network/technology.	Yes	• Electronic and mobile data services (Tsai & Kong 2013) • Implementing technology in healthcare (Morilla et al. 2017)	-----------
3.	Access to all necessary equipment.	Yes	• m-health (Gagnon et al. 2016) • e-health patient record portal (Tavares & Oliveira 2016)	-----------
4.	Availability of all the necessary equipment/resources.	Yes	• m-health (Gagnon et al. 2016) • HIS (Bawack & Kala Kamdjoug 2018)	-----------

The Qualitative Phase findings indicate the availability of necessary resources such as equipment and funding are important to the adoption of mobile devices in the Telehealth context. There are four items obtained for the Resource issues factor which are all consistent with the technology adoption in healthcare literature (Moffatt & Eley 2011; Morilla et al. 2017; Parliamentary Committees 2014).

The findings of the Qualitative Phase confirmed all the factors proposed in the initial conceptual framework, except for gender differences. These findings also revealed six additional factors explaining the adoption of mobile devices in Telehealth from HCPs' perspective. Many direct influences of these factors on each other were also explored in this Phase. All the factors and their influences on each other are represented in the refined conceptual framework and explained in the next section.

5.4 Refinement of Conceptual Framework

The goal of the Qualitative Phase was to refine the initial conceptual framework and prove hypothesis developed in Chapter 2. In the initial conceptual framework, nine factors were proposed. These factors were: 1. Intention, 2. Technology readiness, 3. Self-efficacy, 4. Social influences, 5. Demographic factors (Age, Gender and Experience), 6. Relative advantages, 7. Complexity, 8. Compatibility and 9. Functional features. These factors were categorised into three themes: Technological context, Individual context and Usage context. On the basis of these themes and factors, the initial conceptual framework was developed as mentioned in Chapter 2.

During the Qualitative Phase, one new theme and six new factors were also obtained which were used to refine the initial conceptual framework. The new theme was Organisational context and the six new factors were: 1. Trialability, 2. Network coverage, 3. Privacy and security, 4. Training, 5. Management and 6. Resource issues. Of the six new factors, three (Training, Management support and Resource issues) were placed in the Organisational context. Two new factors, Network coverage and Privacy and security, were included in the Technological context and and the final factor Trialability was considered under the Usage context. Also, during this Phase two factors (Technology readiness and Self-efficacy) were merged together and represented as Self-efficacy alone because the items obtained for Technology readiness were getting covered in the Self-efficacy factor. Therefore, in the refined conceptual framework fourteen factors were presented as shown in Figure 5.21.

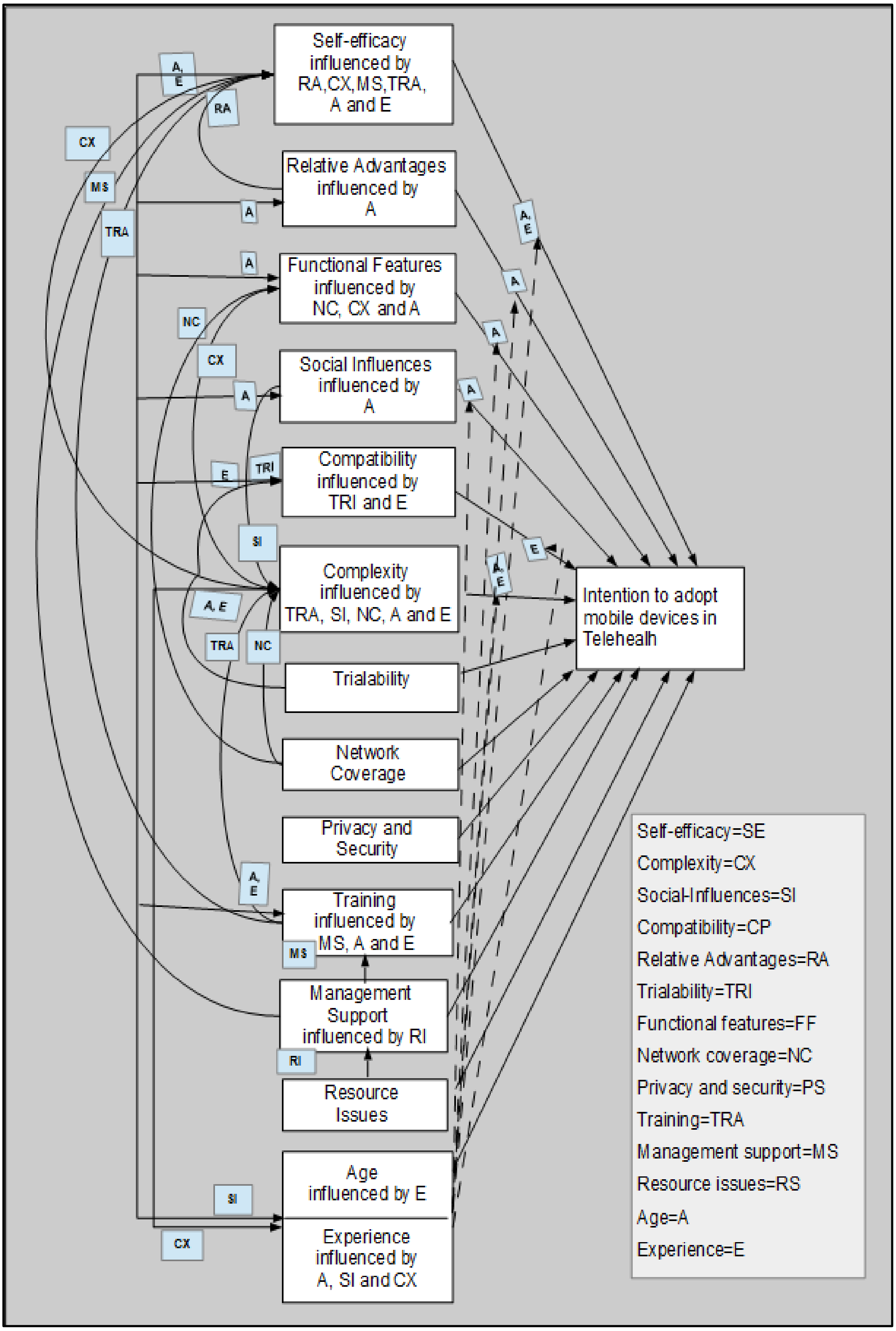

Figure 5. 21: Refined conceptual framework

Source: Developed for this research

All fourteen factors were categorised into four themes in the Qualitative Phase as follows:

Table 5. 19: Four themes and fourteen factors considered after qualitative data analysis

Themes	Factors
Individual (health professionals) context	1. Intention (proposed in the initial conceptual framework) 2. Self-efficacy (proposed in the initial conceptual framework) 3. Social influences (proposed in the initial conceptual framework) 4. Demographic factors (Age and Experience) (proposed in the initial conceptual framework)
Usage context	5. Relative advantages (proposed in the initial conceptual framework) 6. Complexity (proposed in the initial conceptual framework) 7. Compatibility (proposed in the initial conceptual framework) 8. Trialability (included after Qualitative Phase)
Technological (mobile devices) context	9. Functional features (proposed in the initial conceptual framework) 10. Network coverage (included after Qualitative Phase) 11. Privacy and security (included after Qualitative Phase)
Organisational context (included after Qualitative Phase)	12. Training (included after Qualitative Phase) 13. Management support (included after Qualitative Phase) 14. Resource issues (included after Qualitative Phase)

These factors were categorised into four themes by manually analysing the fourteen factors, using N-vivo software and reviewing previous literature.

In addition, the influence of these factors on each other was also explored in the Qualitative Phase and represented in the refined conceptual framework. In the initial conceptual framework, the influences of eight factors on Intention were proposed. These eight factors were: 1. Technology readiness, 2. Self-efficacy, 3. Social influences, 4. Demographic factors (Age, Gender and Experience) 5. Relative advantages, 6. Complexity, 7. Compatibility, and 8. Functional features.

The direct influence of Technology readiness on Intention, and the direct influence of Self-efficacy and Relative advantages on Technology readiness proposed in the initial conceptual framework was also confirmed in the Qualitative Phase. However, the hypothesis H1[9] regarding the Technology readiness factor was rejected because it considered the moderating influence of gender, which was not explored as a significant factor in this research study.

[9] H1: The influences of Technology readiness on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience, such that the effect will be stronger for young, and particularly experienced males.

Confirmation of the direct influence of Self-efficacy and Relative advantages on Technology readiness indicated that hypotheses H2[10] and H4[11] could be accepted. However, the merging of Technology readiness with Self-efficacy removed these influences and emerged into the direct influence of Self-efficacy and Relative advantages on Intention, which is represented in the refined conceptual framework. Also, the indirect influence of Relative advantages through Self-efficacy was explored in this research study and is represented in the refined conceptual framework.

For the Social influences factor, a direct influence of Social influences on Intention and moderating influence of Age, Gender and Experience through Social influences on Intention was proposed in the initial conceptual framework. The Qualitative Phase indicated an indirect influence of this factor on Intention. The indirect influence of Social influences through Complexity and Experience on Intention was observed in the Qualitative Phase. However, Gender turned out to be an insignificant factor, which led to the rejection of hypothesis H3[12].

For the Complexity factor, a direct influence of Complexity on Intention and moderating influence of Age, Gender and Experience through Complexity on Intention was proposed. The Qualitative Phase indicated a direct as well as indirect influence of the Complexity factor on Intention. The indirect influence of Complexity through Functional features, Self-efficacy and Experience on Intention was observed in the Qualitative Phase. However, Gender was not a significant factor, which indicated a rejection of hypothesis H5[13].

For the Compatibility factor, in the initial conceptual framework the direct and moderating influence of Age and Gender through Compatibility on Intention was

[10] H2: Technology Readiness for adoption of mobile devices in healthcare will be positively influenced by the Self-efficacy of the individual.

[11] H4: Technology readiness for adoption of mobile devices in healthcare will be positively influenced by Relative advantages offered by mobile devices in the healthcare process.

[12] H3: The influence of Social influences on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience such that the effect will be stronger for women, particularly older women who have less experience with technology.

[13] H5: The influence of Complexity on Intention to adopt mobile devices in healthcare will be moderated by Age, Gender and Experience such that the effect will be greater for older inexperienced women.

proposed. In the Qualitative Phase, a direct influence of Compatibility on Intention was confirmed. However, as mentioned earlier, Gender was not a significant factor, thus hypothesis H6[14] was rejected.

The direct influence of Functional features proposed in the initial conceptual framework was also confirmed in the Qualitative Phase and is represented in the refined conceptual framework. However, Gender turned out not to be a significant factor, which led to rejection of hypothesis H7[15].

The influences of some factors on Intention, which were not proposed in the initial conceptual framework also emerged in the Qualitative Phase. These factors were: 1. Trialability, 2. Network coverage 3. Privacy and security, 4. Training, 5. Management support and 6. Resource issues. The direct influence of these factors on Intention was considered after the Qualitative study. The indirect influence of these factors on Intention was observed in the Qualitative study and are mentioned below:

1. The indirect influence of Trialability through Compatibility was explored in the Qualitative Phase.
2. The indirect influence of Network coverage through complexity and Functional features was revealed in this Phase.
3. The indirect influence of Training through Self-efficacy and Complexity was demonstrated in the Qualitative Phase.
4. The indirect influence of Management support through Self-efficacy and Training was discovered in the Qualitative Phase.
5. The indirect influence of Resource issues through Management support was explored in the Qualitative Phase.

For the refinement of the initial conceptual framework, fourteen factors and their influences on each other were proposed in the refined conceptual framework. Among

[14] H6: The influence of Compatibility on Intention to adopt mobile devices in healthcare will be moderated by Age and Gender, such that the effect will be stronger for women who have less experience with technology.

[15] H7: The influence of mobile device Features on Intention to adopt mobile devices in healthcare will be moderated by Age and Gender such that the effect will be stronger for older women.

these fourteen factors, nine were confirmed from the initial conceptual framework, but in the refined conceptual framework only eight factors from the initial conceptual framework were presented because Technology readiness (one of the factors proposed in the initial conceptual framework) was merged into the Self-efficacy factor. Also, Gender as one of the Demographic factors was not confirmed as a significant factor in the Qualitative Phase, so it was not presented in the refined conceptual framework. Six new factors[16] from the Qualitative Phase were included in the refined conceptual framework. The direct influences of thirteen factors on Intention and the influences on each other were represented in the refined conceptual framework. The direct influences of these thirteen factors on each other were as follows:

1. Influence of Relative advantages, Complexity, Management support, Training, Age and Experience on Self-efficacy
2. Influence of Age on Relative advantage
3. Influence of Network coverage, Complexity and Age on Functional features
4. Influence of Age on Social influences
5. Influence of Trialability and Experience on Compatibility
6. Influence of Training, Social influences, Network coverage, Age and Experience on Complexity
7. Influence of Management support, Age and Experience on Training
8. Influence of Resource issues on Management support
9. Influence of Experience on Age
10. Influence of Age, Social influences and Complexity on Experience.

It was difficult to interpret the moderating influence of Demographic factors in the Qualitative Phase. Therefore, the moderating influences proposed in the initial conceptual framework were kept as is, except for the moderating influence of Gender because it was not found to be significant in the Qualitative Phase.

[16] Six factors explored in the qualitative study were: 1. Trialability, 2. Network coverage 3. Privacy and security, 4. Training, 5. Management support and 6. Resource issues.

The moderating influences of Age on Functional features, Complexity, Social influences, Compatibility; and the moderating influence of Experience on Complexity as proposed in the initial conceptual framework were kept the same. However, the moderating influences of the Demographic factor, Age proposed on Technology readiness was changed to Self-efficacy because Technology readiness was merged with Self-efficacy; and the moderating influences of one of the Demographic factors Experience proposed on Technology readiness was changed to Self-efficacy. Thus in the Qualitative Phase fourteen factors and their influences on each other were considered and represented in the refined conceptual framework.

Regarding the conclusion of each hypothesis, in the literature, hypotheses are accepted or rejected based on a Quantitative Phase. However, in this research study there was sufficient evidence to accept or reject all hypotheses in the Qualitative Phase. In this Phase, hypotheses H2 and H4 were accepted and the remaining hypotheses H1, H3, H5, H6 and H7 were rejected. Hypotheses H2 and H4 considered the influence of Self-efficacy and Relative advantages factors on Technology readiness and were supported by this Qualitative Phase, whereas, H1 H3, H5, H6 and H7 considered the moderating influence of one Demographic factor, Gender, which did not emerge as one of the factors in the Qualitative Phase findings, indicating a rejection of these hypotheses.

Even though all hypotheses were concluded in the Qualitative Phase in this research yet the Quantitative Phase proceeded in order to validate the factors with the wider sample size. When using only one research design, the findings of a research study may be uncertain (Sofaer 1999). The uncertainties can be reduced by ensuring the reliability and validity of the study and using another research design (Sofaer 1999). Reliability and validity in the Qualitative Phase are represented as credibile and are explained in the next section. Another research design used in this study is quantitative and this Phase is explained in Chapters 6 and 7.

5.5 Credibility of Qualitative Phase

As noted by qualitative researchers, validity and reliability are not separately applicable in qualitative research. The concept of reliability in qualitative research can be referred to as validity and can be represented as credibility, trustworthiness or authenticity (Bashir, Afzal & Azeem 2008; Creswell & Miller 2000). There are no standard tests to ensure the credibility of qualitative research (Winter 2000). The credibility of qualitative research can only be ensured using multiple methods of data collection, a description of the respondent verbatim quotations, detail on how data was collected, revisiting respondents and verification by respondents (Ali & Yusof 2011; Bashir, Afzal & Azeem 2008). Creswell and Miller (2000) state that qualitative researchers routinely employ member checking, triangulation, thick description, peer reviews and external audit techniques to ensure the credibility of qualitative research. Maxwell (1992) indicated five types of credibility: 1. Descriptive 2. Interpretive 3. Theoretical 4. Evaluative 5. Generalizability. Onwuegbuzie and Leech (2007) mention two types of validity: internal and external. Internal validity refers to uniformity of procedure and can be confirmed by using the same set of procedures. External validity is also known as themes validity and can be achieved by reviewing the items by the researcher, discussing with supervisors and consulting the literature (Hafeez-Baig 2010; Onwuegbuzie & Collins 2007; Onwuegbuzie & Johnson 2006; Dellinger & Leech 2007). Creswell (2008) suggests that validation of qualitative research should be focussed on the accuracy of the findings. Validity in qualitative research can be determined by ensuring the trustworthiness of data collection, analysis and interpretation procedure and can be determined by researchers, participants, readers and reviewers (Creswell & Miller 2000). The literature indicates that researchers have identified various types of credibility in qualitative research, which are mainly focussed on authenticity of data collection, analysis and the interpretation procedure (Creswell & Miller 2000; Bashir, Afzal & Azeem 2008; Onwuegbuzie & Leech 2007; Maxwell 1992).

The credibility of the Qualitative Phase in this research study is established at the data collection, analysis and results interpretation Phases as represented in Figure 5.22.

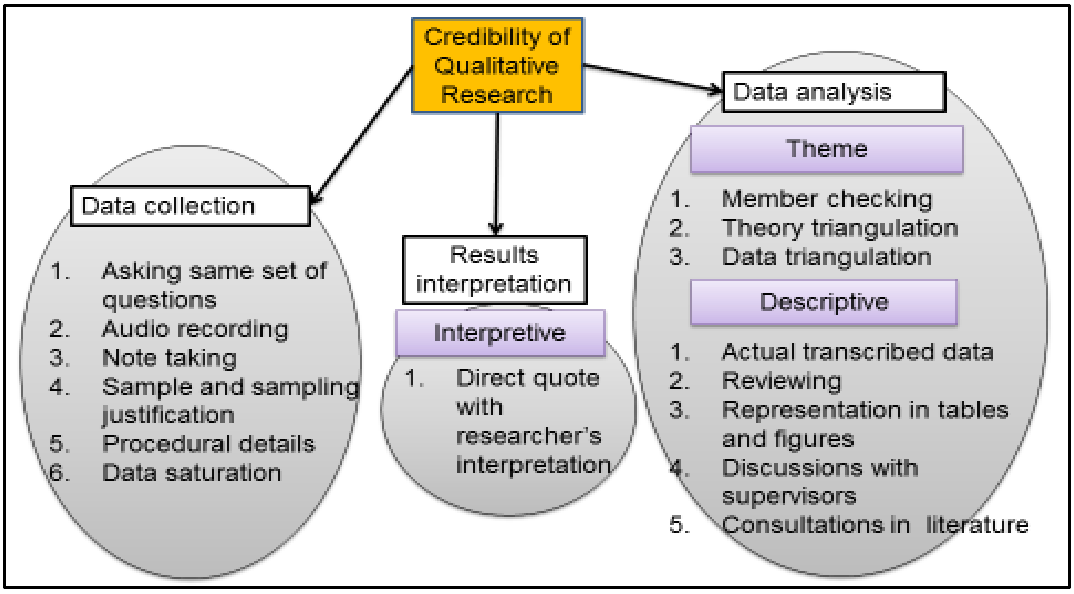

Figure 5. 22: Credibility of the Qualitative Phase

Source: Developed for this research

In the data collection Phase, the credibility of uniformity of the procedure was carried out by asking the same set of questions, using prompts, audio recordings of the data and note taking (Spencer et al. 2003; Tong, Sainsbury & Craig 2007). By asking the same set of questions the researcher ensured the uniformity of the discussion concepts. The prompts were also used during the discussion session to encourage participants to openly convey their viewpoints (Tong, Sainsbury & Craig 2007). Audio recordings of the data ensured the validity of data collection (Spencer et al. 2003).

The researcher also took field notes to keep track of the discussion and note any important topics that were emphasized. Further, the selection of potential participants using purposive sampling, providing procedural details of their involvement and saturation point, ensured the credibility of the participants and data collected in this Phase (Tong, Sainsbury & Craig 2007). Thus, asking the same the set of questions, audio recordings of the data, note taking, justification for selection of the potential participants, procedure for data collection and saturation point ensured the credibility of qualitative data collection (Tong, Sainsbury & Craig 2007; Starr et al. 2013).

In data analysis, two types of credibility mentioned below were also ensured:

1. Theme/Construct Validity
2. Descriptive Validity.

Theme validity refers to the validity of the themes, which was achieved by member checking, theory and data triangulation strategies (Creswell & Miller 2000). In the theory triangulation process the researcher reviewed the themes by consulting with the literature and supervisors. Subsequently, in the member checking process, transcripts and themes were discussed with some of the participants to obtain their views on the accuracy of factors. The researcher asked the participants whether the factors considered in the Discussion Questions Guide were making sense and were realistic (Creswell & Miller 2000). Also, items obtained for the factors were reviewed by the researcher, discussed with the supervisors and consulted upon in both the literature and with the participants (Creswell & Miller 2000; Starr et al. 2013).

Descriptive validity refers to the factual accuracy of the data collected. This validity was ensured by transcribing the data, reviewing the themes, extracting factors and items by the researcher and representing them in the form of figures and tables, discussing with supervisors and consulting with the literature and participants. The information extracted from the transcripts in the form of figures and tables was further adjusted for the same central idea of the participants to obtain factors.

In the data interpretation Phase, interpretive validity refers to the participant's own word validity, which is achieved by providing participant's direct quotes supported by the researcher's interpretation. Furthermore, documenting a systematic process of qualitative data analysis also ensured the validity of the interpretation of data. Thus, by documenting the Qualitative Phase data collection, the analysis process, maintaining uniformity in procedures and collecting data from reliable sources, the credibility of this Phase is ensured (Stenbacka 2001; Bashir, Afzal & Azeem 2008; Rabiee 2004; Starr et al. 2013; Tiong et al. 2006).In the Qualitative Phase of this research study, the researcher also faced some challenges which are explained in the next section.

5.6 Challenges and Mitigation Strategies

In the Qualitative Phase, the researcher faced various challenges regarding participants' involvement in data collection, effective use of data collection techniques, engaging participants in the discussion, running the sessions smoothly, using open ended questions, ensuring uniformity of questions, recalling information for analysis and transcribing the data (Creswell & Miller 2000).

To address these challenges, the following strategies were used:

- With regard to the participants' involvement in the Qualitative Phase, participants who were willing and could conveniently participate in the research were involved to mitigate this challenge. Further, participants were also informed that their participation in the research was voluntary and that they could leave the session anytime they wished
- To use the focus group technique effectively, Pretesting and a pilot study were conducted, giving the researcher some experience of organising group discussion sessions
- To engage the participants in the group discussion sessions and run the sessions smoothly, small group sizes were preferred because organising and handling small group discussions was convenient and manageable for the researcher. Another strategy used to mitigate this challenge was providing the Participants Information Sheet to the participants in advance. By doing this, participants knew of all the activities to be conducted in the discussion so that they could prepare in advance if necessary and actively participate. Further, before starting the session the researcher gave an introductory speech to draw participants' attention to the topic. Furthermore, to engage shy participants in the discussion session, they were requested politely to express their viewpoints. In interviews, an informal chat occurred before starting the interview
- The challenge of open-ended questions was managed by summarising the topic (if there was any open-ended discussion) after the point had been discussed and by asking the same set of questions in all the discussion sessions

- To ensure the uniformity of the questions asked from participants Discussion Questions Guide was provided to the participants.
- To recall the data for analysis, the discussion sessions were audio recorded so that all the important data could be recorded and recalled for further analysis.

5.7 Conclusion

This chapter discussed the qualitative data analysis and the findings of the Qualitative Phase. The findings of the Qualitative Phase were used to refine the initial conceptual framework, prove hypotheses and to obtain items to develop the survey questionnaire for the next Phase. In the following chapter, the procedure for the development of the survey questionnaire and quantitative data collection is explained.

Chapter 6
Quantitative Data Collection

CHAPTER 6: QUANTITATIVE DATA COLLECTION

6.1 Introduction

In the previous chapter, qualitative data analysis and its findings were explained. The results of these findings are used in the Quantitative Phase of this study to design the survey questionnaire. This chapter describes the process of development of the survey questionnaire and the quantitative data collection, and is organised into six sections as shown in Figure 6.1.

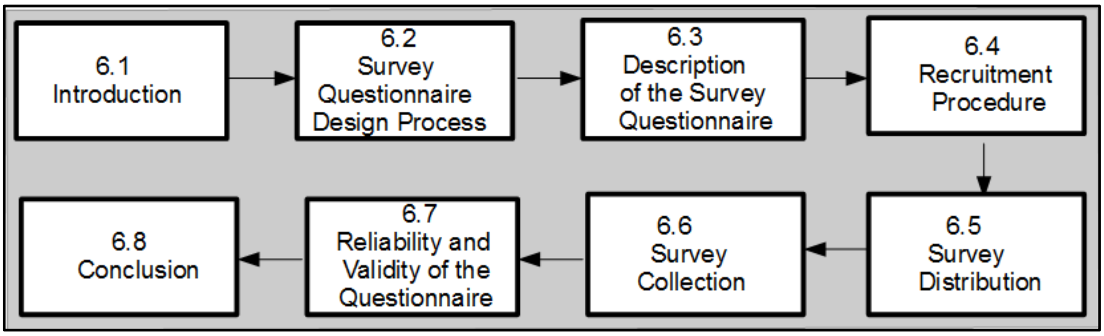

Figure 6. 1: The outline of Chapter 6 on quantitative data collection

Source: Developed for this research

Section 6.1 outlines the chapter. Sections 6.2 and 6.3 explain the survey design process and describes the survey questionnaire respectively. Sections 6.4, 6.5 and 6.6 explain the recruitment procedure, survey distribution and collection processes respectively. Section 6.7 presents the reliability and validity of the survey questionnaire. Finally, the conclusion of this chapter is presented in Section 6.8.

6.2 Survey Questionnaire Design Process

The technology adoption literature provides three main steps of survey questionnaire development: item creation, item refinement and item testing (Gao, Krogstie & Siau 2011). In this research, a themes and factors selection step is added to the development of the survey questionnaire. The themes and factors selection step is important because the survey design process should begin with what is needed in the research and selecting themes and factors is the best way to understand these needs (Stone 1993).

In step 1, overarching themes and factors were selected from the HIT adoption literature and then verified using the Qualitative study. In step 2, the survey questionnaire's items were created from the existing studies into technology adoption in healthcare and from the Qualitative study. In step 3, the items developed in step 2 were refined with the help of lay people and HCPs. In step 4, items refined in step3 were tested with 41 HCPs. In this step, inter-item correlation and Cronbach alpha were used to check the reliability of the survey questionnaire. This process of survey questionnaire development is shown in Figure 6.2 and explained further in detail.

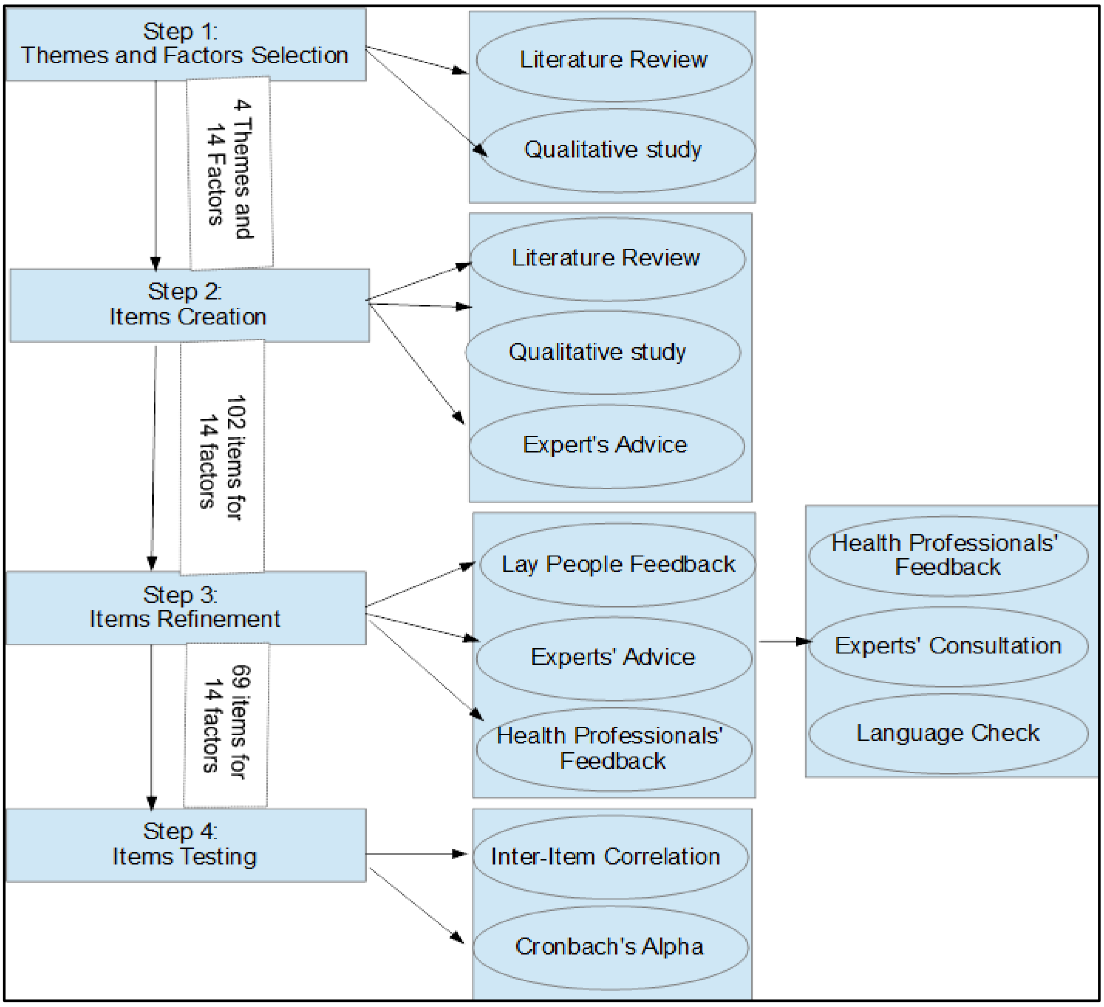

Figure 6. 2: Survey questionnaire development process

Source: Developed for this research

Step 1: Themes and Factors Selection

To develop an integrative tool for explaining HCPs' experiences and perceptions of the use of mobile devices in the health domain, the comprehensive process started with the identification of overarching themes and factors. Three themes initially considered were: 1. Individual context 2. Usage context and 3. Technological context (Sood et al. 2017).

In the first theme, Individual context, it is important to identify what customers really expect from technology because the chance of adopting a particular technology is much less if customers consider that their expectations cannot be met (Tan 2013; Parasuraman 2000). In this theme, five factors, three from the TPB (Intention, Social norms and Self-efficacy/Perceived behaviour control) and two from the literature (Technology readiness and Demographic factors) were considered. These factors were:

1. Intention
2. Technology readiness
3. Self-efficacy Social influences
4. Demographic factors (Age, Gender and Experience).

Intention was an important factor as user intention is a good indicator of how a system is likely to be accepted in the future (Perkins et al. 2007; Tiong et al. 2006). Individual Self-efficacy and Technology readiness were important because mobile device use in Telehealth would demand a certain level of knowledge and skills from the HCPs, with some likely to be confident and ready and others less likely to be so. The Social influences factor was important because the adoption of technology is a socio-technical phenomenon and HCPs (working in the Telehealth environment) may be influenced by their colleagues. Demographic factors were important to study as different HCPs could perceive mobile device use in Telehealth in different ways and their intention to use mobile devices might differ depending upon their Age, Gender and Experience.

The second theme, Usage context, was important because users' concerns and needs vary within the context in which they are using the technology. The Usage context provides an understanding of the ways and circumstances in which a technology is used and adopted. In the Usage context, three factors from the DOI Theory were considered. These factors were:

1. Relative advantage
2. Compatibility
3. Complexity.

These factors were important because technology such as mobile devices are often developed to provide an alternative channel for accessing health services and not to replace the existing health services completely. When a health service is required to be accessed or delivered immediately regardless of time and place barriers, the usefulness, compatibility and ease-of-use of the technology could implicitly influence the users' intention to use it. Hence, initially, these three factors from the Diffusion of Innovation Theory were considered in this theme.

The third theme, Technological context, was important because the healthcare domain deals with the health and life of people. Every second counts in this domain, even the delay of a fraction of a second could cost a life. Under such circumstances, the technology used should have good supporting features for clinical tasks. As a result, one factor, Functional features, was considered vital in this theme.

The themes and factors obtained from the literature and technology adoption theories were further verified in the Quantitative study. One new theme, Organisational context, and six new factors were also obtained during this study. A detailed discussion of all the themes and factors finalized after the Qualitative study to develop the survey questionnaire is given in the next section.

Verification of the Factors

The three themes and nine factors obtained after reviewing the literature were further verified in the Qualitative study using six focus group discussions and two interviews. In these discussions, a Discussion Questions guide containing open-ended questions for the factors considered from the literature review were used for obtaining information from the respondents. The sample of Discussion Questions Guide used in this research is given in Appendix 4.1. Respondents were also asked to give their free and fair opinions of mobile device use in the Telehealth environment.

In this process, the Qualitative study showed that most of the factors identified from the literature were significant. One new theme and six new factors also emerged during the Qualitative study. All the themes and factors considered after the Qualitative study for the development of the questionnaire are provided in Table 6.1.

Table 6. 1: List of themes and factors considered for the development of the survey questionnaire after the Qualitative study

Themes	Factors	References
Individual context	Intention	(Yangil & Chen 2007; Mun et al. 2006; Wu, Li & Fu 2011) and confirmed in qualitative analysis
	Self-efficacy	(Mun et al. 2006; Wu, Li & Fu 2011; Gagnon et al. 2016; Yangil & Chen 2007; Parasuraman 2000) and confirmed in qualitative analysis
	Social influences	(Karahanna, Straub & Chervany 1999; Mun et al. 2006; Wu, Li & Fu 2011) and confirmed in qualitative analysis
	Demographic factors (Age and Experience)	(Yangil & Chen 2007) and confirmed in qualitative analysis
Usage context	Relative advantage	(Yangil & Chen 2007; Mun et al. 2006; Karahanna, Straub & Chervany 1999) and confirmed in qualitative analysis
	Complexity	(Yangil & Chen 2007; Mun et al. 2006; Wu, Li & Fu 2011) and confirmed in qualitative analysis
	Compatibility	(Karahanna, Straub & Chervany 1999; Yangil & Chen 2007) and confirmed in qualitative analysis
	Trialability	(Yangil & Chen 2007) and confirmed in qualitative analysis
Technological context	Functional features	(Gagnon et al. 2016; Kargin & Basoglu 2006; Kim & Shyam 2014) and confirmed in qualitative analysis
	Security and privacy	(Gagnon et al. 2016; Premarathne et al. 2015) and confirmed in qualitative analysis
	Network coverage	Discovered in qualitative analysis
Organisational context	Training	Discovered in qualitative analysis
	Management support	Discovered in qualitative analysis
	Resource issues	Discovered in qualitative analysis

Organisational context emerged as a new theme in the Qualitative study. Earlier, while selecting themes from the literature review, Organisational context was not considered important as the development of the questionnaire was focused on the individual level of adoption, and the organisational context did not appear to be significant and appropriate (Moore & Benbasat 1991).

As well as the Organisational context theme, six factors emerged in the Qualitative study:

1. Trialability
2. Network Coverage
3. Privacy and security
4. Training
5. Management Support
6. Resource Issues.

These six factors were further confirmed with the literature on technology adoption in healthcare and were included in various themes. They were either considered in the previous three themes or placed into the new theme, Organisational context. The Trialability factor was included in the Usage context as the other three factors in the Usage context were identified from the DOI theory and Trialability was also one of the constructs of the DOI theory. Three factors, Training, Management support, and Resource issues were placed in the Organisational context, as these are the functions of an organisation. Two factors, Network coverage and Privacy and security were considered in the Technological context.

Further, during this verification, the Individual's Technology readiness and Self-efficacy factors were merged and represented as Self-efficacy because the respondents' opinions for Technology readiness and Self-efficacy were similar.

Furthermore, Gender as one of the factors considered in the Individual context, was removed from the study because respondents confirmed that both male and female health professionals were equal in handling and using technology. Hence, the four themes and fourteen factors as given in Table 6.1 were considered important to the questionnaire design.

The items for these fourteen factors/constructs were developed from the Qualitative study and from the previous technology adoption literature and are explained further.

Step 2: Items Creation

The survey questionnaire's items were developed from three sources: the literature review, Qualitative phase and expert advice. Initially, the items were considered from the literature review and confirmed with the help of the Qualitative study. Then, the items were revised with the help of experts' advice (discussions with the two PhD supervisors who are expert in the adoption and implementation of technology research and discussions with statistical experts). In line with the expert statistical advice, some items from one factor were intentionally retained in another factor enabling the observation of trends in participants' responses. Finally, the items obtained from the Qualitative Phase were tracked back to the literature to avoid any duplication and to write the questionnaire questions in a standard language style.

As a result, 102 items represented in the form of survey questions were developed. Next, the 102 items were reduced to 99 items in Pretesting. These were then reduced to 69 items in pilot testing. A detailed explanation of pretesting and pilot testing including the justification for reducing the number of items used, is given in the next step.

Step 3: Items Refinement

In any research study, it is important that respondents understand the items as intended by the researcher as misinterpretation of the questions may affect the quality of the data and subsequently produce biased results. Therefore, items represented in the form of the 102 survey questions were refined using Pretesting and pilot testing. Pretesting was conducted to increase the face validity and to identify any particularly ambiguous or redundant items. Pilot testing was conducted to increase item validity.

<u>Pretesting</u>

The Pretesting was conducted to test the survey questions for comprehension, readability and to remove any redundant items from the survey (Zikmund 2010). Pretesting is usually conducted with participants who are similar to potential respondents. This Pretesting was conducted with two participants who were similar to the potential respondents, four experts and four lay people. The four experts were comprised of two PhD supervisors expert in the adoption and diffusion of technology literature, and two professors', both expert in statistical analysis. The lay people respondents had no experience working in the health domain, and were not expert in adoption and diffusion of technology literature or statistical analysis of data.

The pre-test began with a brief introduction of the goal of the survey questionnaire. Participants were then asked to read the items and give their feedback on the questions (Gao, Krogstie & Siau 2011). The respondents were also requested to interpret the meaning of randomly selected questions to ensure that the questions were correct and understandable to the respondents. The sample of pretesting questions asked from participants is given in Appendix 6.1 on Page 340. A brief description of the feedback obtained in the pretesting is given below:

1. Lay people Feedback

The four lay participants indicated that they found the questions to be understandable. One suggested breaking the questions into two parts: tag line and key idea. That respondent had the perception that breaking the content into two components might reduce the reading content for respondents and so help to obtain good response rates for the survey. One example of breaking questions into two components is:

I intend to use mobile devices in the Telehealth environment:

To finish my work timely

If I have a mobile device

Whenever I need them.

The feedback obtained from lay people was further discussed with experts.

2. Experts' Feedback

The two statistical experts approved of breaking the questions into two parts, as suggested by one of the lay people participants (an English professor). The literature also used this way of writing survey questions (Yangil & Chen 2007). However, the two supervisors did not agree with the suggestion. They considered that respondents may have to read the tag line again and again to make sense of each of the survey questions, thus confusing the respondents and resulting in the consumption of even more time to complete the survey. As supervisors were experienced in collecting data in the healthcare context, it was decided to go with the supervisors' advice and each question was written as a full sentence rather than in two parts.

3. Health Professionals' Feedback

After feedback from the experts, the survey was further revised and tested with the two health professionals. These two respondents indicated that the survey questions were clear and made sense but that some questions were repeated and the layout was unattractive, making it difficult to move from one question to another. After careful examination, the repeated questions were eliminated. To make the survey questions more readable and attractive, a new colour scheme was implemented to represent question and response options.

Pretesting resulted in a reduction of items from 102 to 99, ensured face validity and identified ambiguous and redundant items. Next, the survey containing 99 items were pilot tested with the nine participants.

Pilot Testing

The pilot testing was conducted to validate the items and remove any redundant items from the survey questionnaire (Zikmund 2010). Nine people (five HCPs, two statistics professors and two supervisors' expert in the literature) participated in the pilot test. This number of participants was considered sufficient to achieve the aim of pilot testing (Morgan 1997). A review of the literature revealed that pilot testing is generally conducted with respondents who are similar to the sampling frame, however, this pilot study was conducted with a variety of respondents to ensure that the survey questionnaire was simple, understandable, valid and useful for further data collection and statistical analysis (Gillham 2007). The process of pilot testing started with the health professionals' feedback.

1. Health Professionals' Feedback

The pilot testing was conducted with three HCPs. Each went through the questions given in the survey questionnaire and provided their feedback for: a) redundant questions, b) merging of questions, c) rewording of questions, and d) verified convergent and discriminant validity by reshuffling and removing some of the items in the survey. Below is an example of one of the reworded questions:

- Initial question: I intend to use mobile devices in Telehealth context to improve my work.
- Refined question: I intend to use mobile devices in the Telehealth context to improve my work processes and outcome.

After receiving detailed feedback from the health professionals the researcher revised the survey questions by changing sequence numbers, rewording and deleting/modifying some of the survey questions as per the feedback and this is now explained further.

In the first theme: Individual context, four factors: 1. Intention, 2. Self-efficacy, 3. Social influences and 4. Demographic factors were considered important. In the first factor/construct of the Individual context theme, 'Intention', seven items were considered to be important. However, after the pilot study, only five items were used in the revised copy of the survey (given in Appendix 6.3 on Page 345). Item 'intended to whenever I need them' was modified as 'if required in the health facility' was merged into the Management Support factor (as item MS2). Further, the item 'intended to use if access to necessary equipment' was shifted to Resource issues (as item RS4). Three items were modified in the Intention construct to better suit the research context. Item 'intended to finish work timely' was reworded as 'intended to use mobile devices to make more efficient use of time'. Item 'I intend to use mobile devices in Telehealth context to do different things' was modified to 'I intend to use mobile devices in Telehealth context to do different clinical work'. Item: 'I intend to use mobile devices in Telehealth context to improve my work' was modified to: 'I intend to use mobile devices in Telehealth context to improve my work processes and outcomes'.

In the second factor/construct of the Individual context, ‘Self-efficacy’, 14 items were initially considered however, one item ‘wise decision’ which was taken from the literature was deleted due to its unclear meaning and nine items were shifted into other related constructs. Two items ‘easy to use’ and ‘software used is too easy’ were shifted to the Complexity construct, two items ‘age’, and ‘healthcare job experience’ were shifted to Demographic factors, one item ‘beneficial’ was shifted to Relative advantage, one item ‘need health facility permission’ was shifted to Management support, one item ‘training required’ was shifted to Training and one item ‘trialability needed’ was shifted to the Trialability construct. Thus, after pilot testing, five items: 1. Ability to use, 2. Adequate knowledge, 3. Confidence, 4. Familiarity with mobile devices because of their use in daily life, and 5. Entirely under my control, were retained.

In the third factor/construct of the Individual context, ‘Social influences’, nine items were initially considered. However, three items: ‘important people, ‘people whose opinions are important and people who influence individual’ were covered in colleagues, friend, and peer group influence items and were therefore deleted from the questionnaire. Further, the item ‘influence of top management’ was reworded as ‘manager prefers the team to use mobile devices’ to better fit with the research context. Also, one item ‘influence of management preference’ was shifted into the Management support factor (as item MS1) because if management prefers a particular technology, they will support the staff’s use of that technology. Thus, after pilot testing, five items for the Social influence factor were retained.

In the final factor/construct of the Individual context, ‘Demographic factors’, two items: Age and Experience were considered. Initially, one item in the Age and five items in the Experience category were considered. In the revised copy of the survey, with the help of HIT adoption literature, four items were re-worded and considered in the Demographic factors, one for the Age category and three for the Experience category. Further, all five items of the Demographic factors were retained in the Social-Demographic questions in Part II of the revised copy of the survey.

The second theme was the Usage context with four constructs, 1. Relative advantage, 2. Complexity, 3. Compatibility and 4. Trialability, were considered to be important.

In the first factor/construct of the Usage context, ‘Relative Advantage’, seven items were initially considered. Three items, however, ‘perform tasks more quickly’, ‘reduce organisation cost’, and ‘reduce patient cost’ were getting covered in the ‘beneficial in Telehealth context’ items and so were removed from the final survey version. Thus, after the pilot study, two items were placed in Task effectiveness category (‘improves work quality’ and ‘improve job performance’) and two items placed in Productivity category (‘effectiveness in Telehealth context’ and ‘beneficial in Telehealth context’).

In the second factor/construct of the Usage context, ‘Complexity’, seven items were initially considered. However, after pilot testing, three items ‘require training, ‘easier if others in the health facility are using’ and ‘easier to me if initially I use them on trial bases’ were shifted into the Training, Social influences and Trialability constructs respectively. While two items were modified to ‘easier to use application software’ and ‘facilitate work in the high demand and emergency environment’ as indicated by the participants. Therefore, five items falling into three categories 1. Facilitation of process, 2. Mental effort, and 3. Understand ability) were used to select items for the Complexity construct; one item ‘facilitate work in the high demand and emergency environment’ in Facilitation of process, two items: ‘does not require much mental efforts’ and ‘easier for me to use application software’ in Mental Effort and two items: ‘understand ability’ and ‘easy for the things which I want to do’ in Understandability categories were retained.

In the third factor/construct of the Usage context, ‘Compatibility’, five items were initially considered. The item ‘I need certain transition time’ was placed in the Trialability construct. One new item ‘brings positive change in the Telehealth process’ was included from the Qualitative Phase because a significant number of participants agreed that using mobile devices in Telehealth enhanced work processes and brought changes that would benefit the healthcare domain. The first four items of the Compatibility construct were retained with some minor word changes to fit in with the research context. Therefore, five items for the Compatibility construct were finalized.

In the final factor/construct of the Usage context, 'Trialability', five items were initially considered. These five items with some minor changes in wording were finally kept in the survey questionnaire. The item 'on a trial bases' was re-worded 'to trial basis prior to embedding into clinical practices'. Two items, 'for a certain period to understand how to use it' and 'for a certain period to get satisfied before the actual use', were merged as 'I need time to be allocated to trialing the mobile devices so I can understand how to use them'. Further, the item 'for a certain period to see what it can do' is reworded to 'if these were available for a certain time period so I could become familiar with their use before the actual use.' Also, the item 'before deciding on whether or not to adopt mobile devices in Telehealth context, I like to properly try it out' was reworded, as 'I would try out certain features of mobile devices prior to embedding into clinical practices'. One new item: 'a trial environment is required to refresh the knowledge' was included in the survey questionnaire as a result of the Qualitative Phase.

The third theme Technological context with three constructs, 1. Functional features, 2. Privacy and security and 3. Network coverage, was also considered. In the first factor/construct, Functional features, the most common features such as screen size which users prefer to check before they use a new technology were considered. Two items: 'screen size' and 'image quality' were considered from the literature and confirmed in the Qualitative Phase. Six items of Functional features ('battery life', 'data storage capacity', 'sound quality', 'easiness of clinical software', 'weight' and 'facilitation of work') were considered from the Qualitative Phase. After the pilot testing, 'the easiness of clinical software' item was deleted because it belonged to the Complexity construct and was available there. Also, one item 'Facilitate clinical/ ward related work' was merged with the Complexity factor. Thus, six items for Functional features were finalized for the survey questionnaire.

In the second factor/construct of the Technological context, 'Privacy and security', nine items fell into three main categories: 1. Security of patient data, 2. Privacy of patient care and data and 3. Security of mobile devices. Four items in the Security of patient data category ('network security', 'authentication of processes', 'secure photographing', and 'security of patient data'), three items in the Privacy of patient care and data ('location privacy', 'privacy of patient care' and 'privacy of patient data') and two items in the Security of mobile devices ('security of mobile devices' and 'threat of stealing mobile devices') were included in Privacy and security issues. During the pilot testing, two items, 'security of mobile devices' and 'threat of stealing mobile devices', were not considered important because, in the HCPs' opinions, there had been no evidence of stealing mobile devices in the healthcare domain. Thus, seven items for Privacy and security factors were retained in the final version for the survey questionnaire.

In the final factor/construct of the Technological context, Network coverage, six items were initially developed for the survey. After pilot testing, one item was reworded and one item was modified. Item: 'Availability of network coverage whenever needed' was reworded as 'available anytime and anywhere and item: 'easy access of network' was replaced with 'secure network' to better suit the context. Also, a negative item: 'poor network coverage' was added to exaggerate the responses (as suggested by statistical experts) to see possible variation in the responses. Thus, five items for the Network coverage were retained in the final version of the survey questionnaire.

The final theme was Organisational context with the three constructs: 1. Training, 2. Management support and 3. Resource issues being considered. In the first factor/construct of Organisational context, Training, seven items were initially considered which were reduced to five items after the pilot study. Three items: 'some guidance to update knowledge', 'regular information session' and 'practice environment to refresh knowledge' were merged to create one item: 'requires regular information session to update my knowledge'. Thus, five items (TR1-TR5) for the Training construct were retained in the final version of the survey questionnaire.

In the second factor/construct of the Organisational context, 'Management Support', six items were initially considered and then reduced to four items. Two items: 'if health facility require mobile devices' and 'if manager forces individual' were removed from the survey questionnaire because these items could be covered in the Management support construct (as MS1 item). Further, if the individuals feel apprehensive about the use of mobile devices, management can be expected to provide support to its staff. Furthermore, if a health facility requires mobile device use, then management policies will guide staff to use mobile devices. Thus, four items (MS1-MS4) representing the Management support construct were considered in the final version of the survey questionnaire.

In the final factor/construct of the Organisational context, Resource issues, six items were initially considered which were reduced to five items after pilot testing. Two items: ‘funds required to buy necessary equipment’ and ‘availability of funds to buy necessary equipment’ were similar and representing two different items: Cost and Resources. The item related to Cost was covered in RS2 item: ‘availability of funds’ and the item related to Resources was represented as the new item RS5:‘availability of all necessary equipment’ in the Management support construct.

Further, experts’ advice was taken for more improvement in the survey questionnaire.

2. Experts’ Consultation

After the three health professionals had reviewed the survey questionnaire, a meeting was held with the two experts (supervisors) in the technology adoption and diffusion literature. They guided the researcher to: a) Track back the literature and Qualitative study output to finalise the items, b) Change the layout of the survey, c) Remove the definitions of factors from the survey, d) Include demographic questions at the end of the survey, e) Number the questions in a continuous sequence and f) Include a five point scale (strongly disagree, disagree, neutral, agree, strongly agree) and add an extra scale, ‘I do not know’.

During the discussion the two expert supervisors also indicated that most of the proposed items were placed in the right factor category and matched the intended scale. Gao, Krogstie and Siau (2011, p. 53) stated that if the placement of the measurement items into the construct categories supplied by the subject was consistent with the initial placement of the items, then it was considered to demonstrate convergent validity of the construct and discriminant validity with the other constructs. Thus, the feedback obtained from the expert supervisors helped to refine the survey questionnaire and also demonstrated the convergent and discriminant validity of the survey questionnaire.

The survey was then tested with two expert statistics professors and received the following feedback: a) Keep the definition and name of the factor to avoid the misinterpretation of the questions, b) Keep the five point scale, and remove 'I do not know' option from the scale as the five point Likert scale is a standard scale mentioned in the literature, c) Do not repeat an item if it shows a relationship with more than one construct, d) However, in rare cases, repeat the item if it shows a relationship with more than one construct to check the respondents' trend for obtaining the responses for repeated item/(s).

The feedback obtained from the two expert statistics professors was discussed with the two expert supervisors. The supervisors suggested removing the definition of the factors. To obtain the feedback for the overall survey and the second opinion concerning keeping or deleting the definitions of factors, the questionnaire was further tested with one of the health professionals and received the following feedback: a) Questions are understandable, b) Keeping the factors' name and their definition in the survey may distract the respondents, c) Too many questions and written content in the survey, d) Text size is appropriate and e) Items are making sense with the factors (convergent validity ensured). At the conclusion of the consultation, the name and definitions of the factors were removed from the survey.

3. Language Check

Finally, the questionnaire was tested for simple English language and spelling mistakes by a university English language professor. After the language check, the final version of the survey (given in Appendix 6.3 on Page 345) was obtained which contained 14 constructs with 69 items. A detailed explanation of items merged, deleted and reshuffled among the constructs to reduce the survey length from 102 to 69 items is provided in the next section and summarised in Appendix 6.2 on Page 341.

After revising the survey questionnaire in Phase three, 69 items were finalised which were represented as 69 questions in the final version of survey questionnaire.

Step 4: Item Testing

Further, the survey questionnaire containing 69 questions was tested with the 41 HCPs to assess the internal consistency of each construct, which is measured using Cronbach's alpha and Pearson's inter-item correlation. Cronbach's alpha and Pearson's inter-item correlation have been used in other studies and are fairly standard test in most reliability discussions (Gao, Krogstie & Siau 2011; Yangil & Chen 2007). The literature indicates that ≥ 0.7 values is acceptable for Cronbach alpha (Lance, Butts & Michels 2006; Gao, Krogstie & Siau 2011; Barnes & Vidgen 2006). However, the sample size suggested in the literature for a sufficiently precise estimate of the Cronbach's alpha is a minimum sample of 300 participants (Yurdugul 2008). In this phase of pilot testing ≥ 0.6 value of Cronbach's alpha was considered acceptable because the questionnaire was tested with a small sample size. The Pearson's inter-item correlation indicates the correlation between two variables. Too high a value ($r \geq 0.8$) of Pearson's inter-item correlation indicates that two variables are separate identities and too low a value ($r < 0.3$) of Pearson's inter-item correlation indicates that two variables are the same identity and hence both the values are unacceptable.

In this phase, the Cronbach's alpha value for most of the constructs was > 0.6 excluding Training construct as indicated in Table 6.2. Whereas the values for Pearson's inter-item correlations were varied. Some of the correlations were > 0.8 and some have a Pearson's inter-item correlation of < 0.3. Therefore, it was difficult to present the inter-item correlation items. To overcome this problem, averaging all the values of the inter-item correlation matrix in each row and ranking them in ascending order calculated an inter-item correlation rank. After that, in each group of constructs, an item with the lowest correlation rank was identified and if Cronbach's alpha value improves by deleting that item, then it was chosen as the candidates for elimination. Table 6.2 below indicates the Cronbach's alpha values for each group of constructs before and after deleting the lowest averaged values items. From Table 6.2, it is clear that Cronbach's alpha value improves for most items excluding four: CP4, FF6, MS3 and RI1. This indicated that the remaining ten lowest correlation ranked items could be considered for deletion.

Table 6. 2: Cronbach's alpha values for each group of variables/items

Constructs	Number of items in original questionnaire	Cronbach's alpha	Item with the lowest correlation rank	Cronbach's alpha after deleting Item with the lowest correlation rank
1. Intention	5	.905	IN5	.906
2. Self-efficacy	4	.707	SE3	.805
3. Social influences	5	.883	SI5	.900
4. Demographic factors	4	.660	DC2	.747
5. Relative advantage	4	.936	RA4	.937
6. Complexity	5	.879	CX4	.883
7. Compatibility	5	.920	CP4	.915
8. Trialability	5	.848	TRI5	.888
9. Functional features	6	.881	FF6	.877
10. Network coverage	5	.612	NS5	.821
11. Privacy and security	7	.674	PS1	.814
12. Training	5	.129	TR5	.605
13. Management support	4	.940	MS3	.939
14. Resource issues	5	.936	RS1	.932

Next, to ensure that domain coverage of the scales did not suffer, the items with the lowest rank and improved alpha values were again checked. If the domain coverage of the scale for a particular factor was suffering then the item (for which the correlation rank was lowest and their deletion can improve Cronbach's alpha) was not considered for deletion. As a result of this analysis, ten items (as mentioned in Appendix 6.3 on Page 345 with an asterisk (*[17]) could be considered for deletion. A detailed explanation concerning the items which could be considered for deletion is given below.

In the first construct, Intention, items IN1, IN2, IN3, and IN4 were the four top-ranked items and IN5 was least ranked on the basis of the analysis of computed averaged item-to-item correlations. Further, if item IN5 was deleted, there was a slight improvement in Cronbach's alpha value from .905 to .906 as shown in Table 6.2. The researcher further examined the domain coverage of IN5. Referring to the

[17] The items marked with asterisks (*) were not deleted in this study due to testing of the questionnaire with a small sample size. It was decided to keep these items for subsequent statistical analysis such as factor analysis and regression analysis.

domain coverage of the scale item IN5, it could be covered in the Relative advantage construct and thus removed from the Intention construct.

In the second construct, Self-efficacy, item SE3 could be removed because it was the lowest ranked of the four items. Cronbach's alpha value improved from .707 to .805 when item SE3was considered for deletion. However, when researchers looked at the domain coverage, SE3 was covering the domain. Further, the Self-efficacy construct already had four items and the Cronbach's alpha value for the four items were at the acceptable level of $\geq$ 0.6. Therefore, all the items of Self-efficacy construct were retained.

In the third construct, Social influences, item SI5 was the lowest ranked. Deletion of SI5 increased Cronbach's alpha values from .883 to .900. Further, a domain coverage check indicated that item SI5 was included with negative meaning because in the Qualitative Phase HCPs had conflicting views of the Social influences constructs. Hence, SI5 was considered for deletion in the survey.

In the fourth construct, Demographic factors, DC2 was the lowest ranked of the four items, and removing this item improved Cronbach's alpha values from .660 to .747. However, DC2 covered the domain of the construct and hence was retained in the scale.

In the fifth construct, Relative advantage, item RA4 was the lowest ranked of the four items and Cronbach's alpha value slightly improved from .936 to .937 when the RA4 item was considered for deletion from the scale. However, there were only four items to represent the Relative advantage construct. Therefore, no items were considered for deletion from the Relative advantage construct.

In the sixth construct, Complexity, the item CX4 was the lowest ranked among five items and could be considered for deletion because Cronbach's alpha value improved from .879 to .883. Further, item CX4 could also be covered in the Relative advantages construct. Therefore, CX4 could be removed from the Complexity construct.

In the seventh construct, Compatibility, even though item CP4 was lowest ranked among the five items of Compatibility, all five items were highly correlated and Cronbach's alpha value did not improve when any item was considered for deletion. Therefore, CP4 was retained in the survey.

In the eighth construct, Trialability construct, TRI5 was lowest ranked among five items. Removing item TRI5 improved Cronbach's alpha values from .848 to .888, but TRI5 covered the domain of the construct and hence was retained in the scale.

In the ninth construct, Functional features, according to item-to-item correlation, FF6 was the lowest ranked item. However, the deletion of this item did not increase Cronbach's alpha value. Further, item FF6 was also covered in the domain of the construct. Therefore, FF6 was retained in the Functional features construct.

In the tenth construct, Network coverage, the lowest ranked of the five items was NS5. Removing item NS5 improved the Cronbach's alpha value from .612 to .821. In the domain check, it was found that NS5 covered the domain of the Network Coverage construct but in the opposite way and hence could be removed from the survey.

In the eleventh construct, Privacy and security, PS1 was the lowest ranked among seven items, and removing item PS1 improved the Cronbach's alpha value from .674 to .814. Furthermore, PS1 covered the domain of the Privacy and security construct but in the opposite way and hence could be removed from the survey.

In the twelfth construct, Training, Cronbach's alpha value was 0.129 below the acceptable limit (≥ 0.6), indicating that Training was not an influential factor for the development of the questionnaire. In the Qualitative Phase, participants indicated that they receive regular training to stay up-to-date and familiar with the technology. This may be the reason that participants ignored Training as an important influential factor in the survey. Therefore, all the items of in the Training construct could be removed in the survey. However, at this stage no items were removed from the Training construct from the final survey questionnaire used for data collection because this survey questionnaire was pilot tested with only a small number of participants.

In the thirteenth construct, Management support, MS3 was the lowest ranked item. However, removing MS3 did not improve the Cronbach's alpha value from 0.940. Further, item MS3 represented the domain of the construct and hence, could be removed.

In the fourteenth construct, Resource issues, RS1 was the lowest ranked among five items however, removing it did not improve Cronbach's alpha values from .936. Furthermore, RS1 covered the domain of the construct and hence was retained in the scale.

In summary, the use of a four step systematic approach resulted in a high degree of confidence in the reliability and validity of the questionnaire. Ten items could be dropped to reduce the length of the survey from 69 to 59 as shown in Appendix 6.3 on Page 345 with asterisks (*). Fifty-nine items are in line with the existing literature where 58 items were developed to analyse the adoption of new technology (Parasuraman 2000). However, in this research, the researcher wanted to have an opportunity to develop an enhanced survey questionnaire as using more items is considered better in an exploratory study (Eisinga, Te Grotenhuis & Pelzer 2013). Also, the reliability tests were conducted with a small sample size so the researcher did not delete any items from the survey questionnaire.

In the future, the survey questionnaire developed in this research study can be improved using confirmatory factor analysis (Straub 1989; Katerattanakul & Siau 2008). Furthermore, testing this questionnaire by including more individuals representing different countries and cultures may increase the generalizability of the questionnaire and give higher confidence in its reliability. Moreover, the questionnaire can be refined with an additional option of allowing participants to write comments related to each question to enhance its reliability and validity.

Therefore in this research study for quantitative data collection, the questionnaire mentioned in Appendix 6.3 on Page 345 with 69 items was used. A detailed description of the questionnaire is now provided.

6.3 Description of the Survey Questionnaire

The survey questionnaire used in this research study has 69 questions for fourteen factors as indicated in Table 6.3. All factors /constructs were measured by 4-7 items.

Table 6. 3: Factors and number of items in each factor considered for the development of the survey Questionnaire

Factors and number of measurement items		Sources	Technology used
Intention	5	• (Yangil & Chen 2007; Mun et al. 2006; Wu, Li & Fu 2011; Ajzen 1988) • Qualitative analysis	• Smartphone • Information Technology • Mobile healthcare
Social influences	5	• (Karahanna, Straub & Chervany 1999; Mun et al. 2006; Wu, Li & Fu 2011; Ajzen 1988) • Qualitative analysis	• Information technology • Mobile healthcare
Self-efficacy	4	• (Mun et al. 2006; Wu, Li & Fu 2011; Gagnon et al. 2016; Yangil & Chen 2007; Parasuraman 2000; Ajzen 1988) • Qualitative analysis	• Information technology • Mobile health • Smartphone • New Technology
Demographic factors (Age and Experience)	4	• (Yangil & Chen 2007) • Qualitative analysis	• Smartphone
Relative advantages	4	• (Yangil & Chen 2007; Mun et al. 2006; Karahanna, Straub & Chervany 1999; Rogers 2003) • Qualitative analysis	• Smartphone • Information Technology
Complexity	5	• (Yangil & Chen 2007; Mun et al. 2006; Wu, Li & Fu 2011; Rogers 2003) • Qualitative analysis	• Smartphone • Information Technology
Compatibility	5	• (Karahanna, Straub & Chervany 1999; Yangil & Chen 2007; Rogers 2003) • Qualitative analysis	• Information Technology • Smartphone
Trialability	5	• (Yangil & Chen 2007; Rogers 2003; Lin & Bautista 2017) • Qualitative analysis	• Smartphone • m-health applications
Functional features	6	• (Gagnon et al. 2016; Kargin & Basoglu 2006; Kim & Shyam 2014) • Qualitative analysis	• m-health • Mobile services
Security and privacy	7	• (Gagnon et al. 2016; Premarathne et al. 2015) • Qualitative analysis	• m-health • m-health services
Network coverage	5	• (Wu, Li & Fu 2011) • Qualitative analysis	• m-healthcare
Training	5	• (Agarwal et al. 2015; Bennett-Levy et al. 2017; Chang et al. 2013) • Qualitative analysis	• m-health • e-mental health • m-health interventions
Management support	4	• (Igbaria et al. 1997; Yangil & Chen 2007) • Qualitative analysis	• Personal computing • Smartphone
Resource issues	5	• (Gagnon et al. 2016) • Qualitative analysis	• M-health

The survey questionnaire also had ten socio-demographic questions providing information on participants' gender, age, healthcare job experience, Telehealth job experience, mobile device usage experience in healthcare, mobile device usage experience in Telehealth, mobile device usage experience in personal life, job position, type of hospital and bed size. These socio-demographic variables were measured using various measurement units as mentioned in the sample survey questionnaire used for quantitative data collection in Appendix 6.3 on Page.345

6.4 Recruitment Procedure

The participants in the Quantitative Phase were recruited with the help of the Director of Nursing, Health Managers and Nurse Unit Managers. The researcher also approached the participants by visiting the health facilities, consulting with receptionists, friends of friends, through Telehealth conferences and through the participants who participated in the Qualitative Phase of this study. An email, text message, Facebook, mobile phone and personal visit were used as the medium of communication to request their participation and get references from them. People who could not participate in the focus group discussions and interviews due to time constraints were also contacted to participate in the survey.

The Director of Nursing, health managers and ward managers were also contacted using emails, telephone calls or personally visiting the health facilities but were reluctant to give the contact details of the participants due to hospital policy and, therefore, were requested to distribute the surveys.

6.5 Survey Distribution

Fifteen hundred (1500) paper-based surveys were distributed through the Director of Nursing, Nurse Unit Manager, through a responsible person in two conferences and through a responsible person at the reception of the various health facilities. The online survey was accessed via a link, which was sent to participants through a responsible person and by the researcher. If participants were interested in participating in the online survey they needed to click on the link to complete the survey questionnaire.

To distribute the surveys in one of the health facilities, a meeting with the Executive Director and Coordinator of Telehealth was organised. In this meeting the researcher explained the purpose of her research and showed them a sample of the survey and Participant Information Sheet. They agreed to assist the researcher with the data collection and suggested that they would further distribute the survey and Participant Information Sheet to the manager of each ward. They also advised the researcher to provide an email with the survey link, which would then be forwarded to the responsible person who would forward the email containing the survey link onto the potential participants. After this meeting, an email was provided to the officials. Paper-based surveys and Participants' Information Sheets were also left in the Executive Director's Office for further distribution. These two documents were not stapled together and became separated with only the survey taken by the participants, causing an ethical issue.

In other health facilities, meetings were organised with the facility manager or Director of Nursing for the purpose of distributing the survey. A responsible person at each health facility was provided with the link to the survey as well as paper-based survey and Participants Information Sheet for further distribution.

To distribute the survey in two conferences, 1000 printed surveys and Participants Information Sheets were provided to the responsible person. In one conference the survey questionnaire and Participants Information Sheet were inserted in the conference delegates' bags. In another conference, the survey questionnaire and Participants Information Sheet were kept outside the conference hall. In both conferences the researcher and the responsible person requested the delegates to complete the survey and drop it in the survey box, which was located in a suitable area.

In order to increase the response rate, the researcher also personally visited some wards and left some surveys along with Participants Information Sheet at the reception of each ward and also explained the research motive to the HCPs who were available at that time.

6.6 Survey Collection

Quantitative data was collected using a cross-sectional survey design. The cross-sectional survey design is a survey design allowing data on the variables to be collected at one single point in time (Bryman & Bell 2007). The survey questionnaire was collected in both paper-based and electronic formats. Both the online and paper format of the survey questionnaire were used for the convenience of the participants.

The responses for the paper-based surveys were collected from the various health facilities through a responsible person as well as personally visiting the reception and staff room. The survey responses from conferences were collected in a survey box. The responses for the online survey was collected through the 'lime survey' (a service provided by University of Southern Queensland (USQ) to collect online surveys) and extracted by the researcher using a user name and password provided to her for accessing the 'lime survey' platform. In total, 135 survey responses were collected but due to ethical challenges, only 39 responses were used for the purpose of analysis.

6.7 Reliability and Validity of the Questionnaire

A measure is considered reliable if different attempts at measuring something converge on the same results. It is a measure of internal consistency and generally measured by correlating items which comprise a scale (Zikmund 2010). The items' correlation can be done using various methods such as the Split half method, Test retest, and Cronbach's alpha (Nathan 2009; Gao, Krogstie & Siau 2011; Bashir, Afzal & Azeem 2008; Zikmund 2010). The problem with the Split half method is that the reliability is performed by checking half of the items on a scale against the other half, which is not suitable in this research, as the researcher did not intend to study the items in two groups. The Test-retest method was also considered unsuitable as this research study is a cross-sectional study and data was collected at one point in time.

In this research, a Cronbach's alpha was used to measure the reliability of the questionnaire's constructs as the survey questionnaire contained multiple-item scales, and Cronbach's alpha test is suitable for multiple-item scales (Eisinga, Te Grotenhuis & Pelzer 2013; Gao, Krogstie & Siau 2011). Cronbach's alpha test was selected to assess the internal consistency of each construct as previously used in other questionnaire development studies in the field of IS (Gao, Krogstie & Siau 2011). It is a fairly standard test in most reliability discussions (Gao, Krogstie & Siau 2011).

Validity is the accuracy of a measure (Zikmund 2010). It deals with whether the questionnaire is measuring what it is meant to measure (Bashir, Afzal & Azeem 2008). It is most concerned with specific inference made from the measurement (Creswell & Miller 2000; Dellinger & Leech 2007). The three basic types of validity are: 1. Face validity, 2. Content validity, 3. Construct validity.

Face validation of the questionnaire is conducted to check readability, feasibility, clarity of wording, layout and style (Zikmund 2010). Face validity in this research study was conducted with lay people, experts, Language check and HCPs and is explained in Section 6.2 in detail. Content validity is the degree to which a measure covers the domain of interest (Zikmund 2010). Experts are often used to judge items on a measurement questionnaire in terms of the specified domain being studied. In this research, content validity was tested through a pilot study with HIT adoption experts and HCPs. Construct validity requires researchers to demonstrate that questionnaires measure the unique constructs that they were designed to measure (Zikmund 2010). This validity ensures the interrelationship among items and the group of items that can be justified to share sufficient variance to prove their existence as a factor/construct. In this research study, construct validity is represented using inter-item correlation among the item and is explained in detail in step 4, Section 6.2.

6.8 Conclusion

In this chapter the development of the survey questionnaire used in the quantitative data collection and the procedure for quantitative data collection were explained. The survey questionnaire was developed with the help of previous technology adoption literature in general and in healthcare in particular, and using Qualitative Phase 1 findings, and was refined with the help of Pretesting and pilot testing. The refined survey questionnaire was used for quantitative data collection. The quantitative data collected was further analysed using SPSS IBM 23 software. The analysis of the quantitative data is explained in the next chapter.

Chapter 7
Quantitative Data Analysis

CHAPTER 7: QUANTITATIVE DATA ANALYSIS

7.1 Introduction

In the previous chapter the development of the survey questionnaire and procedure for collecting quantitative data was explained. This chapter explains quantitative data analysis through exploratory factorial analysis (EFA) and regression analysis with a small sample size[18]. The chapter consists of eight sections as shown in Figure 7.1.

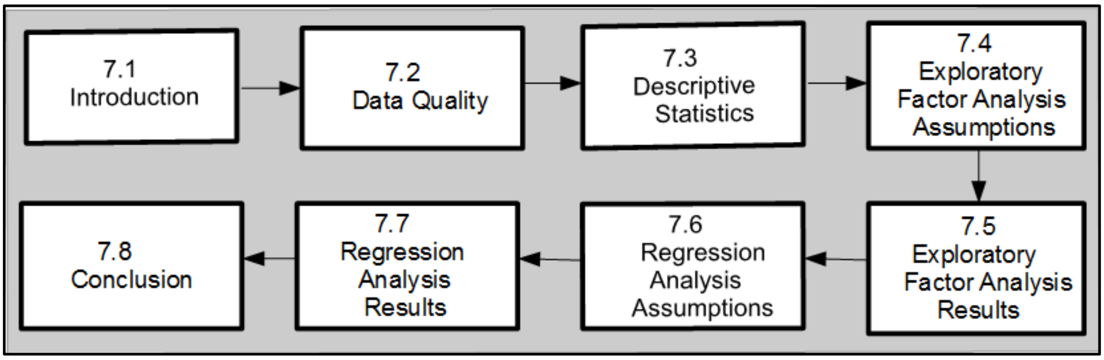

Figure 7. 1: The outline of Chapter 7 on quantitative data analysis

Source: Developed for this research

Section 7.1 outlines the chapter. In Sections 7.2 and 7.3 data quality and descriptive statistics for quantitative data are explained. Sections 7.4 and 7.5 discuss Exploratory Factor Analysis (EFA) assumptions and its results respectively. Sections 7.6 and 7.7 address regression analysis and its results respectively. Finally, the conclusion of the chapter is presented in Section 7.8.

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[18] A small sample size of 39 participants is used for EFA and Regression analysis.

7.2 Data Quality

Quantitative data obtained in the form of survey responses (14 online and 25 paper based surveys) was analysed with aims to: (a) describe the basic statistical features of the data collected in the Quantitative Phase, (b) validate the items used to measure the constructs/factors, and (c) validate all fourteen factors which were considered after the findings of the Qualitative Phase.

Before starting the quantitative data analysis, the data was checked for quality. Data quality is important to ensure the completeness, consistency and suitability of data to attain a certain level of quality for reasonable statistical decisions (Karr, Sanil & Banks 2006). Before beginning the data analysis, pre-data analysis was conducted to ensure the completeness, consistency and suitability of data for conducting certain statistical tests designed to achieve the objective of quantitative analysis.

Pre-Data Analysis

In pre-data analysis, two steps were followed: 1. Creating a data file and 2. Checking the data file. This process was advised in the literature (Huizingh 2007; Karr, Sanil & Banks 2006).

First, quantitative data was collected in the form of survey responses, entered into SPSS IBM 23 software to create a data file. During this process, for each of the responses, the raw data was systematically coded with a number, name and other attributes such as scale (ordinal or categorical).

The data file was then checked to detect and remove errors and inconsistencies, thus improving the quality of the data (Rahm & Do 2000; Karr, Sanil & Banks 2006). In this step the quantitative data was validated using predetermining validation rules in SPSS IBM 23. These rules were:

1. For the fourteen constructs/factors measured using 69 items, a value range from 1 to 5 (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree) was defined

2. For demographic data, depending on the questions mentioned in the survey questionnaire, different value ranges were defined.

Thus, pre-data analysis helped to create a SPSS file, which contained 69 variables representing 14 constructs and 10 variables representing socio-demographic variables with predefined data values. This file was used for the further quantitative data analysis.

Response Rate

Response rate is an important factor in assessing the values of research findings (Baruch & Holtom 2008). Low response can result in bias and can challenge the findings of the research (Creswell 2013; Fan & Yan 2010). The literature indicates a decline in the response rate in survey data collection in an organisational environment (Baruch & Holtom 2008). This trend is the same in health organisations (Cook, Dickinson & Eccles 2009). Nulty (2008) compared previous research studies and concluded that the response rate of online surveys is lower (on average 33%) compared to paper based surveys (56%). Manfreda et al. (2008) analysed the research results of 45 studies and found that the response rate of web surveys is approximately 11% lower than that of other kinds of surveys. The low response rate in the survey data collection is caused by factors such as poor wording, too long, content and presentation style, and inadequate format of the survey questionnaire.

Even though low response rates are reported in the previous literature, there is no agreed norm for the acceptable limit in response rates. An acceptable response rate for a survey can vary from 1% to 75% depending upon the different interpretations, sampling techniques and the research topic (Nulty 2008). A low response rate for example 1% may has or may not has generalisability to the population because generalisation of research results not only depend response rate but it also depend on research objectives as well. According to Nulty (2008, p. 306):

> *'If the data gathered from a teaching evaluation survey were to be used only to bring about improvements by that teacher, and there is even one response that provides information*

which can be used in this way, the survey's purpose has, at least in part, been served'.

So the generalisation of the results may be or may not be solely based on the response rate. It also depends on research objective.

The literature indicates that the acceptable response rate in the health domain varies from 5% to 85% (Wu, Li & Fu 2011; Tavares & Oliveira 2016; Sezgin, Özkan-Yildirim & Yildirim 2016; Cook, Dickinson & Eccles 2009; Bawack & Kala Kamdjoug 2018). The response rate for survey data collection in the Taiwan healthcare context for the adoption of medical alerts is 56.8% (Kuo & Cheng 2017), in the USA and Portugal healthcare context for the adoption of electronic health record portal is 21.9% and 24.4% respectively (Tavares & Oliveira 2017). In the Australian, New Zealand and British healthcare contexts response rates are very low, at 5% (Chen et al. 2017).

The response rate in this research study was 2.9%. In this research, a total of 1500 surveys were distributed to HCPs. Of these, 135 responses were received. However, due to unforeseen events occurring during data collection, only 39 responses were used for the purposes of statistical testing. The low response rate in this research study was due to limited communication with participants due to hospital policy, length of the survey and ethical issues. In the health domain, HCPs do not usually have time to read a long survey. A survey consuming thirteen minutes or less has a better response rate than longer surveys. In this research, the survey was designed in such a way that it would consume 10-15 minutes, but still the response rate was low.

Next, the usable surveys were checked for missing values.

Missing Values

Checking the missing values in a data set is important because many missing values decrease the power of the analysis. In missing values analysis, the data may be missing completely at random (MCAR) or not at random (MNAR) (Acock 2005). In MCAR, the reason for the missing values is completely random. In MNAR, the reason for the missing values depends on factors that are not observed (Donderset al. 2006). A data set with missing values up to 10% is unlikely to be problematic and can be considered for the interpretation of findings.

In this research, missing values data analysis was conducted based on the SPSS IBM 23 missing values analysis pattern. The output for the missing values analysis pattern for surveys showed a range of missing values from 2.6% to 5.1% which was considered completely random because the missing values were not dependent on each other.

The missing values can be excluded using various methods such as list wise, pairwise, substituting missing values with mean, median, single imputation expectation maximization or multiple imputation expectation maximization methods (Acock 2005). In this research, missing values were replaced with a median because the data used for the statistical purpose was ordinal and the median is an accurate representative of the ordinal data.

Assessing the quality of data by reporting pre-data analysis, response rate and missing values is the basic criteria in all statistical analysis. Including this criteria, descriptive statistics are also reported in statistical analysis, and is explained further in this research.

7.3 Descriptive Statistics

The importance of descriptive statistical analysis is to summarise the information of a sample. It helps the researcher to assess the basic features and distribution of data across all variables, and is important to report in any statistical analysis (Andy 2009). In this research, the descriptive analysis was mainly used to determine the characteristics of the sample and the variability among the participants’ responses for the 69 variables.

Descriptive statistics are reported using frequency and variance tables. The frequency table listed the values of 10 socio-demographic variables and the corresponding number and percentage of the participants for these variables.

The variance table described the variability in the participants' responses for 69 variables divided into 14 groups, and helped to find the maximum and the minimum variability in the participants' responses for each group of variables. Variability can also be explained using the frequency table. However, in this research, there were 69 variables making the frequency table too large to explain the variance in responses (Voelkl & Gerber 1999). Therefore, it was convenient to use variance tables to represent the measure of variability among participants' responses.

The frequency table representing demographic characteristics of the participants in this research study is provided in the next section. The variance tables for each group of constructs/factors are provided in Appendices 7.1 - 7.14 From Page 348-351 and their explanation is provided in the next section.

Demographic Characteristics

As shown in Table 7.1 below, of the 39 respondents, 74.4 % were females and 25.6% were males, and most were young (less than 39 years age) nurses. The participants' working experience in healthcare ranged from less than 5 years to greater than 25 years. 38.5% of the HCPs had less than 5 years of job experience and 20.5 % of the participants had greater than 25 years of job experience in the health domain. Information given in Table 7.1 also indicated that 38.5 % of the participants had no experience using mobile devices in healthcare but they were familiar with their use in Telehealth.

Table 7. 1: Demographic characteristics of the respondents in the Quantitative Phase

Variables	Measurement Units	Frequency	Valid Percentage (%)
Gender	Female	29	74.4
	Male	10	25.6
Age	20-29 years	13	33.3
	30-39 years	11	28.2
	40-49 years	7	17.9
	50-59 years	7	17.9
	60-69 years	1	2.6
	70-79 years	0	0
	80-80+ years	0	0
Job experience in healthcare	Less than 5 years	15	38.5
	5-15 years	10	25.6
	16-25 years	6	15.4
	Greater than 25 years	8	20.5
Job experience in Telehealth	No experience	20	51.3
	Less than 5 years	12	30.8
	5-15 years	6	15.4
	16-25 years	1	0.0
	Greater than 25 years	20	2.6
Mobile device use experience in healthcare	No experience	15	38.5
	Less than 5 years	23	59.0
	5-15 years	0	0
	16-25 years	0	0
	Greater than 25 years	0	0
Mobile device use experience in Telehealth	No experience	22	56.4
	Less than 5 years	15	38.5
	5-15 years	2	5.1
	16-25 years	0	0
	Greater than 25 years	0	0
Mobile device use experience in personal life	Less than 5 years	6	15.4
	5-15 years	21	53.8
	16-25 years	9	23.1
	Greater than 25 years	3	7.7
Job position	Physician	5	14.3
	Nurse	29	82.9
	Others	1	2.9
Hospital type	Public	36	92.3
	Private	0	0
	Others	3	7.7
Bed size	Less than 500	35	89.7
	500-1000	3	7.7
	1001-1500	0	0
	Greater than 1500	0	0

The descriptive data also indicated that most of the HCPs had some experience with mobile device usage in their daily routine and some of them (17 participants) were also using them in the Telehealth environment.

Variability in Responses

The variability of the 69 variables under investigation was measured to see the variations in participants' responses in this research. Fourteen constructs/factors representing 69 variables were examined in this research study. These fourteen factors were: 1. Intention, 2. Self-efficacy, 3. Social influences, 4. Demographic characteristics, 5. Relative advantages, 6. Complexity, 7. Compatibility, 8. Trialability, 9. Functional features, 10. Network coverage, 11. Privacy and security, 12. Training, 13. Management support and 14. Resource issues.

These factors/constructs were measured using the five point Likert scale. Descriptive statistics were performed on individual items for each of the constructs by reporting the ranges. The maximum and minimum values obtained for each of the constructs in SPSS are explained below.

1. Intention

The Intention construct measured the intention of HCPs to use mobile devices in the Telehealth environment. Five items were used to measure the Intention construct. Appendix 7.1 on Page 348 showed enough variance in this factor and indicated that the item 'if health facility require mobile devices' appeared as the most preferred item with a mean of 4.41 ± 0.938. On the other hand, the item 'if I have mobile devices, I am intended to use them' was the least preferred item with the lowest mean of 3.92 ± 1.061.

2. Self-efficacy

The Self-efficacy construct measured the respondents' perceptions and experiences for confidence in using mobile devices. Four items were used to measure the Self-efficacy construct. The respondents' level of agreement on the item 'I am able to use mobile devices in Telehealth' was the highest with a mean of 3.85 ± 0.988 and they agreed least with the item: 'how, why and when to use mobile devices' with a mean of 2.77 ± 0.902 as shown in Appendix 7.2 on Page 348.

3. Social influences

The Social influences construct measured the respondents' perceptions and experiences on Social influences on the use of mobile devices in Telehealth.

Descriptive statistics for Social influences, shown in Appendix 7.3 on Page 348, indicated enough variance in the responses. The respondents' level of agreement on the 'manager's influences on team' was the highest with a mean of 4.10 ± 0.995. They were however, less agreeable in term of 'Friends influences' which showed a mean of 3.33 ± 1.243.

4. *Demographic factors*

The Demographic factors: Age and Experience measured the respondents' perceptions and experiences on the use of mobile devices in Telehealth. The detailed descriptive statistics for Demographic factors, shown in Appendix 7.4 on Page 348, indicated variance in the responses. The respondents' level of agreement on the 'staff who use mobile devices in the health care context are more likely to use them in the Telehealth environment' and 'Staff who use mobile devices in their daily routine are more likely to use them in the Telehealth environment' were the highest with a mean of 3.90 ± 0.998 and 3.90 ± 1.095 respectively. They were however, less in agreement on 'staff who have worked in the hospital environment for a number of years do not prefer to use mobile devices in the Telehealth environment' with a mean of 3.15 ± 1.040.

5. *Relative advantages*

The Relative advantages construct measured the respondents' perceptions and experiences on influence of Relative advantages on the use of mobile devices in Telehealth. The detailed descriptive statistics for Relative advantages, shown in Appendix 7.5 on Page 349, indicated sufficient variance in the responses. The respondents' level of agreement on the item 'overall, using mobile devices in the Telehealth context is beneficial for me' was the highest with a mean of 4.03 ± 0.843. They were however, less in agreement with 'using mobile devices in the Telehealth context improves my job performance' and 'using mobile devices in the Telehealth context is effective in my Telehealth work context' with a similar mean of 3.87 ± 0.081 for both items.

6. *Complexity*

The Complexity construct measured the respondents' perceptions and experiences for ease of the use of mobile devices in Telehealth. Descriptive statistics for Complexity, shown in Appendix 7.6 on Page 349, indicate enough variance in the responses. The respondents' level of agreement on the item 'ease of use for the things which they want to do in Telehealth' was the highest with a mean of 3.85 ± 1.113. They were, however, least in agreement with the item 'does not require mental effort' with the mean of 3.33 ± 1.155.

7. *Compatibility*

The Compatibility construct measured the respondents' perceptions and experiences on the influence of Compatibility on the use of mobile devices in Telehealth. Descriptive statistics for Compatibility, shown in Appendix 7.7 on Page 349, indicate enough variance in the responses. The respondents' level of agreement on 'using mobile devices in the Telehealth context brings positive change in the Telehealth process' was the highest with a mean of 4.15 ± 0.904. Respondents were however, less in agreement with the 'using mobile devices in the Telehealth context fits well with all aspects of Telehealth work' with a mean of 3.54 ± 1.097, as shown in Appendix 7.7 on Page 349.

8. *Trialability*

The Trialability construct measured the respondents' perceptions and experiences on the influence of Trialability on the use of mobile devices in Telehealth. The detailed descriptive statistics for Trialability, shown in Appendix 7.8 on Page 349 indicated less variance in the responses. The respondents' level of agreement on the item 'I would use mobile devices on a trial basis prior to embedding into normal clinical practices' was the highest with a mean of 4.33 ± 0.772. They were however, less in agreement on 'a trial environment is required so I can refresh my knowledge for using mobile devices in the Telehealth environment' with a mean of 3.87 ± 0.801.

9. Functional features

The Functional features construct measured the respondents' perceptions and experiences on the general Functional features for the use of mobile devices in Telehealth. The detailed descriptive statistics for Functional features, as shown in Appendix 7.9 on Page 350, indicate enough variance in the responses. The respondents' level of agreement on the item 'weight of mobile devices' was the highest with a mean of 3.95 ± 1.025. They were, however, least agreeable with the item 'storage capacity of mobile devices' with a mean of 3.38 ± 0.990.

10. Network coverage

The Network coverage construct measured the respondents' perceptions and experiences on the influence of network coverage on the use of mobile devices in Telehealth. The detailed descriptive statistics for Network coverage, shown in Appendix 7.10 on Page 350, indicate enough variance in the responses. The respondents level of agreement on the items 'network coverage in my Telehealth environment is adequate to effectively use mobile devices' and 'network coverage in my Telehealth environment is poor for the effective use of mobile devices' were the highest with a mean of 3.28 ± 1.337 and 3.28 ± 1.191 respectively. They were however, less in agreement with 'network coverage in remote area for Telehealth is adequate for the effective use of mobile devices' with a mean of 2.87 ± 1.128.

11. Privacy and security

The Privacy and security construct measured the respondents' perceptions and experiences on the influence of Privacy and security on the use of mobile devices in Telehealth. The detailed descriptive statistics for Privacy and security, shown in Appendix 7.11 on Page 350, indicate enough variance in the responses. The respondents' level of agreement on the item 'the privacy of patient's data needs to be assured before using mobile devices in the Telehealth context' was the highest with a mean of 4.49 ± 0.914. They were however, less in agreement with the 'Network coverage in remote areas for Telehealth is adequate for the effective use of mobile devices' with a mean of 2.72 ± 1.376.

12. <u>Training</u>

The Training construct measured the respondents' perceptions and experiences on the influence of training on the use of mobile devices in Telehealth. Descriptive statistics for Training, shown in Appendix 7.12 on Page 351, indicate variance in the responses. The respondents' level of agreement on 'using mobile devices in the Telehealth requires sufficient training' was the highest with a mean of 4.28 ± 0.724. They were however, less in agreement in 'using mobile devices in the Telehealth context requires printed manuals to support my learning' with a mean of 3.62 ± 1.091.

13. <u>Management support</u>

The Management support construct measured the respondents' perceptions and experiences on the influence of management support on the use of mobile devices in Telehealth. Descriptive statistics for Management support, shown in Appendix 7.13 on Page 351, indicated less variance in the responses. The respondents' level of agreement on the item 'I would use mobile devices in the Telehealth context if management approves them' and 'I would use mobile devices in the Telehealth context if management supports me' were the highest with a mean of 4.36 ± 0.932 and 4.36 ± 0.778 respectively. They were however, less agreeable with 'I would use mobile devices in the Telehealth context if appropriate policies of management guide me' and 'I would use mobile devices in the Telehealth context if my management allows me' with a mean of 4.31 ± 0.950.

14. <u>Resource issues</u>

The Resource issues construct measured the respondents' perceptions and experiences on the influence of Resource issues for the use of mobile devices in Telehealth. The detailed descriptive statistics for resource issues, shown in Appendix 7.14 on Page 351, indicated enough variance in the responses. The respondents' level of agreement on 'I would use mobile devices in the Telehealth context if all the necessary equipment is available in my health facility' was the highest with a mean of 4.36 ± 0.843. They were however, less in agreement with 'I would use mobile devices in the Telehealth context if sufficient funding is available to implement good wireless network in my health facility' with a mean of 4.18 ± 0.942.

In this research, the demographic characteristics and variability in participants' responses provided the basic characteristics of the participants and the quantitative data. The main statistical analyses conducted with quantitative data were EFA and regression analyses. A detailed description of these analysis is provided in the following sections.

7.4 Exploratory Factor Analysis Assumptions

Factor analysis is a multivariate statistical approach and is considered the method of choice for interpreting self-reporting questionnaires (Williams, Onsman & Brown 2010). This technique of data analysis is commonly used in the fields of psychology and education, and more recently in the health domain for exploring rich psychometric information (Williams, Onsman & Brown 2010; Pett, Lackey & Sullivan 2003).

Factor analysis is often used for factor reduction. It explains a larger set of variables with a smaller set of latent variables which can explain the observed Phenomena. The latent variables can be represented as factors/constructs causing the observed score/phenomenon on measuring variables (Henson & Roberts 2006).

Factor analysis includes both exploratory and confirmatory methods. Exploratory Factor Analysis (EFA) is generally used to generate the theory, reduce the number of variables, examine the structure and relationship between variables, develop parsimonious analysis and address multicollinearity (Williams, Onsman & Brown 2010). It does not consider prior theory strong (Daniel 1989). In this research study EFA is conducted because this analysis can extract the factors which can best reproduce the variables under the maximum likelihood conditions (Henson & Roberts 2006). Therefore, the importance of EFA in this research study is to validate the factors considered in the Qualitative Phase.

Confirmatory factor analysis is generally used to test the theory. Testing of the theory is only possible if the researcher has a strong rationale regarding what factors should be in the data and what variables should define each factor. Confirmatory factor analysis is used for hypotheses testing (Henson & Roberts 2006; Williams, Onsman & Brown 2010). In this research, although some factors have been explored from a Qualitative Phase, they need to be validated using EFA as there may be some factors which may have merged with other factors or some factors may not appear as a factor when tested in the Quantitative Phase. Therefore, compared with confirmatory factor analysis, EFA is more suitable in this research.

There are many different ways to conduct EFA, and each approach may render distinct results when certain conditions are satisfied (Kieffer 1999). A complete overview of the assumptions necessary to conduct EFA is beyond the scope of this research study. However, the researcher has tried to cover some of the main assumptions given in the literature and mentioned by statistics experts to proceed with the EFA in this research. These pre-assumptions for EFA are explained further.

1. Measurement Scale

The literature provides four types of scale: nominal, ordinal, interval and ratio. Factor analysis does not work nominal data (Pett, Lackey & Sullivan 2003). In this research study all 69 variables used for the EFA were ordinal variables. Hence, this measurement scale is suitable for conducting EFA. Another condition for proceeding with the EFA is sample size as explained in the next section.

2. Sample Size

When conducting EFA, there are varying options and several guiding rules of thumb for sample size. For EFA, various sample sizes ranging from 50-1000 are recommended (Pearson 2008; Williams, Onsman & Brown 2010). The minimum ratio of the sample size to the number of variables ranging from 3:1, 6:1, 10:1, 15:1, 20:10 or 5:10 has also been mentioned in the literature (Pearson 2008; Williams, Onsman & Brown 2010).

In this research, even though the usable sample size was 39, the researcher proceeded with the EFA because the rules of thumb for determining sample size to proceed with

EFA may be misleading as they do not consider many complex dynamics of factor analysis (Williams, Onsman & Brown 2010). Some researchers have mentioned that a smaller sample size can be adequate for EFA if the correlation coefficient is >0.80 (Guadagnoli & Velicer 1988). Henson and Roberts (2006, p. 402) explained that if communalities are > 0.60 and each factor is defined by several items, sample size can actually be small. Communalities gives the proportion of variance of each variable that is explained by the factor.

In this research, the communalities for those items extracted from the original 69 to proceed with the EFA was ≥ 0.7 as shown in Table 7.2.

Table 7. 2: Communalities values for the extracted items of 69

Variables	Communalities	Variables	Communalities
Intention	.835	Training	.817
Intention	.862	Training	.915
Intention	.898	Training	.890
Intention	.837	Training	.812
Functional features	.894	Training	.773
Functional features	.863	Network coverage	.907
Functional features	.879	Network coverage	.802
Functional features	.869	Network coverage	.902
Functional features	.859	Network coverage	.800
Complexity	.807	Privacy and security	.842
Complexity	.847	Privacy and security	.906
Complexity	.847	Privacy and security	.913
Complexity	.735	Privacy and security	.939
Social influences	.917	Privacy and security	.864
Social influences	.874	Privacy and security	.926
Social influences	.902	Resource issues	.894
Social influences	.792	Resource issues	.925
Compatibility	.810	Resource issues	.922
Compatibility	.845	Resource issues	.924
Compatibility	.912	Resource issues	.921
Compatibility	.806	Trialability	.809
Compatibility	.812	Trialability	.813
		Trialability	.946
		Trialability	.823
Extraction Method: Principal Component Analysis			

These values of communalities indicate that each variable has shown enough variance to proceed with the EFA in this research study.

3. Data Outliers

To justify the data for EFA and various parametrical statistical tests, it is necessary to screen for outliers and assess for the normal distribution of a data set. When running EFA, there should be no outliers in the data set (Liu & Zumbo 2007).

A number of methods, such as skewness and kurtosis, boxplot and Q-Plot, are available for checking the normal distribution of data and outliers. If there are one or two variables, then testing for an outlier is easily completed using graphical statistical methods such as a histogram and scatterplot. However, if there are multiple variables, testing for an outlier using graphical statistical methods becomes complex. The best way to test the multivariate outlier is using Mahalanobis distance. Usually, Mahalanobis distances are run across all variables and any cases with $p<0.05$ are removed from the analysis.

In this research study outliers were checked using Mahalanobis distances. The Mahalanobis distances were performed separately for each of the 14 groups of variables and six cases were found to have outliers, where p was < 0.05. However, the researcher did not remove the outliers at this stage because some outliers are difficult to avoid in research due to data recording errors, typing errors, unpredictable measurements (related errors which include guessing, inattentiveness because of fatigue or misunderstanding instructions) (Liu & Zumbo 2007). Not removing the outlier restricted the generalizability of these research findings.

4. Inter-Item Correlation

To conduct the EFA, the researcher must describe the relationships between the variables. Most statistical analysis software uses a correlational matrix as the default in EFA (Henson & Roberts 2006). Correlation is a statistical method used to assess a possible linear relationship between two continuous variables (Kapoor, Dwivedi & Williams 2014). Continuous variables can be dependent as well as independent. There are two types of correlation: Pearson's product moment correlation and Spearman's rank correlation. Pearson's product moment correlation is affected by extreme values which may exaggerate the strength of a relationship between the variables. When extreme values are present in the dataset then Spearman's rank correlation is a more robust method (Williams, Onsman & Brown 2010). In this research, to proceed with EFA, Pearson's inter-item correlation method was used because extreme values in the data set were not expected.

Pearson's product moment correlation determines whether the variables are correlated with each other or dependent of each other. Excessive high correlation values, that is $r \geq 0.80$, indicates that two related constructs are separate identities and excessive low values of correlation, that is $r < 0.30$, indicate that two related constructs are one identity (Creswell 2013; Pett, Lackey & Sullivan 2003). Therefore, the items with excessive high or low correlation should be deleted.

In this research, when inter-item correlation was conducted using Pearson's product moment correlation, it was found that most of the items were correlated at different correlation values. Some of the correlations were greater than 0.80 and some had a Pearson correlation below 0.30. However, it was difficult to select an item for deletion because each item sometimes indicated high correlation with some of the items and low correlation with others. Therefore, to delete an item to proceed with EFA, an item-to-item correlation rank was calculated by averaging all the values of reliabilities of the item for each row in the item-to-item correlation rank matrix (Gao, Krogstie & Siau 2011). Then, a check was conducted to see the smallest averaged value items. Then the following rules were used to delete an item to proceed with EFA:

1. If the deletion of the lowest item-to-item correlation rank improved Cronbach's alpha value then these items were deleted.

   Coefficient alpha values range from 0 to 1 where 0 means no consistency and 1 means complete consistency. Generally, Cronbach's alpha values from 0.6 to 0.7 indicate fair reliability, 0.7 to 0.8 indicates good reliability, 0.8 to 0.9 is considered very good reliability, and ±0.30 considered minimal, ±0.40 considered nominal, ±0.50 considered practically significant, acceptable values (Hair, Black, Babin, Anderson & Tatham 1998). In the literature, a reliability coefficient of 0.6 to 0.7 is marked as the lowest acceptable limit for Cronbach's alpha (Gao, Krogstie & Siau

2011). In this research, a reliability coefficient of ≥ 0.6 was considered acceptable because of the sample size and as a result of this type of analysis, eleven items were selected for deletion to reduce the length of the items so as to proceed with EFA.

2. The minimum number of measurement items was set to four. In the EFA a component is comprised of at least the minimum of three items loading (Akhtar-Danesh 2017; Rahn 2017). If, after deletion of an item by following the first rule, there were less than four items in a construct/factor, then the whole factor was excluded from EFA.

With this type of analysis, twenty four items were selected for deletion to proceed with EFA. The items which were considered for deletion are shown in Table 7.3 below.

Table 7. 3: Cronbach's alpha before and after deletion of lowest rank item

Constructs	Number of items	Cronbach's alpha	Items with the lowest rank correlation	Cronbach's alpha if item deleted	Items considered for deletion to rerun EFA
Intention	5	.900	IN2	.906	IN2
Self-efficacy	4	.706	SE3	.774	SE1-SE4
Functional features	6	.891	FF1	.898	FF1
Complexity	5	.760	CX5	.794	CX5
Social influences	5	.772	SI5	.875	SI5
Compatibility	5	.814	CP1	.807	-----
Relative advantages	4	.911	RA3	.919	RA1-RA4
Training	5	.808	TR4	.802	-----
Management support	4	.904	MS2	.907	MS1-MS4
Network coverage	5	.674	NS5	.877	NS5
Privacy and security	7	.849	PS1	.930	PS1
Resource issues	5	.934	RS1	.927	-------
Trialability	5	.819	TR5	.852	TR5
Demographic factors	4	.700	DC1	.716	DC1-DC4

The remaining 45 items were checked for the normal distribution of data and multicollinearity and are explained further.

5. Normal Distribution

Any phenomenon which is produced by a large number of independent factors that are not interrelated will produce a normal distribution (Kerr, Hall & Kozub 2002). The graphical representation of normal distribution generates a bell shaped curve that is symmetrical (Kerr, Hall & Kozub 2002).

In this research, the graph given in Figure 7.2 indicates that the 45 variables were normally distributed. Therefore, EFA could proceed.

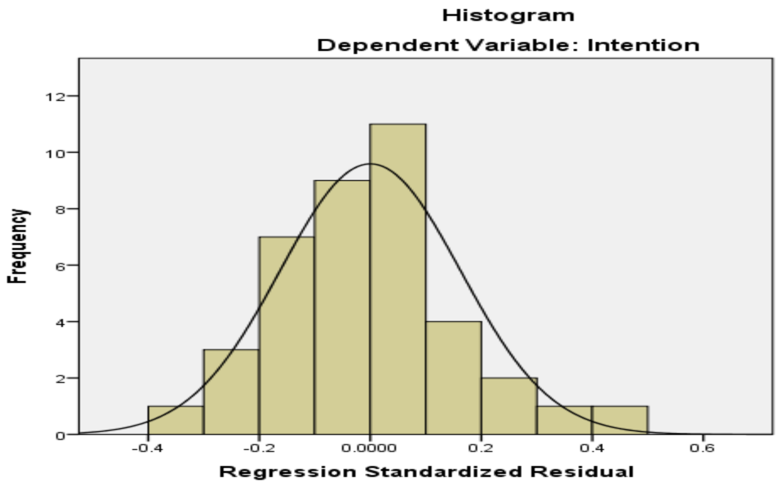

Figure 7. 2: Normal distribution curve indicating that data is normally distributed

Source: Developed for this research study

6. Multicollinearity

Mild multicollinearity is not an issue for EFA, but it is important to avoid extreme multicollinearity and singularity (two variables perfectly correlated with each other). To avoid multicollinearity and singularity, any items from the correlations matrix greater than 0.9 should be considered for deletion.

In this research, multicollinearity for 69 items was checked using the Pearson's product moment matrix. If deletion of the lowest correlation rank item in Pearson's product moment matrix improved Cronbach's alpha value then the item was considered for deletion. However, by following this rule, if there were less than four items left in a group of factors then the whole factor was considered for exclusion from

EFA. As a result, with this type of analysis 24 items were deleted to proceed with EFA. The items which were considered for deletion are shown in Table 7.3.

After deleting the 24 items by following the rules above, the Pearson's correlation matrix was checked again and no multicollinearity was found, indicating that EFA can proceed with the remaining 45 items.

7. Homoscedasticity

Homoscedasticity assesses the variance of the variables under investigation and should be approximately the same for all values of the predictors (Lyngstad et al. 2015). Data which lacks homoscedasticity, indicates higher residues (errors) for some portions of the range compared to others. To check if the homoscedasticity assumption is met, a plot of residues should be checked. If the residues form a patternless cloud of dots then the assumption is met. However, homoscedasticity is not considered a critical assumption for factor analysis as factors are linear functions of measured variables, homoscedasticity of the relationship is assumed.

In this research, as shown in Figure 7.3, the scatterplot of homoscedasticity did not form a cloud pattern for 45 variables which indicated that there was enough variance among the items to proceed with EFA.

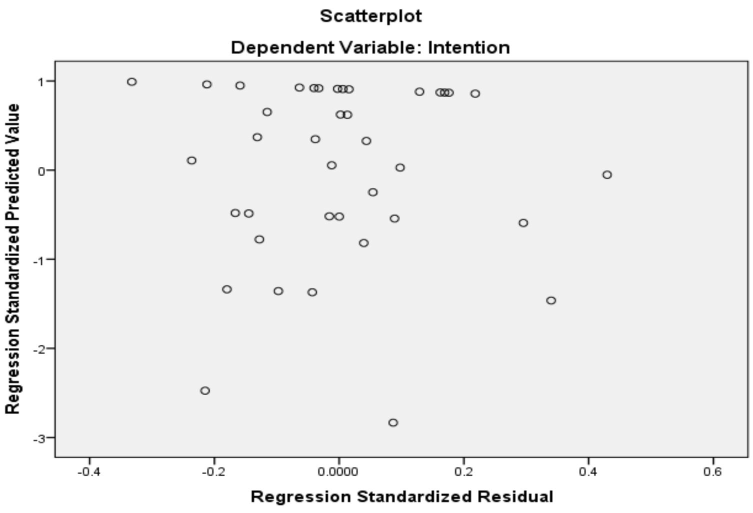

Figure 7. 3: Homoscedasticity graph indicating sufficient variance in participants' responses

Source: Developed for this research

The above explanations demonstrated that EFA in this research can proceed using 45 items because they were satisfying most of the assumption for EFA. There are some other factor extraction assumptions which need to be considered before proceeding with the EFA. These assumptions are factor extraction, factor rotation and factor retention rules.

8. Factor Extraction

Factor extraction allows us to extract main factors which can explain the observed phenomena. There are a number of ways to extract factors:

1. Principal Factor Analysis (PCA)
2. Principal Axis Factoring (PAF)
3. Centroid Factor Analysis (CFA)
4. Maximum Likelihood (ML)
5. Unweighted Least Square (ULS)
6. Generalised Least Square (GLS)
7. Alpha Factoring
8. Image Factoring
9. Minimum Residual Method.

PCA is the most common method for factor extraction (Henson & Roberts 2006; Akhtar-Danesh 2017; Pett, Lackey & Sullivan 2003) and starts by extracting the maximum variance and puts them into the first factor. After that, it removes the variance explained by the first factor and then starts extracting maximum variance for the second factor, and this process continues until 100% of the variance in the dataset is explained by the factors. PCA is mainly used when the researcher tends to summarise the relationships between variables with a smaller number of components. PCA and PAF tend to give similar results if the number of original variables are highly correlated and the number of original variables are quite high.

In this research, the number of original variables was quite high. Therefore, there is no difference between using either PCA or PAF methods for factor extraction. The only difference between PAF and PCA is that in PAF the correlation matrix 1's in the diagonal are replaced with the estimates of the communalities (Akhtar-Danesh 2017).

The CFA is a factoring procedure based on the idea that if the original variables are represented as a set of vectors, then the common factor can be thought of as the vector that passes through the centroid of the terminal points for this set of vectors. The difference between PAF and CFA is that in PAF the 'sum of square' of 'loadings is maximised', whereas in CFA, the average of the 'loadings is maximised'.

In ML, like PAF, the communalities are used instead of 1's in the diagonal of the correlation matrix. This approach is based on the assumption of normal distribution for each variable and is suitable for theoretical purposes (Akhtar-Danesh 2017) (Akhtar-Danesh 2017), and is most commonly used in confirmatory factor analysis. ML, ULS and GLS are often used in confirmatory factor analysis (Pett, Lackey, & Sullivan 2003). ULS is based on minimizing the sum of squared differences between the observed and estimated correlation matrices, ignoring the values on diagonal matrix (Pett, Lackey, & Sullivan 2003). GLS is based on minimizing the sum of squared differences between the observed and estimated correlation matrices, and adjusts the unweighted least squares by weighting the correlations. The difference between ULS and GLS is that in GLS, the correlations are weighted by the inverse of their uniqueness.

Other extraction methods such as alpha factor, image-factoring and CFA are available in the SPSS software but are not a popular extraction tools in the previous research studies. The Alpha factoring method uses Cronbach's alpha or the inter-correlation among the items to obtain a measure of internal consistency of the extracted factors. Image factoring is an alternative method to CFA. Based on image theory the common variance in a given variable is defined as its linear regression on remaining variables in the correlation matrix rather than a function of hypothetical factors as in CFA.

The above-mentioned techniques have their own advantages and disadvantages and most of them are available in the SPSS software. Each of these techniques of factor extraction uses a different orthogonal solution. However, with a large sample size the differences in the extracted factors are usually negligible. PCA solution is the best solution mentioned in the literature and hence used in this research study to extract factors. However, using such types of solution the original un-rotated factors obtained are difficult to interpret (Akhtar-Danesh 2017). Therefore, there is the need to rotate original extracted factors to provide interpretable results.

In the next section, the information regarding various types of factor rotation is provided.

9. Factor Rotation

Factor rotation is the process in which the original factors are rotated about their origin to yield a simple structure and easily interpretable factors (Akhtar-Danesh 2017). Factors are rotated using two main types of rotation: orthogonal and oblique. These rotations are mainly applied using five techniques:

1. Varimax
2. Quartimax
3. Equamax
4. Direct Oblimin
5. Promax.

Varimax is the most common orthogonal rotation method used in statistical analysis. It is an orthogonal rotation technique that minimizes the number of variables with high loadings, either positive or negative, for each factor. In other words, this method maximizes the variance of each factor loading by making high loadings higher and low loadings lower to simplify factor interpretation (Akhtar-Danesh 2017). Varimax is a suitable rotation method when there are fewer factors and if there is not a general factor among the variables because it overinflates the smaller factors and it eliminates the general factor, even if one exists (Akhtar-Danesh 2017).

Quartimax is another orthogonal method that minimizes the number of factors that explain each variable. In other words, each variable is loaded on the minimum number of factors (Akhtar-Danesh 2017). It is a suitable method if the existence of a general factor is expected (Akhtar-Danesh 2017). However, it may create a general factor even if one does not exist among the variables (Akhtar-Danesh 2017).

Equamax is a combination of varimax and quartimax techniques that simplifies both the number of variables that load highly on a factor and the number of factors needed to explain variables (Akhtar-Danesh 2017). However, this technique may behave erratically (Akhtar-Danesh 2017).

Direct oblimin is an oblique rotation method. This technique minimizes the cross product of loadings to simplify factors (Akhtar-Danesh 2017). This method permits fairly high correlation between factors, although factors may not necessarily correlate if this method is used (Akhtar-Danesh 2017).

Promax is another oblique rotation method. It is computationally faster than the direct oblimin rotation method and thus is recommended for a very large data set (Akhtar-Danesh 2017).

The above-mentioned techniques of factor rotation have their own advantages and disadvantages and most of them are available in the SPSS software. Each of these techniques of factor rotation uses either the orthogonal or oblique solution. In this research, varimax rotation is used because it is the simplest form of rotation and can reduce the mathematical complexity of calculation. Further, compared with other rotation techniques it extracts the medium number of factors. In other words, it does not extract too many or too few factors compared with equamax or quatrimax (Akhtar-Danesh 2017). Further still, no general factor is expected in this research. So, using varimax rotation is appropriate.

By using any of the above mentioned factor rotation methods it is difficult to decide how many factors should be retained in an EFA. To retain a particular number of factors in an EFA, factor retention rules are given in the literature and are explained in the next section.

10. Factor Retention Rules

In EFA it is difficult to decide which factors should be retained. Many of the factors obtained in the EFA may not contribute substantially to the overall solution. In the literature, many rules are mentioned to retain the number of factors (Henson & Roberts 2006; Yangil & Chen 2007; Akhtar-Danesh 2017; Rahn 2017). These are:

a. Eigen values > 1 (Kaiser Criterion)
b. Scree Plot
c. Percentage of Variance
d. Meaningful factors
e. Parallel Analysis.

a. Eigen Values > 1

Eigen value is a single value which represents the amount of variance in all the items that can be explained by given principal components (Akhtar-Danesh 2017). It can be positive or negative, however, for the factor analysis, Eigen values should be > 1 (Pett, Lackey, & Sullivan 2003). If this condition is met then the matrix being analysed is said to be factorable. The main drawback of this criterion is that sometimes the yield has a high number of factors. However, the main motive for the factor analysis in this research study is to reduce the large number of variables into a smaller number of latent variables, therefore this factor retention rule is suitable.

b. Scree Plot

A scree plot is the plot of Eigen values. It shows the Eigen values on the y-axis and the number of factors on the x-axis and it always display a downward curve. The point where the slope of the curve levels off (the elbow) indicates the number of factors that should be generated by the analysis (Rahn 2017). In the example shown in Figure 7.4 a cut-off of an Eigen value > 1 indicates that seven factors can be extracted. In this research study scree plot is suitable to clearly represent the number of extracted factors in an EFA.

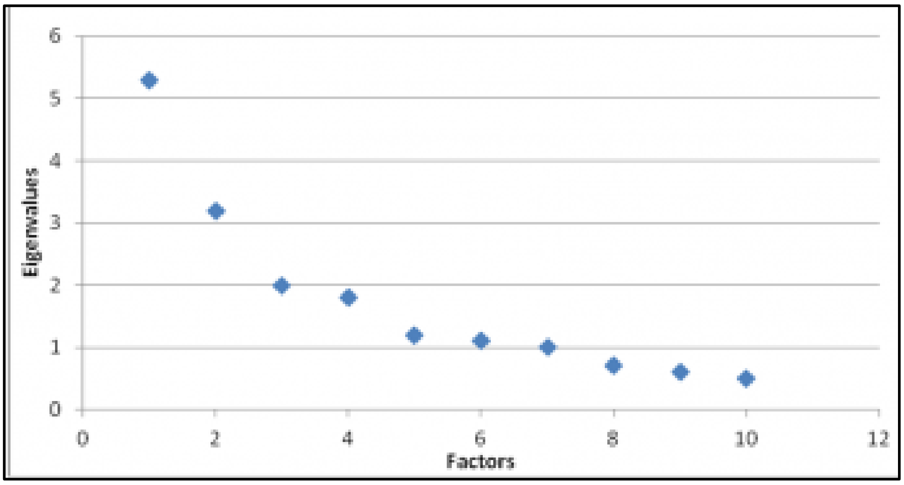

Figure 7. 4: Sample Scree plot

Source: Adapted from (Rahn 2017)

c. Percentage of Variance

Another important criteria is the total amount of variability of the original variables explained by each factor solution (Rahn 2017). The concept of percentage of variance can be understood in a simplified way as follows: For example, if among ten variables, the first three factors can explain most of the variability, then those three factors are a good substitute for the ten variables (Rahn 2017).

This concept seems suitable for extracting the main factors in this research. According to this retention rule, the researcher terminates the factor extraction process when a threshold for maximum variance is extracted (Pett, Lackey, & Sullivan 2003). The advantage of this approach is that it ensures the practical significance of the extracted factors. However, there is no definite guidelines for the threshold values (Pett, Lackey, & Sullivan 2003). Therefore, an intuitive subjective analysis of factors retention by the researcher is carried out.

d. Meaningful factors

The rotated solution of the extracted factors should also make sense to the researcher (Rahn 2017). If the variables loading can make a concept which can be named, then the factor solution is reasonable. Further, at least each identified factor should be supported with three variables with a high factor loading upon it (Rahn 2017). In this research, these meaningful factor analysis rules are also followed and explained in detail in the next section.

e. Parallel Analysis

Parallel analysis is an alternative method for determining the number of factors to interpret. It is a Monte Carlo simulation technique and is a more robust technique of factor retention. Despite its superior alternative to the six techniques explained above, it is not used in this research study because it is not viable in many software packages including SPSS. In this research, the above mentioned first four rules of factor retention were used to retain the factors from EFA. The results of EFA using these factor retention rules are explained below.

7.5 Exploratory Factor Analysis Results

An Exploratory Factor Analysis (EFA) in this research study was used for extracting the main components in a set of 45 items, which were used to represent the ten factors. These factors were: 1. Intention, 2. Social influences, 3. Complexity, 4. Compatibility, 5. Trialability, 6. Functional features, 7. Network coverage, 8. Privacy and security, 9. Training and 10. Resource issues.

In this research, Principal Component Analysis (PCA) was used for extraction and orthogonal rotation varimax, rather than promax rotation, was used to derive non-correlated factors (Chau & Hu 2002a). Through this analysis, unrelated items or the items which were not loading properly in the rotated matrix solution were removed.

In this research, for retaining the number of factors, Kaiser Criterion, namely Eigen value > 1 and meaningful factor retention rules (explained further) were used.

The results of EFA were represented in the form of rotated components matrix, scree plot and cumulative percentage of variance (cumulative frequency).

In the first run of EFA, from 69 variables/items, 45 variables/items were factored using eigenvalues > 1. These 45 items were those items for which the inter-item correlation (Cronbach's alpha) was ≥ 0.6 and a minimum four items represented a construct. The items deleted before conducting the first EFA were: IN2, SE1-SE4, FF1, CX5, SI5, RA1-RA4, MS1-MS4, NS5, PS1, TR5 and DC1-DC4. This deletion indicated that four constructs (Self-efficacy, Demographic factors, Relative advantages and Management support) were removed before conducting the EFA. Also, one item from each of the six factors (Intention, Social influences, Triability, Functional features, Network coverage and Privacy and security) was removed before EFA. The SPSS rotated component matrix for the First EFA results provided in Table 7.4 indicating that, the possible eleven factors could be extracted from 45 variables/items.

Table 7. 4: Rotated Component matrix for the Exploratory First Factor Analysis

Items	Components										
	1	2	3	4	5	6	7	8	9	10	11
I intend to increase my use of mobile devices in telehealth.					.665						
I intend to use mobile devices in the telehealth context, if required by my health facility.					.799						
I intend to use mobile devices in the telehealth context to improve my work processes and outcome.					.751						
I intend to use mobile devices to make more efficient use of my time.					.809						
Battery backup of mobile devices such as smart phones and tablets is adequate for use in telehealth.				.772							
Data storage of mobile devices such as smart phones and tablets is adequate for use in telehealth.				.888							
Sound quality of mobile devices such as smart phones and tablets is adequate for use in telehealth.				.732							
Image quality of mobile devices such as smart phones and tablets is adequate for use in telehealth.				.751							
The weight of mobile devices such as smart phones and tablets does not present a problem when using them in telehealth.			.634								
I understand how I would use a mobile device in the telehealth context.			.611								
It is easy for me to use mobile devices for the telehealth context for the things I want to do.			.686								
Using mobile devices in the telehealth context does not require much mental effort from me.			.433			.563					
Using mobile devices for telehealth facilitates my work in high demand and emergency environments.			.650								
I would use mobile devices in the telehealth context if my manager prefers the team to use them.		.522			.453						
I would use mobile devices in the telehealth context if my colleagues prefer to use them.					.420			.614			
I would use mobile devices in the telehealth context if my friends prefer to use them.								.891			
I would use mobile devices in the telehealth context if people in my peer group are using them.								.750			
Using mobile devices in the telehealth context fits well with all aspects of telehealth work.			.769								

Table 7.4: Continued from previous page 233

Items	Components										
	1	2	3	4	5	6	7	8	9	10	11
Using mobile devices in the telehealth context fits into my current telehealth work process.							.491			.467	
Using mobile devices in the telehealth context matches and supports the way I prefer to work in the telehealth context.										.851	
Using mobile devices in the telehealth context is compatible with different clinical processes.									.740		
Using mobile devices in the telehealth context brings positive change in the telehealth process.			.531								
Using mobile devices in the telehealth requires sufficient training.	.444								.467		
Using mobile devices in the telehealth requires specific training.	.503						.468		.518		
Using mobile devices in the telehealth requires regular information sessions to update my knowledge.	.437						.728				
Using mobile devices in the telehealth context requires printed manuals to support my learning.							.844				
Using mobile devices in the telehealth context requires video clips to help me to refresh my knowledge.							.791				
Network reception is good in my health facility to support the use of mobile devices in the telehealth environment.						.893					
Network coverage in remote area for telehealth is adequate for the effective use of mobile devices.						.818					
Network coverage in my telehealth environment is available anytime and anywhere to support the use of mobile devices.						.862					
Network coverage in my telehealth environment is poor for the effective use of mobile devices.									-.422		
Authentication processes needs to be assured before I would use mobile devices in the telehealth context.		.409	.501	.431							
Permission must be obtained from the patients or a responsible other before photographing patients' using mobile devices in the telehealth context.		.623	.463								
Secure transmission of patient data needs to be assured before I would use mobile devices in the telehealth context.		.895									
Patients need to have appropriate location privacy assured before using mobile devices in the telehealth context.		.858									
Privacy is ensured while providing patient care before using mobile devices in the telehealth context.		.814									
The privacy of patient's data needs to be assured before using mobile devices in the telehealth context.		.794									
I would use mobile devices in the telehealth context if sufficient funds are allocated to my health facility.	.733										
I would use mobile devices in the telehealth context if sufficient funding is available in my health facility.	.761										
I would use mobile devices in the telehealth context if sufficient funding is available to implement good wireless network in my health facility.	.657	.513									
I would use mobile devices in the telehealth context if all the necessary equipment is available in my health facility.	.854										
I would use mobile devices in the telehealth context if I have access to all necessary equipment.	.826										
I would use mobile devices on a trial basis prior to embedding into normal clinical practices.	.833										
I would use mobile devices in the telehealth context if these were available for a certain time period so I could become familiar with their use before the actual use.	.745										
I would try out certain features of mobile devices prior to embedding into clinical practices.	.725								.414		
I need time to be allocated to trialling the mobile devices so I can understand how to use them in the telehealth environment.	.416										.689
Note: The items highlighted were removed after the first Factor analysis											

The scree plot provided in Figure 7.5 also levelled off at the 11th factor in the first EFA.

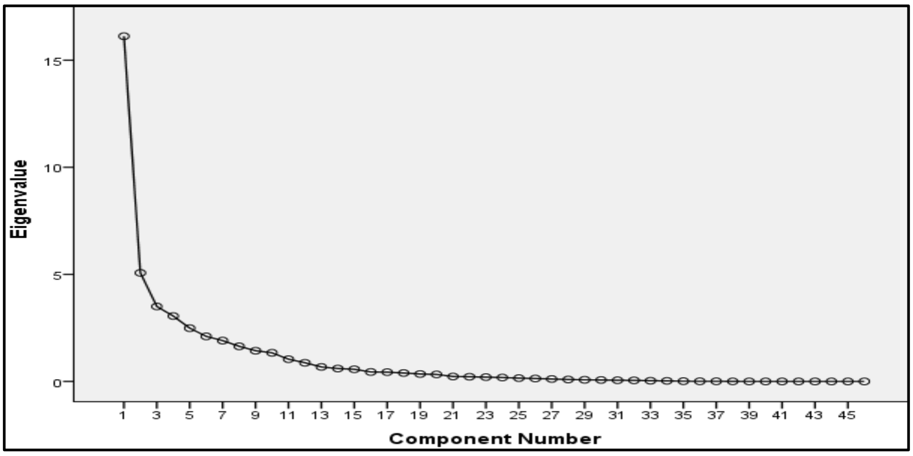

Figure 7. 5: Scree plot for the First Exploratory Factor Analysis indicating extraction of eleven factors

Source: Developed for this research

This factor analysis solution represented 86.26% of the total variance in the data as shown in Table 7.5, which was satisfactory according to the HIT adoption literature (Yangil & Chen 2007).

However, the rotated factor structure represented in Table 7.4 shows that some of the highlighted items were not loading properly with the hypothesised factor or loading more than one component. To remove these items and re-run the EFA to extract the main components, the meaningful factor extraction rules mentioned below were used.

Table 7. 5: Cumulative frequency for the components extracted in the First and Second Exploratory Factor Analysis

Components	Cumulative frequency (for eleven factors)	Cumulative frequency (for nine factors)
1	35.041	34.355
2	46.059	46.877
3	53.668	55.664
4	60.305	62.664
5	65.711	68.578
6	70.284	74.025
7	74.429	77.897
8	77.992	81.388
9	81.107	84.290
10	84.011	
11	86.267	

Meaningful Factors Extraction Rules

1. The contribution of each item towards making a component was checked. Usually, items which were loading iteratively, on more than one component were considered for deletion. However, if the loading of an item in one component is of a high value compared with its loading on another component, or if the item is making sense with the other items of the same component, then the item was not considered for deletion
2. The items not loading together with the other items were considered for deletion
3. The items which were not constructing a component were considered for deletion (Rahn 2017)
4. There must be at least three items to make a component (Akhtar-Danesh 2017; Rahn 2017).

In the second and following run of EFA, these rules were considered for deletion of the items until a proper loading table was obtained.

Following these rules, 11 items were deleted and a second EFA was carried out using the remaining 34 items to evaluate the component identified in the first EFA. The rotated factor structure in Table 7.6 indicate that nine possible factors could be extracted from a second EFA.

Table 7. 6: Rotated Component matrix for the Second Exploratory Factor Analysis

Items	Components								
	1	2	3	4	5	6	7	8	9
I intend to increase my use of mobile devices in telehealth.				.550					
I intend to use mobile devices in the telehealth context, if required by my health facility.				.811					
I intend to use mobile devices in the telehealth context to improve my work processes and outcome.				.721					
I intend to use mobile devices to make more efficient use of my time.				.814					
Battery backup of mobile devices such as smart phones and tablets is adequate for use in telehealth.			.810						
Data storage of mobile devices such as smart phones and tablets is adequate for use in telehealth.			.896						
Sound quality of mobile devices such as smart phones and tablets is adequate for use in telehealth.			.771						
Image quality of mobile devices such as smart phones and tablets is adequate for use in telehealth.			.741						
The weight of mobile devices such as smart phones and tablets does not present a problem when using them in telehealth.								.637	
I understand how I would use a mobile device in the telehealth context.			.406					.601	

Table 7.6: Continued from previous Page 236

Items	Components								
	1	2	3	4	5	6	7	8	9
It is easy for me to use mobile devices for the telehealth context for the things I want to do.				.452	.418			.558	
Using mobile devices for telehealth facilitates my work in high demand and emergency environments.								.695	
I would use mobile devices in the telehealth context if my colleagues prefer to use them.							.646		
I would use mobile devices in the telehealth context if my friends prefer to use them.							.889		
I would use mobile devices in the telehealth context if people in my peer group are using them.							.761		
Using mobile devices in the telehealth requires specific training.	.485					.526			.533
Using mobile devices in the telehealth requires regular information sessions to update my knowledge.	.429					.768			
Using mobile devices in the telehealth context requires printed manuals to support my learning.						.835			
Using mobile devices in the telehealth context requires video clips to help me to refresh my knowledge.						.816			
Network reception is good in my health facility to support the use of mobile devices in the telehealth environment.					.856				
Network coverage in remote area for telehealth is adequate for the effective use of mobile devices.					.878				
Network coverage in my telehealth environment is available anytime and anywhere to support the use of mobile devices.					.859				
Secure transmission of patient data needs to be assured before I would use mobile devices in the telehealth context.		.673						.421	
Patients need to have appropriate location privacy assured before using mobile devices in the telehealth context.		.898							
Privacy is ensured while providing patient care before using mobile devices in the telehealth context.		.850							
The privacy of patient's data needs to be assured before using mobile devices in the telehealth context.		.801							
I would use mobile devices in the telehealth context if sufficient funds are allocated to my health facility.		.783							
I would use mobile devices in the telehealth context if sufficient funding is available in my health facility.	.617			.476					
I would use mobile devices in the telehealth context if sufficient funding is available to implement good wireless network in my health facility.	.631			.492					
I would use mobile devices in the telehealth context if all the necessary equipment is available in my health facility.	.843								
I would use mobile devices in the telehealth context if I have access to all necessary equipment.	.844								
I would use mobile devices on a trial basis prior to embedding into normal clinical practices.	.840								
I would use mobile devices in the telehealth context if these were available for a certain time period so I could become familiar with their use before the actual use.	.840								
I would try out certain features of mobile devices prior to embedding into clinical practices.	.846								
I need time to be allocated to trialling the mobile devices so I can understand how to use them in the telehealth environment.	.519								-.551
Note: The items highlighted were removed after the second Factor analysis									

The scree plot provided in Figure 7.6 also levelled off at the 9th factor in the second EFA.

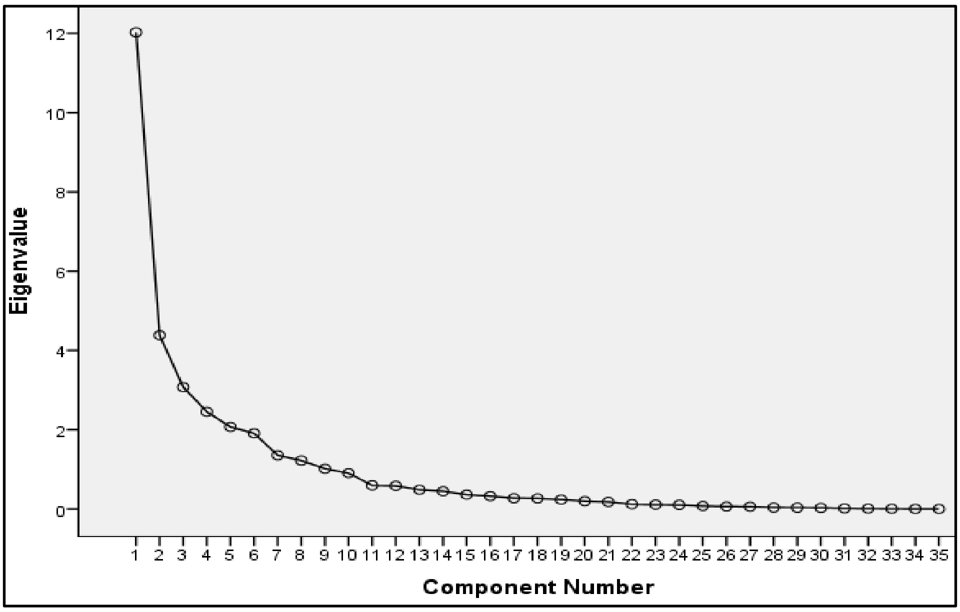

Figure 7. 6: Scree plot for the Second Exploratory Factor Analysis indicating extraction of nine factors

Source: Developed for this research

This factor analysis solution accounted for 84.29% of the total variance in the data as shown in Table 7.5, which is satisfactory according to previous research studies (Yangil & Chen 2007). However, the six items highlighted in Table 7.6 indicated their inappropriate loading so they were subsequently removed prior to carrying out the final EFA.

In the final factor analysis, six items/variables were removed and the remaining 21 items/variables were factored using Eigenvalues >1. The rotated component matrix represented in Table 7.7 indicated that six possible factors could be extracted.

Table 7. 7: Rotated component matrix for the Final Exploratory Factor Analysis

No	Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1.	Secure transmission of patient data needs to be assured before I would use mobile devices in the	.872					
2.	Patients need to have appropriate location privacy assured before using mobile devices in the	.898					
3.	Privacy is ensured while providing patient care before using mobile devices in the Telehealth context.	.878					
4.	The privacy of patient's data needs to be assured before using mobile devices in the Telehealth context.	.798					
5.	Battery backup of mobile devices such as smart phones and tablets is adequate for use in Telehealth.		.813				
6.	Data storage of mobile devices such as smart phones and tablets is adequate for use in Telehealth.		.880				
7.	Sound quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.		.797				
8.	Image quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.		.760				
9.	I intend to increase my use of mobile devices in Telehealth.			.689			
10.	I intend to use mobile devices in the Telehealth context, if required by my health facility.			.869			
11.	I intend to use mobile devices in the Telehealth context to improve my work processes and outcome.			.847			
12.	I intend to use mobile devices to make more efficient use of my time.			.855			
13.	I would use mobile devices on a trial basis prior to embedding into normal clinical practices.				.799		
14.	I would use mobile devices in the Telehealth context if these were available for a certain time period				.885		
15.	I would try out certain features of mobile devices prior to embedding into clinical practices.				.909		
16.	I need time to be allocated to trialling the mobile devices so I can understand how to use them in the				.569		
17.	Network reception is good in my health facility to support the use of mobile devices in the Telehealth					.927	
18.	Network coverage in remote area for Telehealth is adequate for the effective use of mobile devices.					.848	
19.	Network coverage in my Telehealth environment is available anytime and anywhere to					.886	
20.	Using mobile devices in the Telehealth requires regular information sessions to update my						.787
21.	Using mobile devices in the Telehealth context requires printed manuals to support my learning.						.891
22.	Using mobile devices in the Telehealth context requires video clips to help me to refresh my						.786
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.						

The scree plot also levelled off at the 6th factor in the final EFA as shown in Figure 7.7.

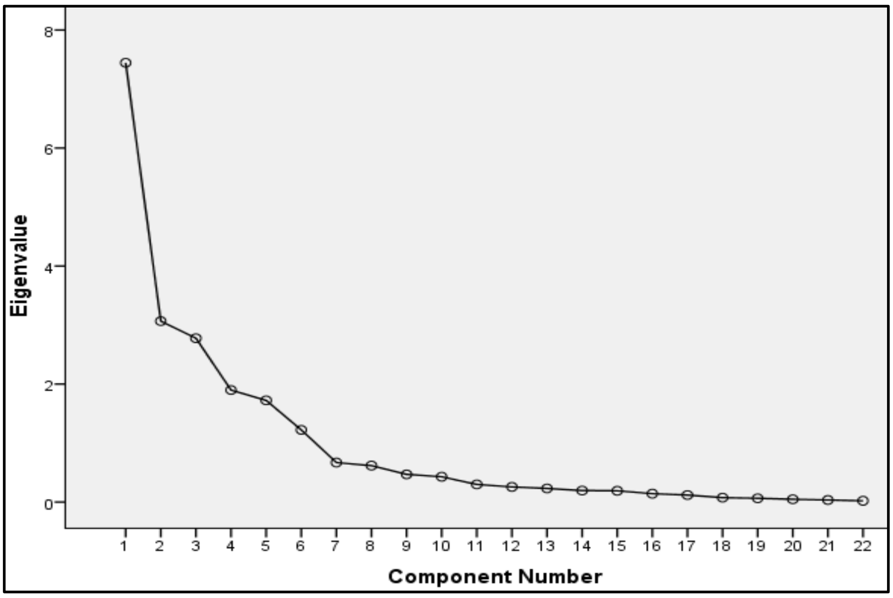

Figure 7. 7: Scree plot obtained for the Final Exploratory factors Analysis indicating extraction of six factors

Source: Developed for this research

All the items in this factor solution were loading properly on their relevant factor. Therefore, this factor solution was considered the final solution for EFA.

This factor solution accounted for 82.42% of the total variance in the data as shown in Table 7.8.

Table 7. 8: Cumulative frequency for the final EFA

Factors	Cumulative frequency (for six factors)
Privacy and security	33.839
Functional features	47.778
Intention	60.403
Trialability	69.031
Network coverage	76.866
Training	82.428

Note: Percentage of variance for each factor is calculated by subtracting the values of cumulative frequency of each factor from their previous factor.

The first factor, which accounted for 33.8% of the variance was Privacy and security as shown in Table 7.8. In this factor, a high factor loading [19](0.7-0.8) of four items was found. These items were: 1. Security of patient data, 2. Location privacy, 3. Privacy of patient care, 4. Privacy of patient data were observed.

The second factor which explained 13.9% of the total variance was Functional features. High factor loading of four items: 1. Battery backup, 2. Data storage, 3. Sound quality and 4. Image quality was observed.

The third factor described 12.6% of the total variance and this factor was Intention and was characterised by the following four items: 1. Intended to increase use of mobile devices, 2. If required by health facility, 3. Intended to improve work processes and outcome using mobile devices and 4. Intended to make more efficient use of time using mobile devices.

The fourth factor which accounted for 8.6% of the total variance was Trialability and was characterised by the following four items: 1. Requires trialabiltiy before embedding mobile devices in normal clinical environment, 2. Trialability to become familiar with the devices, 3. Trialability to use features and 4. Trialability to understand how to use mobile devices in Telehealth.

The fifth factor which accounted for 7.8% of the total variance was Network coverage and was characterised by three variables/items: 1. Network reception is good in my health facility, 2. Network coverage in remote areas for Telehealth is adequate and 3. Network coverage in my Telehealth environment is available anytime and anywhere.

The last and the sixth factor which explained 5.5% of the total variance was Training which was characterised by the following three items: 1. Requires regular information sessions, 2. Requires printed manuals and 3. Requires video clips.

To ensure the validity of these EFA results, Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were conducted.

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[19] Factor loading is the correlation of a variable with a factor. A loading of 0.3 or more is considered to be meaningful. Foster, J 1998, *Data analysis using SPSS for windows : a beginner's guide*, Sage Publications, London.

Kaiser-Meyer-Olkin (KMO): KMO test measures sample size adequacy for each variable in the model as well as for the complete model (Venkaiah, Brahmam & Vijayaraghavan 2011). In this research study the KMO test was used to represent the sample adequacy for the six extracted factors. This test's value ranges from 0 to 1. A KMO value of ≥ 0.5 to ≤ 0.9 is considered an acceptable limit (Venkaiah, Brahmam & Vijayaraghavan 2011).

In this research, the results of the KMO test as shown in Table 7.9 indicated that the sample size was adequate for the extracted six factors and the value of KMO was 0.6 which was considered acceptable.

Table 7. 9: KMO and Bartlett's test results for the Final Exploratory Factor Analysis

Test	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.675
Bartlett's Test of Sphericity	.000

Bartlett's Chi Square Test: Bartlett's Chi Square test tests the strength of the relationship between the variables (Venkaiah, Brahmam & Vijayaraghavan 2011). To be suitable for factor analysis, the Bartlett's test of Sphericity value should be significant (≤ 0.05).

In this research, Bartlett's test of sphericity indicated that the extracted six factors were significant as the significant value of this test was 0.000, which was acceptable.

Although KMO and Bartlett's tests indicate that extracted factors were significant, one of the problems with the EFA is the subjectivity of the decision (Williams, Onsman & Brown 2010). In EFA, there is no criteria variable against which the solution can be tested (Henson & Roberts 2006). Therefore, to provide more robust results and the relationship of these extracted six factors with each other, regression analysis was conducted.

7.6 Regression Analysis Assumptions

Regression analysis is a way of predicting an outcome variable (dependent) from one predictor (independent variable) called linear regression or multiple predictors (Andy

2009) called multiple regression. This technique is suitable in research questions where the relationship between two or more independent variables and one dependent variable is of interest (Kerr, Hall & Kozub 2002).

In this research study, in the EFA, six main factors (five independent and one dependent variables) are already predicted. Further, for the sake of making accurate predictions of these six factors and the influence of five independent factors on Intention, regression analysis was conducted (Kerr, Hall & Kozub 2002). Before proceeding with the regression analysis, necessary assumptions about how they were fitting in with the data in this research study were studied and are explained further.

11. Variable Types

For regression analysis all predictor variables must be quantitative or categorical (Andy 2009). In this research, the predictors for the regression analysis were quantitative and thus this assumption for regression analysis was satisfied.

12. Sample Size

Numerous rules of thumb have been suggested for determining the minimum sample size required to conduct multiple regression analysis. Most of these rules of thumb have been evaluated based on power analysis (Green 1991). A power analysis is important for statistical tests because it defines the probability that a test will correctly reject the null hypothesis when the alternative hypothesis is true. It is also used to calculate the required sample size. For the regression analysis, power analysis calculates the sample size as the function of effect size and predictors (Green 1991). Effect size is effect of statistical power on the relationship between the outcome variable and predictors. By convention the statistical power values should be equal to or greater than 0.8 (Daniel 2017). By convention the effect size of 0.02, 0.15, and 0.35 are considered small, medium and large and usually, the medium size effect is considered appropriate (Venkaiah, Brahmam & Vijayaraghavan 2011; Daniel 2017).

In this research, based on the power analysis concept, using a priori sample size calculator the sample size was calculated by entering the probability level of 0.05, the six predictors, medium effect and 0.8 statistical power (which is the lowest values for statistical power). The result of this calculation indicated that a minimum sample size of 91 participants for regression analysis is required (Daniel 2017).

Green (1991) had given two rules of thumb for the minimum acceptable sample size. These are:

1. To test the overall fit of the regression model, the minimum sample size should be 50+8m, where ‘m’ is the number of predictors
2. To test the individual predictors, the minimum sample size should be 100+m, where ‘m’ is the number of predictors.

In this research, the researcher is interested in the overall model fit and in the individual contribution of six predictors, therefore, according to Green (1991) a sample size of 98 is required to see the overall fit of the regression model and a sample size of 106 is required to test the individual predictors.

The literature review indicates that with a sample size of 39 in this research, proceeding with regression analysis is impossible. However, if the researcher is interested in proceeding with it, the generalizability of the findings from this research study is limiting (Andy 2009). The researcher understands this limitation of the Quantitative Phase and is not making any generalisation of the findings obtained in this research.

To proceed with the regression analysis, other assumptions were also checked and explained further.

13. Multicollinearity

Multicollinearity is a situation in which two or more dependent variables in a multiple regression model are highly correlated. Mild multicollinearity is not an issue for regression analysis but it is important to avoid extreme multicollinearity. To avoid multicollinearity and singularity, any items with inter-item correlations > 0.9 should be considered for deletion (Andy 2009).

In this research, all five factors were found to be uncorrelated, as shown in Table 7.10 below, because the values of Pearson's Coefficient were less than 0.9.

Table 7. 10: Multicollinearity check for regression analysis

Independent Variables	Functional features	Training	Network coverage	Privacy and security	Trialability
Functional features	1.000	.042	.129	.507	.230
Training	.042	1.000	.008	.084	.304
Network coverage	.129	.008	1.000	.212	.060
Privacy and security	.507	.084	.212	1.000	.351
Trialability	.230	.304	.060	.351	1.000

Therefore, according to the multicollinearity concept it was safe to proceed with regression analysis.

Outliers

The literature indicates that outliers may distort the parameter estimations such as mean, correlation and regression (Liu & Zumbo 2007). In this research, the scatter plot represented in Figure 7.8 indicated that there are some outliers.

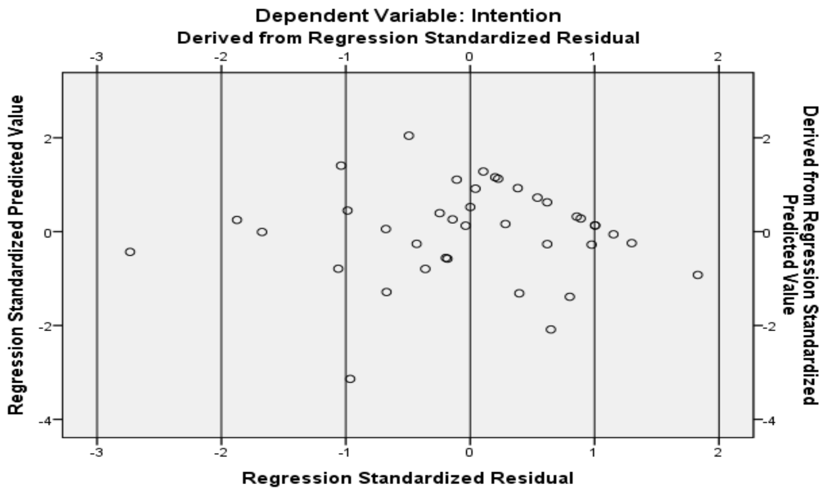

Figure 7. 8: Representing some outliers in the data

Source: Developed for this research

However, regression analysis can proceed because the results from regression analysis are not generalised in this research.

14. Linear Relationship

To proceed with regression analysis it is also important to see the linear relationship between the expected values and observed values for a dependent variable. If the relationship is curvilinear then the data may be transformed to the linear relationship through the use of the log transformation procedure (Kerr, Hall & Kozub 2002), but this may not necessarily affect the residuals. If the assumption of linear relationship is violated then logistic regression may be an alternative.

In this research, although there were some deviations from the normal distribution as shown in Figure 7.7, because some dots were not immediate beside straight line, the P-P still plot indicated a straight line between the observed values and expected values for Intention. Hence, it was safe to proceed with regression analysis.

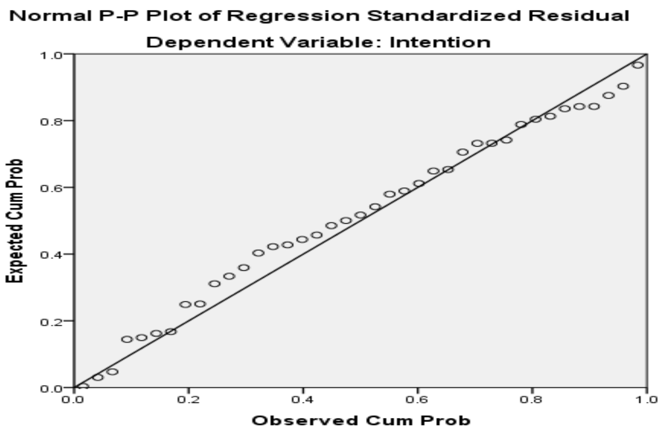

Figure 7. 9: P-P plot for Intention factor indicating linear relationship between the observed values and expected values for Intention

Source: Developed for this research

The preconditions explained above indicate that regression analysis can proceed but the findings from the results cannot be generalised as the sample size assumption is not met in this research. The results of regression analysis in this research study are explained further.

7.7 Regression Analysis Results

The results from the regression analysis indicate that, for adopting mobile devices in the Telehealth environment, six factors are important. The six factors are:

1. Intention
2. Functional features
3. Trialability
4. Network Coverage
5. Privacy and security
6. Training.

Of these factors, the first is a dependent factor and the remaining factors 2-6 are independent. The five independent factors jointly accounted for 60% of the strength of the relationship on Intention. The value of the strength of relationship of five independent factors on Intention is provided in the form of 'R'[20] values (0.6) in Table 7.11.

Table 7. 11: Regression Analysis results

R	R-Square	Adjusted R-Square	ANOVA Value
.643	.414	.325	.003
Dependent variable: Intention Predictors: Triability, Network coverage, Functional features, Training and Privacy and secuirty			

In this research, the explanatory power of the model (goodness of fit) as per the value of 'R-Square'[21] was on the lower side (0.4) but acceptable according to previous HIT adoption literature (Chau & Hu 2002a). The values of 'R-Square' indicates that 41.1%, variance in the dependent variable Intention is shared by five independent variables which was acceptable according to the HIT adoption literature. In the HIT adoption literature 'R-Square' values ranging from 40% - 60% are reported (Wu, Li & Fu 2011;

[20] 'R' is the coefficient which reflects the strength of the relationships between dependent variables and independent variables. 'R' values range from 0 to 1. The higher the value of R, the stronger the linear relationship between the set of predictors. Kerr, AW, Hall, HK & Kozub, S 2002, Doing statistics with SPSS, Sage Publications, Thousand Oaks, London.

[21] 'R square' is the percentage of variance in the dependent variables that is shared by the combination of the weighted independent variables.

Chau & Hu 2002b; Bawack & Kala Kamdjoug 2018) and used to indicate the explanatory power of the conceptual model.

The explanatory power of the model can also be explained using ‘Adjusted R-Square’ which is 32.5% in this research. The difference in ‘R-Square’ and ‘Adjusted R-Square’ is that the ‘Adjusted R-Square’ provides an adjustment to the ‘R-Square’. ‘R-Square’ is a basic matrix which tells how much variance is explained by the model. However, if more variables are added to the model, the ‘R-Square’ values keep on increasing irrespective of the variable significance. ‘Adjusted R-Square’ avoids this problem by calculating ‘R-Square’ from only those variables whose addition in the model is significant. In this research study ‘Adjusted R-Square’ values for explaining the exploratory power of the model was low but SPSS calculated ‘Adjusted R-Square’ using Wherry’s equation, which does not explain the significance of the model on the entire set of data (Kerr, Hall & Kozub 2002).

The analysis of Variance (ANOVA) test indicates whether the model is significant or not. For a model to be significant, ANOVA significant (p) values should be <0.05 (Andy 2009). In this research, overall, the regression model with five independent variables and one dependent variable is significant ($F_{(5, 33)}$=4.057; p (=0.003)).because p values for ANOVA are 0.003 which is < 0.05 and is significant. Regression residual (F statics=4.057) also indicated that the relationship between dependent variable Intention and five independent variables is significant because degree of freedom value (4.057) is high which is significant and p value is also (<0.05) significant. F-statistics (4.057) is the ratio of mean sums-of-squares for the regression (5df) / the mean sums-of-squares for the residuals (33 df).

The joint influence of five independent predictors on Intention can also be represented using the following mathematical equation:

Intention=B0 (slope of the line)+B1*Functional features+B2*Training+B3*Network coverage+B4*Privacy and security+B5*Trialability.

B0 is the slope of the line and B1-B5 values show the relationship between Intention and each of its predictors. The values of B0-B5 are given in Table 7.12 and represented in Figure 7.10.

Table 7. 12: Contribution of each factor for the regression model

Model 1	B(slope of the line)	p-value
Constant	B0=1.545	.106
Functional features	B1=.428	.009
Trialability	B5=.001	.997
Network coverage	B3=-.162	.173
Privacy and security	B4=.275	.081
Training	B2=.104	.480

If the values of slopes of lines are positive, they indicate a direct positive relationship between the independent variables (predictors) and one dependent (outcome) variable and if they are negative this indicates a direct negative relationship between the predictors and outcome variables (Andy 2009). The values of slopes mentioned in Table 7.12 also indicate a direct positive relationship of 1. Functional features, 2, Trialability, 3. Privacy and security and 4. Training on Intention; and a negative relationship between Network coverage and Intention.

Even though Table 7.12 indicates that there is a direct relationship between the independent factors: Functional features, Trialability, Network coverage, Privacy and security and Training, on the dependent factor Intention, the influence of Functional features on Intention is the only significant relationship as ANOVA significant (p) values are <0.05 as indicated in Figure 7.10.

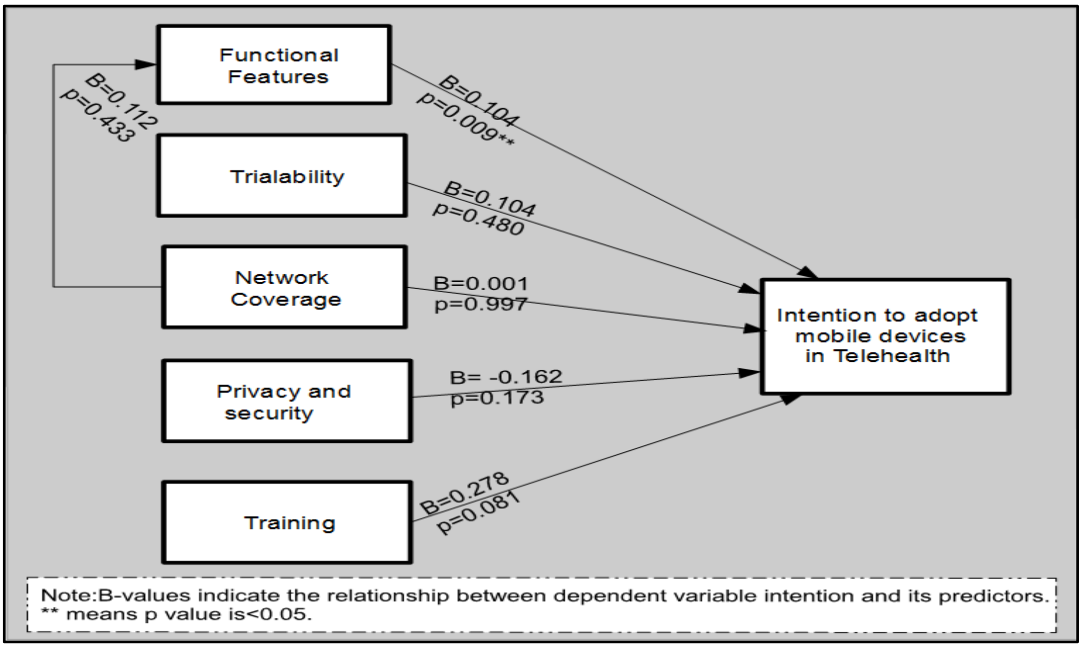

Figure 7. 10: Final conceptual framework

Source: Developed for this research

For the remaining factors (Trialability, Network coverage, Privacy and security and Training) ANOVA p value is >0.05 which is not a significant value for considering the influence of these factors on Intention. The direct influence of Network coverage on Functional features proposed in the Qualitative Phase was also found to be insignificant.

Overall, of the fourteen factors considered to proceed with in Quantitative Phase 2, six factors were validated as the most influential factors for the adoption of mobile devices in this research study, as represented in Figure 7.10. These six factors come under four themes: 1. Individual context, 2. Technological context, 3. Usage context and 4. Organisational context. In Individual, Usage and Organisational contexts, Intention, Trialability and Training factors respectively were considered and in the Technological context three factors, Functional features, Network coverage and Privacy and security, were considered.

Of these six factors the influence of Functional features on Intention turned out to be the only significant influence. Further, the final conceptual framework represented in Figure 7.10. predicts low (Adjusted R-Square value was 0.3) explanatory power. However, the ANOVA value indicates that the final conceptual framework presented in Figure 7.10 is significant.

7.8 Conclusion

This chapter presented the quantitative data analysis using SPSS IBM 23 software. The quantitative data was analysed for EFA and regression analysis. Using EFA, six factors (1. Intention, 2. Trialability, 3. Functional features 4. Network coverage 5. Privacy and security and 6. Training) were extracted. Regression analysis indicated that an overall model with one dependent factor, Intention, and five independent factors from 1-5 as mentioned above was significant as $p<0.05$. In the next chapter, the discussion, conclusion, recommendations, limitations, and future scope of this research study are provided.

Chapter 8

Discussions, Conclusions and Recommendations

CHAPTER 8: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

Chapter 1 emphasised the background of the research and presented the research problem, purpose of the research and research objectives. Also, key elements of this research study were highlighted: the justification for the research, research scope and methodology. In Chapter 2, the existing literature related to the research was reviewed and gaps in the literature were identified. These research gaps were used to formulate the research question. Based on the research question, the initial conceptual framework was developed and hypotheses were formulated. Chapter 3 explained the research philosophies and research methodologies used in the HIT adoption literature, and justified the suitability of a pragmatic research philosophy and the mixed methodology used in this research study. The information on suitable data collection and analysis techniques was also provided in Chapter 3. Chapter 4 explained the procedure for the development of the Discussion Questions Guide and the collection of qualitative data. In Chapter 5, qualitative data was analysed and the fourteen factors obtained were explained, hypotheses were concluded and the refined conceptual framework was presented. In Chapter 6, the procedure for survey questionnaire development and the collection of quantitative data was explained. In Chapter 7, quantitative data was analysed and of the fourteen factors considered in the Qualitative Phase, six factors were confirmed and the final conceptual framework was presented. Finally in Chapter 8, discussion on the research question, key research findings, key contributions, recommendations of findings, limitations and future scope of this research study were presented.

The outline of this chapter is presented in Figure 8.1. Section 8.1outlines the chapter. Section 8.2 explains the research problem. Sections 8.3, 8.4 and 8.5 present the discussion, key findings and key contributions respectively. The implications, limitations and future scope of the research are presented in Sections 8.6, 8.7 and 8.8 respectively.

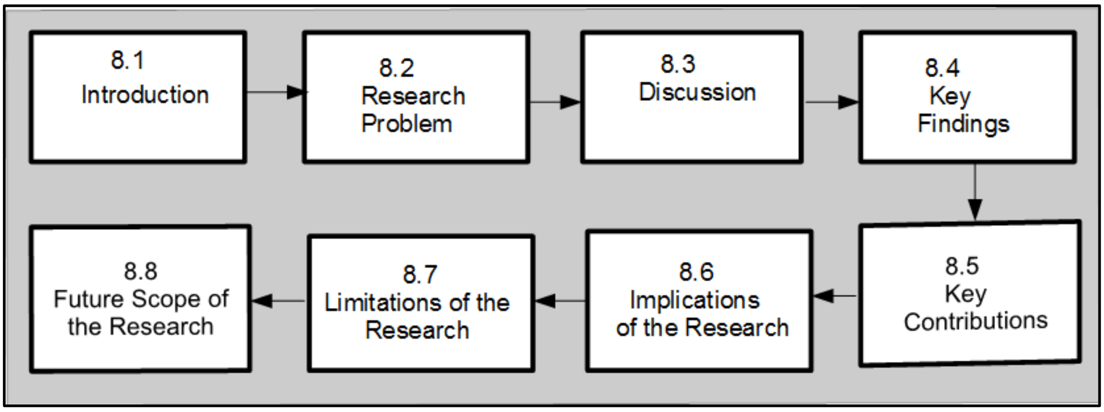

Figure 8. 1: Outline of Chapter 8 on conclusion of the research

Source: Developed for this research

8.2 Research Problem

Despite global claims of the widespread use of mobile devices in healthcare, their adoption is slow (Fox 2009; Christensen & Remler 2009). Mobile device based projects are implemented on a pilot basis and details of how these pilot projects are further adopted remains mostly unknown (Carreiro et al. 2014; Crombie et al. 2014; De'Ath et al. 2011; Gee 2015; Hao et al. 2015; Hebden et al. 2013; Willcox et al. 2015). Literature explaining the adoption of technology in healthcare is also not sufficient to understand the adoption of mobile devices in this research study context as previous studies are either too old, not conducted in the Australian health domain or not focussed on Telehealth (Shareef, Kumar & Kumar 2014; Brown III et al. 2013; Kay 2011; West 2012; Wu, Li & Fu 2011; Yangil & Chen 2007; Sezgin, Özkan-Yildirim & Yildirim 2016; Hafeez-Baig 2010). In the HIT adoption literature, no research study was found to investigate factors explaining the adoption of mobile devices in Telehealth. Focussing on the research problem, the primary objective of this research study has been to understand the factors influencing the adoption of mobile devices in healthcare particularly in Telehealth.

8.3 Discussion

This research study examined mobile device adoption by HCPs in the healthcare environment focusing on Telehealth. Based on a proposed initial conceptual framework for mobile device adoption by HCPs, a refined conceptual framework was developed in Qualitative Phase 1 and was validated in Quantitative Phase 2.

In the initial conceptual framework nine factors were proposed based on TPB, DOI and technology adoption literature in general and in healthcare in particular. These factors were: 1. Intention 2. Technology readiness, 3. Self-efficacy, 4. Social influences, 5. Demographic factors (Age, Gender and Experience) 6. Relative advantages, 7. Complexity, 8. Compatibility and 9. Functional features.

In the refined conceptual framework fourteen factors were presented. Of these fourteen factors, eight were considered from the initial conceptual framework and six factors were considered from the Qualitative Phase. These fourteen factors were: 1. Intention 2. Self-efficacy, 3. Social influences, 4. Demographic factors (Age and Experience), 5. Relative advantages, 6. Complexity, 7. Compatibility, 8. Functional features, 9. Trialabiliy, 10. Network coverage, 11. Privacy and security, 12. Training, 13. Management support, 14. Resource issues.

In the final conceptual framework six factors were validated as the key factors explaining the adoption of mobile devices in healthcare. These six factors were: 1. Intention 2. Functional features, 3. Trialabiliy, 4. Network coverage, 5. Privacy and security and 6. Training.

A detailed discussion of all the factors proposed in the initial conceptual framework, confirmed in the refined conceptual framework and validated in the final conceptual framework are presented in Table 8.1 and discussed further.

Table 8. 1: Summary of the research results

Initial conceptual framework factors	Refined conceptual framework factors	Final conceptual framework factors	Comments
Intention	√	√	New information obtained in this factor was that HCPs intended to use mobile devices in Telehealth to improve their clinical work processes and outcomes and to utilise their time more efficiently.
Technology readiness	×	×	Technology readiness on Intention emerged to be insignificant in Phase 1 because Technology readiness was combined with Self-efficacy and was not established as a significant factor in Phase 2.
Self-efficacy	√	×	Self-efficacy was confirmed as significant in Phase 1 but could not prove to be significant in Phase 2 because only four items were developed to represent this factor and one of the items (SE3) did not satisfy reliability criteria (Cronbach's alpha value ≥ 0.6) and was considered for deletion. Removal of SE3 left three items in this factor which could not satisfy minimum number of four item's rule for EFA, resulted in insignificance of this factor in Phase 2.
Social Influences	√	×	The insignificance of this factor in Phase 2 could be related to the policies, procedures and norms HCPs have to follow while performing their duties, with responsibilities being more important than their 'peers', 'friends' or 'colleagues' influences.
Age	√	×	Demographic factors Age, Gender and Experience confirmed as significant in Phase 1 but could not prove to be significant in Phase 2 because only four items were developed to represent this factor and one of the items (DC1) did not satisfy reliability criteria (Cronbach's alpha value ≥ 0.6) and was considered for deletion. Removal of DC1 left three items in this factor which could not satisfy minimum number of four item's rule for EFA, resulted in insignificance of this factor in Phase 2.
Gender	×	×	
Experience	√	×	
Relative advantages	√	×	Relative advantages confirmed as significant in Phase 1 but could not prove to be significant in Phase 2 because only four items were developed to represent this factor and one of the items (RA3) did not satisfy reliability criteria (Cronbach's alpha value ≥ 0.6) and was considered for deletion. Removal of RA3 left three items in this factor which could not satisfy minimum number of four item's rule for EFA, resulted in insignificance of this factor in Phase 2.
Compatibility	√	×	One possible reason for the insignificance of the Compatibility factor in Phase 2 may be that HCPs may not merely like to see the compatibility of mobile devices with their current practice style and clinical practices, but they also want to see the various benefits which mobile devices can bring in the Telehealth environment. This explanation was indicated by participants in Phase 1. Also, having a trial environment before the actual introduction of new technology makes Compatibility an insignificant factor in this study.
Complexity	√	×	The insignificance of Complexity factor in Phase 2 could be partially explained by training and the availability of technical support in the health facilities. Also, most of the HCPs who participated in this research study in Phase 2 were young (<39 years) which may have reduced the importance of this factor in Phase 2.
Functional features	√	√	This research study explored battery life, data storage, weight and sound quality are the most important features to use these devices in Telehealth.
	Trialability	√	This research study revealed Trialability as an important factor demonstrating that HCPs are interested in obtaining knowledge prior to the embedding of mobile devices into normal clinical practices. This research study also indicated that HCPs are exposed to a trial environment and time to use any new technology in their clinical practices.

Table 8.1: Continued from previous page 255

Initial conceptual framework factors	Refined conceptual framework factors	Final conceptual framework factors	Comments
	Network coverage	√	This research study revealed Network coverage as an important factor demonstrating that an adequate network signal must be available in the health facilities to use mobile devices in the healthcare environment.
	Privacy and security	√	In line with previous literature, this research study supports Privacy and security as an important factor. The major concern for Privacy and security found in this research study were the security of patient data, location privacy, patient care privacy, and privacy of patient data.
	Training	√	This research study found that regular information sessions, printed references and video clips are required to understand the use of mobile devices in Telehealth and to positively influence HCPs' Intentions.
	Management	×	Management support emerged as a significant factor in Phase 1 but could not prove to be significant in Phase 2 because only four items were developed to represent this factor and one of the items (MS2) did not satisfy reliability criteria (Cronbach's alpha value ≥ 0.6) and was considered for deletion. Removal of MS2 left three items in this factors which could not satisfy minimum number of four item's rule for EFA, resulted in insignificance of this factor in Phase 2.
	Resource issues	×	The reason for the inconsistency of this result in Phase 2 may be related to funds and equipment. HCPs consider these issues to be a management responsibility which may have decreased the significance of Resource issues factor.
	Note: √ means factor was presented × means factor was not presented		

8.3.1 Intention

The first factor proposed in the initial conceptual framework was the Intention. It was proposed as a dependent factor under the Individual context. The eight independent factors posed in the initial conceptual framework were: 1. Technology readiness, 2. Self-efficacy, 3. Social influences, 4. Demographic factors (Age, Gender and Expereince), 5. Relative advantages, 6. Complexity, 7. Compatibility and 8. Functional features. The literature suggested that Intention is a key factor in explaining the successful adoption of technology in healthcare (Lyzwinski et al. 2017; Kamaruzaman, Hussein & Fikry 2018). The role of intention as a key predictor for understanding HIT adoption in healthcare has been firmly established. Various researchers have indicated this factor as a significant dependent factor for understanding the adoption of various types of HIT such as the smartphone, mobile computing, electronic health records, e-health and electronic messaging (Yangil & Chen 2007; Wu, Wang & Lin 2007; Lyngstad et al. 2015; Tavares & Oliveira 2017;

Kamaruzaman, Hussein & Fikry 2018; Sood et al. 2016; Bawack & Kala Kamdjoug 2018). The HIT adoption literature indicates that HCPs are interested and intending to use technology in their job frequently and in future (Bawack & Kala Kamdjoug 2018).

Consistent with the HIT adoption literature, the findings of this research study indicated Intention as an important dependent factor in explaining the adoption of mobile devices in the Telehealth context. This research study also indicated some new directions on HCPs' intentions to use mobile devices in Telehealth. Additional new information obtained in this regard was that the HCPs are intending to use mobile devices if required by their health facility. HCPs intended to use mobile devices in Telehealth to improve their clinical work processes and outcomes and to utilise their time more efficiently. Thus, this research study indicates that HCPs are intending to increase their use of mobile devices in the Telehealth environment.

8.3.2 Technology readiness

The second factor proposed in the initial conceptual framework was the Technology readiness considered under the Individual context. It determines a person's tendency to use and adopt new technologies (Tsourela & Roumeliotis 2015). In the technology adoption literature in general and healthcare in particular, few studies have mentioned this factor as one of the important factors explaining technology adoption (Hafeez-Baig, Gururajan & Wickramasinghe 2018; Sood et al. 2016). Parasuraman (2000) indicated a Technology readiness index to measure readiness to embrace new technology using four categories: 1. Optimism, 2. Innovativeness, 3. Discomfort and 4. Insecurity. Hafeez-Baig, Gururajan and Wickramasinghe (2018) represented Technology readiness in terms of perceived readiness and indicated its importance in explaining the adoption of wireless technology in healthcare and education.

In this research study, Technology readiness was not found to be a significant factor as the findings for this factor were covered in the Self-efficacy factor in Phase 1 and so Technology readiness was merged into the Self-efficacy factor. Therefore, this factor was not carried through to Phase 2 and so could not be proven as an important factor.

8.3.3 Self-efficacy

The third factor proposed under the Individual context in the initial conceptual framework was Self-efficacy and its indirect influence on Intention through Technology readiness was proposed. Bandura (2006) indicated Self-efficacy as an individual's ability to perform a task. The HIT literature indicated that Self-efficacy was an important factor for explaining the adoption of technology in the healthcare environment (Sood et al. 2016; Bennett-Levy et al. 2017; Gagnon et al. 2016; Yangil & Chen 2007; Wu, Wang & Lin 2007; Deng, Mo & Liu 2013; Wu, Li & Fu 2011).

Bennett-Levy et al. (2017) indicated that lack of Confidence/ Self-efficacy is a barrier for the adoption of e-Mental Health among Aboriginal and Torress Strait Islander health professsionals.

This research study defined self-efficacy as an individual's confidence and ability to perform a task. Self-efficacy did not appear to be a significant factor in this research. This finding was inconsistent with previous HIT adoption literature. The reason for this result is the use of the minimum four items' rule to develop a construct in EFA. In this factor one of the items (SE3) was not correlated at Cronbach's alpha acceptable level (considered to be ≥ 0.6 for this study) and the removal of this item left only three items in the Self-efficacy factor which forced the removal of the whole factor before carrying out EFA and made it insignificant in this research.

8.3.4 Social influences

The fourth factor under the Individual context proposed in the initial conceptual framework was Social influences. Some of researchers have represented this factor as a subjective norm (Wu, Li & Fu 2011). In the HIT adoption literature the role of the Social influences factor is considered important (Wu, Li & Fu 2011; Tavares & Oliveira 2017; Bawack & Kala Kamdjoug 2018). Previous HIT adoption literature indicates that HCPs are more likely to adopt technology if it is mandatory and if patients express the need for such technology (Tavares & Oliveira 2017). Further, in the health domain HCPs always considered the advice of their peers and colleagues which may also influence their technology adoption in this environment.

In this research study, Social influences appear to be an insignificant factor for the adoption of mobile devices in Telehealth. The insignificance of this factor could be related to the policies, procedures and norms HCPs have to follow while performing their duties, with responsibilities being more important than their 'peers', 'friends' or 'colleagues' influences. This reasoning is consistent with the previous HIT adoption literature (Bawack & Kala Kamdjoug 2018).

8.3.5 Demographic factors (Age, Gender and Experience)

The fifth factor proposed under the Individual context in the initial conceptual framework was the Demographic factor. In this research study the moderating influence of Demographic factors: Age, Gender and Experience on various technology adoption factors was proposed. These Demographic factors are well-known factors with their moderating influences in the technology adoption in general and in healthcare (Zhang et al. 2017; Bawack & Kala Kamdjoug 2018; Zhao, Ni & Zhou In Press; Hoque & Sorwar 2017). Previous research studies in healthcare suggested that Age, Gender and Experience exert a strong moderating effect on the various technology adoption factors (Hoque, Bao & Sorwarb 2017; Bawack & Kala Kamdjoug 2018).

In this research study, Demographic factors: Age, Gender and Experience did not appear to be important factors. This inconsistency was because there was a minimum four items' rule used to conduct EFA. In this factor one of the items (DC1) was not correlated at Cronbach's alpha acceptable level (considered to be 0.6 for this study) and removing this item left only three items in the Demographic factors which forced the removal of the whole factor before carrying out EFA and resulted in the insignificance of this factor.

8.3.6 Relative advantages

The sixth factor proposed under the Usage context in the initial conceptual framework was the Relative advantages. Its indirect influence on Intention through Technology readiness was proposed in the initial conceptual framework. The HIT adoption literature indicates that perceived benefits of technology can increase the individual healthcare professional’s intention to adopt technology (Bawack & Kala Kamdjoug 2018). HCPs perceive many advantages from the use of technology such as improving the quality of clinical practices, patient health, health cost and administrative work (Yangil & Chen 2007; Karahanna, Straub & Chervany 1999; Mun et al. 2006; Rogers 2003; Lyzwinski et al. 2017; Morilla et al. 2017). Some researchers have represented this factor as perceived usefulness, performance expectancy or outcome (Bawack & Kala Kamdjoug 2018; Morilla et al. 2017; Tavares & Oliveira 2017; Hoque & Sorwar 2017; Hoque, Bao & Sorwarb 2017).

This study’s findings for the Relative advantages factor indicate that it is an insignificant factor, which is inconsistent with technology adoption in general and in healthcare in particular. The reason for the inconsistency of the results for this factor is the use of the minimum four items’ rule to proceed with EFA. In this factor one of the items (RA3) was not correlated at Cronbach’s alpha acceptable level (0.6) and its removal left only three items in Relative advantages, which forced removal of the whole factor before carrying out EFA.

8.3.7 Complexity

The seventh factor proposed under the Usage context in the initial conceptual framework was Complexity. The HIT adoption literature indicated that, in the healthcare environment, the adopted technology should make the healthcare process convenient (Wu, Li & Fu 2011). If HCPs experience any difficulty in operating such technology in clinical settings then their intention to adopt such technology will be weak. The technology adoption literature in general and healthcare in particular indicate that some HCPs find technology easy to use while for others it is difficult (Mun et al. 2006; Yangil & Chen 2007; Wu, Li & Fu 2011; Rogers 2003; Lin & Bautista 2017; Tavares & Oliveira 2017). Some researchers have represented this factor as perceived ease of use or effort expectancy (Bawack & Kala Kamdjoug 2018; Tavares & Oliveira 2017; Yangil & Chen 2007).

In this research study, Complexity appeared to be an insignificant factor. This finding differs from results reported in several prior technology acceptance studies which focused on technology adoption in general and in healthcare in particular. The insignificance of Complexity could be partially explained by training and the availability of technical support in the health facilities to use mobile devices. In this research study HCPs have indicated that they receive regular training in the use of new technology which may have reduced the Complexity for their use of mobile devices in Telehealth. Also, the Complexity factor may become an influential factor for middle-aged and older users (Zhao, Ni & Zhou In Press) but most of the participants in this research study were of a younger age group.

8.3.8 Compatibility

The eighth factor proposed under the Usage context in the initial conceptual framework was Compatibility. Compatibility was considered to be an important factor explaining the adoption of technology in the DOI and technology adoption literature in general and in the healthcare literature in particular (Karahanna, Straub & Chervany 1999; Yangil & Chen 2007; Rogers 2003; Lin & Bautista 2017; Bennett-Levy et al. 2017). Innovations which are considered compatible with the personal and social status are likely to be adopted easily (Lin & Bautista 2017). Bennett-Levy et al. (2017) indicated that a lack of compatibility between organisational culture and new technology was one of the significant barriers for the adoption of technology among HCPs in Australia. Coiera & Magrabi (2015) indicated that compatibility from one version of a system to a new version is important for patient safety. For example, if clinical records moved from an older to a newer system, the risk of different format of information standard of the patient may result in harm to a patient in an emergency, as some of the standards implemented at software level differ among the manufacturers and may only be discovered after the system is implemented (Coiera & Magrabi 2015).

In this research, Compatibility of mobile devices with the HCPs' style of work and clinical processes was proposed but was found to be an insignificant factor for adopting mobile devices in healthcare, which is inconsistent with the previous technology adoption literature in general and in healthcare in particular. One possible reason for the insignificance of the Compatibility factor may be that HCPs may not merely like to see the compatibility of mobile devices with their current practice style and clinical practices, but they also want to see the various benefits which mobile devices can bring to the Telehealth environment. This explanation was indicated by participants in Phase 1. Also, having a trial environment before the actual introduction of new technology makes Compatibility an insignificant factor in this study.

8.3.9 Functional features

The ninth factor proposed under the Technological context in the initial conceptual framework was the Functional features. Poorly designed Functional features of any technology used in the health domain may lead to errors and inefficiency in competing tasks (Coiera & Magrabi 2015). For example, in a poorly designed drop down menu which contains too many options one may accidently prescribe a wrong dose through a pick list error which may potentially lead to the death of a patients (Coiera & Magrabi 2015; Magrabi et al. 2015).

In the HIT adoption literature this factor is presented as design and technical concerns, and covers mainly visual quality, screen size, keyboards and file format features (Gagnon et al. 2016; Boruff & Storie 2014; Kim & Shyam 2014). In this research, the general design and technical features of mobile devices were considered and represented as Functional features.

This research study established Functional features as one of the key factors for the adoption of mobile devices in Telehealth and supported screen size and image quality as important Functional features as mentioned in the HIT adoption literature (Gagnon et al. 2016; Boruff & Storie 2014; Kim & Shyam 2014). This research study also explored battery life, data storage, weight and sound quality, which have not been explored in the literature. The reason for exploring these features is the advancement and improvement in the use of mobile devices and contexts in which these have been used in healthcare. Earlier mobile devices in healthcare were used mainly for text messaging and emailing, which did not require much battery life, data storage, or sound quality. Today, and in this research study scenario, mobile devices are being considered for teleconsultation and remote monitoring which may require a longer battery life (to accommodate 8-12 hour shifts), more data storage and good sound quality (for better communication) as indicated by HCPs.

This research study also indicated a most significant positive relationship (p values < 0.05) of the Functional features factor with Intention, which is not indicated in the previous technology adoption literature in general and in healthcare in particular. One possible reason for obtaining this significant relationship could be the importance of Functional features for their effective use in Telehealth sessions.

8.3.10 Trialability

The Trialability factor (under the Organisational context) was not proposed in the initial conceptual framework but turned out to be an important factor in this research. In the literature, the Trialability factor is considered to be an important factor explaining technology adoption in general and in healthcare in particular (Lin & Bautista 2017; Rogers 2003). Most mobile device based health services are available on a trial basis to attract potential users and to increase adoption rate. Lin and Bautista (2017) indicated that providing Trialability before adopting mobile applications may increase adoption rate as trying an innovation offers an opportunity to the potential users to validate their expectations and needs (Rogers 2003).

This research sudy also revealed Trialability as an important factor demonstrating that HCPs are interested in obtaining knowledge prior to the embedding of mobile devices into normal clinical practices. This research study also indicated that HCPs are exposed to a trial environment and time to use any new technology in their clinical practices.

Limited literature reported that Trialablity of m-health apps positively infleunces m-health literacy (Lin & Bautista 2017). However, the influence of Trialability on Intention is not mentioned in the literature. Consistently, the direct influence of Trialability on HCPs' Intentions proposed after Phase1, could not be established as a significant relationship in this research. The possible reason for not finding a significant relationship between Trialability and Intention could be that HCPs are receiving sufficient training and support for the trialling of emerging technologies such as mobile devices.

8.3.11 Network coverage

The Network coverage factor was not proposed in the initial conceptual framework but turned out to be an important factor in this research study under the Technological context. Limited HIT literature indicates that network coverage is a challenge in the Australian health environment (Parliamentary Committees 2014; Coiera & Magrabi 2015). A network problem can create many other issues in the health domain. Indeed, surgery can be cancelled because of a network problem as picture archiving and communication system (PACS) could be inaccessible for many hours thus, preventing creation or reading of image files (Coiera & Magrabi 2015).

In this research, HCPs also indicated network coverage to be an important factor for the adoption of mobile devices and indicated that network coverage is adequate in most of the health facilities for conducting Telehealth sessions.

The influence of Network coverage on Intention is not mentioned in the literature. In-line with the literature, a direct influence of Network coverage on Intention proposed after Phase 2 was proven to be insignificant in this research. HCPs in this research study revealed that Network coverage is good, adequate and available for the use of mobile devices which may have reduced the significance of the relationship of Network coverage with Intention.

8.3.12 Privacy and security

The Privacy and security factor was not proposed in the initial conceptual framework but turned out to be an important factor in the Technological context. In the literature, privacy and security measures such as authentication, authorization, confidentiality and integrity are mentioned (Tiong et al. 2006; Premarathne et al. 2015; Alaiad &

Zhou 2014; Gagnon et al. 2016; Peddle 2007). The literature suggests that the Privacy and security factor inhibits HCPs' intentions to adopt technology in healthcare (Tiong et al. 2006; Alaiad & Zhou 2014).

In line with previous literature, this research study supports Privacy and security as an important factor. The major concerns for Privacy and security found in this research study were the security of patient data, location privacy, patient care privacy, and privacy of patient data.

A direct relationship between Privacy and security and Intention is found to be insignificant in this research. This finding is inconsistent with the previous HIT adoption literature (Alaiad & Zhou 2014). The inconsistency of this relationship may be related to the HCPs' trust in Queensland Health's network security and receiving location privacy during consultation.

8.3.13 Training

The Training factor was not proposed in the initial conceptual framework but (in this research) turned out to be an important factor under the Organisational context. In the HIT adoption literature, training is considered an important factor for the adoption of technologies such as e-mental health and m-health (Bennett-Levy et al. 2017; Chang et al. 2013; Agarwal et al. 2015; Gagnon et al. 2016; Chen et al. 2017; Sezgin, Özkan-Yildirim & Yildirim 2016). Training is required to improve the health professionals' technological ability to effectively use technology-based interventions (Agarwal et al. 2015; Morilla et al. 2017; Lyngstad et al. 2015), which may further increase the adoption of technology. Lack of training for HCPs in using technology can lead to patient harm. HCPs may prescribe the wrong medication to a patient by wrongly assuming the alert system of an electronic prescription which may be harmful for patients (Coiera& Magrabi 2015). The e-Mental Health Practice (e-MHPrac) report from a Northern Territory training program has shown that HCPs gained knowledge, skills and confidence after receiving training for using the 'Stay Strong' application (Dingwall 2015). Training Programs are thus essential for the use of technology in healthcare.

Consistent with the HIT adoption literature, this research study suggested that Training is an important factor in explaining mobile device adoption in Telehealth. This research study also found that regular information sessions, printed references and video clips are required for HCPs to understand their use in the Telehealth context.

A positive influence of Training on Intention proposed after Phase 1 has not emerged as a strong significant influence in this research. This influence was border line (p value=0.08) and could be considered as a significant. This finding was consistent with the HIT adoption literature (Agarwal et al. 2015; Bawack & Kala Kamdjoug 2018). The familiarity with mobile devices and the receipt of substantial training to use any new technology may have reduced the strength of significance of Training on HCPs' Intentions in this research study context.

8.3.14 Management support

The Management support factor was not proposed in the initial conceptual framework but proposed after Phase 1 of this research study under the Organisational context. Management support is essential for the adoption of technology in healthcare. For example, setting up training in the use of new technology is commendable. However, if there is a lack of management support to enforce completion of such training before the use of new technology then its adoption is less likely. The literature indicates that management support ensures the sufficient allocation of resources and acts as a change agent to create an environment conducive to the successful adoption of technology. Management normally encourages staff to use new technology by providing training and necessary resources (Yangil & Chen 2007; Gagnon et al. 2016).

In this research, Management support did not emerge as a significant factor. This finding was inconsistent with the HIT adoption literature (Gagnon et al. 2016). The reason for not obtaining a significant relationship of Management support with Intention was the minimum four items' rule used to proceed with EFA. In this factor, one item (MS2) was not correlated at Cronbach's alpha acceptable level (≥ 0.6) and the removal of this item left only three items in this factor, forcing the removal of the whole factor before carrying out EFA.

8.3.15 Resource issues

The Resource issues factor was not proposed in the initial conceptual framework but proposed after Phase 1 under the Organisational context. In the HIT adoption literature, this factor is represented as ‘other facilitating conditions’ and covers various aspects such as training, resources, cost and infrastructure (Tiong et al. 2006). The HIT adoption literature considered this factor important for explaining the adoption of technology in healthcare and indicated that availability of resources and access to necessary resources is important for the adoption of technology (Gagnon et al. 2016; Tavares & Oliveira 2016). Resource issues such as the cost of buying equipment, lack of resources, funding and access to necessary resources weakens an individual’s perception of the successful adoption of technology (Tavares & Oliveira 2016; Heidarian & Mason 2013).

In this research, and inconsistent with the current HIT adoption literature, Resource issues were found to be an insignificant factor. The reason for the inconsistency of this result may be related to funds and equipment. HCPs consider these issues to be a management responsibility which may have decreased the significance of the relationship between Resource issues and Intention.

Overall, this research study found the six main factors to be significant, under four themes: 1. Individual, 2. Usage, 3. Technological, and 4. Organisational. The six factors demonstrated in this research study are: 1. Intention, 2. Functional features, 3. Trialability, 4. Network coverage, 5. Privacy and security and 6. Training. Also, the direct influence of Functional features on Intention was explored as the most significant influence among five factors (number 2-6 above) in this research. The complete summary of the key findings of this research study is provided in the next section.

8.4 Key Findings

As mentioned earlier, this research study has demonstrated six factors as key factors. These factors were categorised into four themes as shown in Table 8.2 below.

Table 8. 2: Key findings of this research

Context	Factors
Individual (health professionals) context	1. Intention
Usage context	2. Trialability
Technological (mobile devices) context	3. Functional features 4. Network coverage 5. Privacy and security
Organisational context	6. Training

The First theme confirmed in this research is Individual context. In this theme, Intention is the only factor validated in this research study. The role of Intention factors has been well established in the HIT adoption literature (Tavares & Oliveira 2017). The HIT adoption literature suggests that successful adoption and use of technology needs user intention to adopt technology (Lyzwinski et al. 2017) and this is considered as a dependent factor explaining various types of technology in healthcare. The findings from this research study also suggested that Intention is an important dependent factor for explaining the adoption of mobile devices in healthcare. This research study predicts that mobile devices have a prosperous future in healthcare as HCPs are intending to increase their use of them if required by the health facility. HCPs believe that mobile devices can bring improvements to their clinical work processes and outcomes. They are also intending to use mobile devices because they can help them use their time more efficiently. This information implies that, with health facilities' support, the use of mobile devices in the Telehealth environment could become notable. This research study found that the Intention to adopt mobile devices in healthcare is jointly influenced by five independent factors. These factors are: 1. Functional features, 2. Trialability, 3. Network coverage, 4. Privacy and security, and 5. Training. Of these five factors, Functional features is the only factor which shows a significant direct relationship with Intention.

The Second theme confirmed in this research study is the Usage context. In this theme, Trialability is the only factor established in this research. In the HIT adoption literature, few researchers have suggested Trialability as an important factor explaining the adoption of technology in healthcare (Lin & Bautista 2017; Rogers 2003). This research study confirmed Trialability as an important factor. HCPs want a trial period and environment so that they can obtain the knowledge necessary to become familiar with mobile device usage. In the trial environment they want to learn how to use mobile devices as well as try some features before embedding them into their normal clinical practices. This research study has indicated an insignificant relationship between Trialability and Intention. However, the importance of Triability in this research study cannot be ignored. This finding suggests that trial time and trial environment before using such technology in the healthcare domain is necessary and should be provided by the management of the health facility.

The Third theme is Technological context. In this theme, three factors were confirmed in this research. These factors were: 1. Functional features, 2. Network coverage and 3. Privacy and security. In the Functional features factor the HIT literature suggests that design and technical concerns such as screen size, touch screen, keyboards, a lack of printing options, inability to view certain websites (visual quality) and file format are some of the features which limit the use of technology in healthcare (Gagnon et al. 2016). This study's findings for the Functional features factor has shown that battery life, data storage, weight and sound quality are the most significant features for their adoption by HCPs. This finding indicates that, for mobile device implementation in the Telehealth context, battery backup, data storage, sound quality and image quality should be carefully considered. The battery backup and data storage capacity should last for at least one shift, and for effective Telehealth sessions, sound and image should be clear and understandable. Functional features appear to have a significant direct positive influence on Intention, which is not indicated by previous HIT adoption researchers. This finding suggests that developers should carefully explore the importance of Functional features from HCPs' perspectives. Also, the top level of management and decision makers involved in the formulation and implementation of technology in healthcare should consider mobile device features carefully before implementing these devices in the healthcare context.

The second factor confirmed under Technological context is Network coverage. Limited literature indicates network coverage to be a challenge for the use of technology in the Australian healthcare context (Parliamentary Committees 2014). This research study also indicated Network coverage as an important factor and has shown an insignificant relationship between Network coverage and Intention, indicating that HCPs may be unlikely to exhibit a strong intention to adopt mobile devices based on Network coverage.

The third factor confirmed under the Technological context is Privacy and security. The literature suggests that privacy and security issues influence the adoption of technology in healthcare (Tiong et al. 2006). Privacy and security issues such as authentication, anonymity, authorization, access control, accountability, location privacy, data security and integrity may inhibit technology adoption in healthcare (Premarathne et al. 2015; Htat, Williams & McCauley 2017). This research study also confirmed Privacy and security as an important factor explaining the adoption of mobile devices, and indicates that the major concerns in Privacy and security are: security of patient data, location privacy, patient care privacy and privacy of patient data. These concerns obtained in this research study are supported by the previous HIT adoption literature.

This finding suggests that policy makers and managers should consider these privacy and security concerns carefully. Policy makers should refine policies and procedures by ensuring the privacy and security of patient data and care while using such technology. In health facilities where mobile devices need to be used in Telehealth sessions, managers can recommend a separate location to maintain privacy of patient care and consultation. This research study has shown an insignificant relationship between Privacy and security and Intention which is inconsistent with the HIT adoption literature. The inconsistency of this relationship may be related to HCPs' beliefs concerning the network security of Queensland Health and the use of location privacy during consultation.

The fourth theme confirmed in this research study is Organisational context. In this theme, Training is the only factor validated in this research. The literature indicates that training is an important factor for the adoption of mobile technology in the healthcare domain. Training is important to the improvement of health professionals' technological abilities and effective use of technology-based interventions (Agarwal et al. 2015; Morilla et al. 2017; Lyngstad et al. 2015). Consistent with previous HIT adoption literature, this research study also suggests that Training is an important factor in explaining mobile device adoption in Telehealth. The Training factor findings of this research study indicate that regular information sessions, some printed references and video clips are required to understand the use of mobile devices in Telehealth. This research study has indicated an insignificant relationship between Training and Intention to use mobile devices in healthcare, which means training is not the only important factor for HCPs' use of mobile devices in the Australian Telehealth context. The insignificance of this relationship may be related to the receipt of regular training whenever new technology is introduced into the health facility.

Overall, this research study has indicated four themes (1. Individual, 2. Usage, 3. Technological, and 4. Organisational context) and six factors (1. Intention, 2. Trialability, 3. Functional features, 4. Network coverage, 5. Privacy and security and 6. Training), as important factors for explaining the adoption of mobile devices in the healthcare environment. During the formulation of the initial conceptual framework, the Organisational theme was not proposed. However, this research study indicates that it is important for explaining mobile device adoption in the health environment.

Among the six factors confirmed in this research, Intention and Functional features were proposed in the initial conceptual framework and four factors, Trialability, Network coverage, Privacy and security, and Training, were included in the refined conceptual framework after the Qualitative phase 1.

The most notable findings of this research study are exploring Functional features and Network coverage as important factors. Only limited information concerning these two factors is currently available in the HIT adoption literature. The significant relationship of Functional features and Intention is another important finding of this research. The key contributions of these findings and the overall research are presented in the next section.

8.5 Key Contributions

This research study has significant key contributions as presented in Table 8.3.

Table 8. 3: Key contributions of this research

No.	Key Research contributions	Comments on Contributions
1.	Understanding adoption of mobile devices in the Telehealth environment	Major Contribution
2.	Presenting the process of development of the survey questionnaire	Major Contribution
3.	Development of the survey questionnaire for understanding adoption of mobile devices in the Telehealth environment	Major Contribution
4.	Refining initial conceptual framework and presenting refined conceptual framework in Chapter 5 and validating it in Chapter 7. Exploring the five key factors: Intention, Functional features, Network coverage, Privacy and security, Training and Trialability and new items for understanding these factors in the context of mobile device adoption in Telehealth environment. Exploring the significant relationship of Functional features with Intention.	Major Contribution

The first major contribution of this research study is the uniqueness and importance of this research topic. Existing literature on HIT adoption has investigated the adoption of various types of technologies such as Telehealth, e-health and m-health, but provides limited explanations for the adoption of mobile devices in the Telehealth environment. Mobile device use in Telehealth has the potential to improvement in health services. Therefore, this research study attempts to explain mobile device adoption in the Telehealth context from HCPs' perspectives, but also contributes towards the HIT adoption literature, practices, policies, management, development and methodology.

Another major contribution of this research study is the survey questionnaire development process, and the presentation of the survey questionnaire. The HIT adoption literature does not provide an extensive process for developing the survey questionnaire, nor does it present any survey questionnaire that can be used to develop an explanation for the adoption of mobile devices. This research study offers an extensive process of survey development and presents a survey questionnaire helpful in providing an explanation of mobile device adoption in Telehealth and hence offers methodological contributions to the process of questionnaire development.

The final contribution of this research study is the presentation of a final conceptual framework after undertaking a rigorous process of both qualitative and quantitative data analysis. This framework can be used by various stakeholders and contributes to both theory and practice.

These contributions have some theoretical, practical, policy and methodological implications as explained in the next section.

8.6 Implications of the Research

The findings and contributions of this research study have implications for technology adoption in healthcare from theoretical, practical, managerial, policy and methodological aspects.

8.6.1 Theoretical implications

This research study provides empirical evidence that Intention to adopt mobile devices in Telehealth can be jointly influenced by Functional features, Network coverage, Trialability, Privacy and security and Training. The notable contribution of this research study lies in the identification of Functional features as a key significant predictor explaining HCPs' intentions to adopt mobile devices in Telehealth. Also, Network coverage turned out to be an important factor in this research; a factor which is little explored by earlier research studies. These findings add to the body of HIT literature and can be used to explain the adoption of emerging technologies, such as mobile devices, in the health domain.

8.6.2 Practical and policy implications

Even though the findings from this research study cannot be generalised because of the small sample size in Quantitative Phase 2, the contributions of this research study may prove to be beneficial for the health domain. Managers, developers and policy makers can use it to broaden their understanding of the use of mobile devices in healthcare.

As per the findings of this research study, managers may consider providing a trial environment, trial time and training to HCPs prior to their adoption of mobile devices in Telehealth sessions. Also, management should ensure the privacy of patient data and patient care, as well as the security of various clinical processes using such devices.

With respect to the technical aspects, the findings of this study suggest that developers should give due consideration to the Functional features embedded in mobile devices intended to be used in healthcare. Mobile devices that possess good battery backup (at least 8-12 hours) with a clear image and good sound quality are preferred by HCPs.

Policy makers may consider refining policies regarding privacy and security of patient data and patient care while using mobile devices. In patient care policies, location privacy and security of clinical processes can be recommended.

8.6.3 Methodological implications

This research study also has some methodological implications. Future research conducted into technology adoption can follow the process used in this research. The researcher has used a mixed method research approach by conducting a Qualitative Phase followed by a Quantitative Phase. In the Qualitative Phase, the initial conceptual framework was refined based on participants' views obtained in focus group discussions and interviews, and items for a survey questionnaire were obtained. In the Quantitative Phase, using an extensive four phase process, a survey questionnaire was developed and the refined conceptual framework was validated with the help of data collected using the survey questionnaire. Researchers can also use the methodology followed for the development, refinement and validation of the conceptual framework as well as for the development of the survey questionnaire.

Although this research study provides some meaningful implications on theory, practice, management, policy making and methodology, it has some limitations which are explained in the next section.

8.7 Limitations of the Research

As mentioned earlier, a small sample size was used in the Quantitative Phase of this study which may prevent the generalisation of the research findings outside the selected sample. The small sample size may also have restricted the confirmation of the refined conceptual framework mentioned in Qualitative Phase 1 (Chapter 5). In the Quantitative Phase 2, of the fourteen factors explored in the Qualitative Phase, only six factors emerged as important factors. Although there are studies which support the remaining eight factors as influential factors in explaining the adoption of technology in healthcare, no evidence was found for these eight factors in the Quantitative Phase which may further necessitate this investigation with a larger sample size.

Further, this research study included only four items as factors: Self-efficacy, Demographic factors, Relative advantages and Management support which have affected[22] their extraction in the EFA. Therefore, in future studies the questionnaire developed in this research study needs to be improved by increasing the number of questions related to these factors.

This research study is also limited in the timing of data collection. The data collection was cross-sectional that is, responses from HCPs in both Qualitative and Quantitative Phases were collected at a particular point in time. The adoption of mobile devices in Telehealth may be time variant and may change as HCPs gain more knowledge and experience with the technology (Chau & Hu 2002a). The results from previous HIT adoption literature suggest that the relative influence of key factors may change as users become more experienced with the technology. Hence, the findings of this research study require cautious interpretation.

Another limitation in this research study is the final conceptual framework's explanatory power, which is reasonable but not satisfactory. Compared with those

[22]To conduct an EFA the minimum number of four items required in each factor were considered. If in the factors where only four items (representing four questions in the survey) were developed, and if among those factors one item was deleted because of lowest averaged correlation rank, then the whole factor was removed before conducting EFA.

reported by prior HIT adoption studies, the 'R-Square' obtained in this research study is at an acceptable level. 'R-Square' reported in the HIT adoption studies ranges from 0.4 - 0.6 (Wu, Li & Fu 2011; Chau & Hu 2002b; Bawack & Kala Kamdjoug 2018). In this research study the R-Square for overall fit of final conceptual framework was 0.4 but the adjusted R-Square value was a low 0.3 suggesting that there was a plausible omission of factors important for adoption of mobile devices by HCPs.

Also, the gender difference may differ in different countries and culture. Previous literature strongly indicates gender differences for the use and adoption of technology (Caison, Bulman, Pai & Neville 2008; Liu & Guo 2017). However, these differences are not obvious in the Australian health domain as indicated in this research study. So the gender differences may influence differently as countries' and culture change. Therefore, the final conceptual framework presented in this research study may not be applicable in other countries' health contexts.

8.8 Future Scope of the Research

As explained in the Limitations section, the explanatory power of the final conceptual framework is low. In future, the factors and conceptual framework developed in the Qualitative Phase 1 should be reconfirmed with a larger sample size.

This research study can be further extended to explain mobile device adoption factors from other perspectives. The patient perspective is an important perspective as patients' also play a significant role in the successful adoption of technology in healthcare (Hoque, Bao & Sorwarb 2017). This indicates that a combined study from HCPs' and patients' perspectives can be conducted for a better understanding of mobile device adoption by HCPs.

Furthermore, to fully understand the adoption of mobile devices in healthcare, it is important to understand the moderating influences of age and technical experience because these influence the complexity of individual behaviour, experiences and relationships (Sood, Gururajan & Hafeez-Baig 2016). The Australian HIT literature provides limited explanations for technology adoption from the Individual perspective focussing on the moderating influences of Age and Experience. Future research can also be conducted to explore the influence of these moderating factors.

The HCPs who participated in this research study were heterogeneous in their technology experience and healthcare job experience, indicating that continued investigation is required for further refinement of the conceptual framework validated in this research.

In addition, the survey questionnaire developed in this research study can be further tested with a larger sample size using confirmatory factor analysis as suggested in the literature (Straub 1989; Katerattanakul & Siau 2008). The questionnaire developed in this research study may be refined by including more items for the Relative advantages, Self-efficacy, Demographic factors and Management support factors and tested in different countries and cultures, which may increase the generalizability and reliability of the questionnaire.

List of References

References

Ackerman, MJ, Filart, RF, Burgess, LPB, Lee, IL & Poropatich, RK 2010, 'Developing next-generation telehealth tools and technologies: patients, systems, and data perspectives', *Telemedicine and E-health*, vol. 16, no. 1, pp. 93-95.

Acock, AC 2005, 'Working with missing values', *Journal of Marriage and Family*, vol. 67, no. 4, pp. 1012-1028.

Adler-Milstein, J, Kvedar, J & Bates, DW 2014, 'Telehealth among US hospitals: several factors, including state reimbursement and licensure policies, influence adoption', *Health Affairs*, vol. 33, no. 2, pp. 207-215.

Agarwal, S, Perry, HB, Lesley-Anne, L & Labrique, AB 2015, 'Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: systematic review', *Tropical Medicine & International Health*, vol. 20, no. 8, pp. 1003-1014.

Ahamed, F, Palepu, S, Dubey, M & Nongkynrih, B 2017, 'Scope of mobile health in Indian health care system: the way forward', *International Journal of Community Medicine and Public Health*, vol. 4, no. 4, pp. 875-881.

Ajzen, I & Fishbein, M 1980, *Understanding attitudes and predicting social behaviour*, Prentice-Hall, Englewood Cliffs, New Jersey.

Ajzen, I 1988, *Attitudes, personality, and behavior*, 2nd edn, Open University Press, Milton Keynes, England.

Ajzen, I 1991, 'The Theory of Planned Behavior', *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179-211.

Akhtar-Danesh, N 2017, 'A comparison between major factor extraction and factor rotation techniques in Q-methodology', *Open Journal of Applied Sciences*, vol. 7, no. 04, pp. 147-156.

Akter, S, D'Ambra, J, Ray, P & Hani, U 2013, 'Modelling the impact of mHealth service quality on satisfaction, continuance and quality of life', *Behaviour & Information Technology*, vol. 32, no. 12, pp. 1225-1241.

Alaiad, A & Zhou, L 2014, 'The determinants of home healthcare robots adoption: an empirical investigation', *International Journal of Medical Informatics*, vol. 83, no. 11, pp. 825-840.

Ali, AM & Yusof, H 2011, 'Quality in qualitative studies: the case of validity, reliability and generalizability', *Social and Environmental Accounting*, vol. 5, no. 1, pp. 25-64.

Allin, S & Rudoler, D n.d., *The Canadian health care system*, viewed 16 February 2018, <http://international.commonwealthfund.org/countries/canada/>.

Andersen, P, Lindgaard, A-M, Prgomet, M, Creswick, N & Westbrook, JI 2009, 'Mobile and fixed computer use by doctors and nurses on hospital wards: multi-method study on the relationships between clinician role, clinical task, and device choice', *Journal of Medical Internet Research*, vol. 11, no. 3, pp. 1-17.

Andrew, S & Halcomb, EJ 2007, 'Mixed methods research is an effective method of enquiry for community health research', *Contemporary Nurse*, vol. 23, no. 2, pp. 145-153.

Andrews, V, Tonkin, E, Lancastle, D & Kirk, M 2014, 'Using the Diffusion of Innovations theory to understand the uptake of genetics in nursing practice: identifying the characteristics of genetic nurse adopters', *Journal of Advanced Nursing*, vol. 70, no. 4, pp. 878-893.

Andy, F 2009, *Discovering statistics using SPSS*, 3rd edn, Sage Publications, London.

Aranda-Jan, CB, Mohutsiwa-Dibe, N & Loukanova, S 2014, 'Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa', *BMC Public Health*, vol. 14, no. 1, pp. 1-15.

Armfield, NR, Gray, LC & Smith, AC 2012, 'Clinical use of Skype: a review of the evidence base', *Journal of Telemedicine and Telecare*, vol. 18, no. 3, pp. 125-127.

Armitage, CJ, Conner, M, Loach, J & Willetts, D 1999, 'Different perceptions of control: applying an Extended Theory of Planned Behavior to legal and illegal drug use', *Basic and Applied Social Psychology*, vol. 21, no. 4, pp. 301-316.

Arora, S, Ford, K, Terp, S, Abramson, T, Ruiz, R, Camilon, M, Coyne, CJ, Lam, CN, Menchine, M & Burner, E 2016, 'Describing the evolution of mobile technology usage for Latino patients and comparing findings to national mHealth estimates', *Journal of the American Medical Informatics Association*, vol. 23, no. 5, pp. 979-983.

Australian Institute of Health and Welfare 2012, *Australia's Health 2012*, Australia's health series no.13. Cat. no. AUS 156, Australian Institution of Health and Welfare Canberra, viewed 5 Feburary 2016, <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737422169>.

Australian Institution of Health and Welfare 2013, *Australia's hospitals at a glance 2012-13*, Australia's health services series no. 55. Cat. no. HSE 146, Australian Institution of Health and Welfare, Canberra, viewed 5 Feburary 2016, <http://www.aihw.gov.au/haag12-13/public-and-private-hospitals/>.

Australian Institution of Health and Welfare 2014, *Australia's health 2014*, Australia's health series no. 14. Cat. no. AUS 178, Australian Institution of Health and Welfare, Canberra, viewed 18 January 2015, <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=60129548150>.

Australian Institution of Health and Welfare 2016, *Australia's health 2014*, Australia's health series no. 15. Cat. no. AUS 199, Australian Institution of Health and Welfare, Canberra, viewed 9 March 2018, < https://www.aihw.gov.au/getmedia/9844cefb-7745-4dd8-9ee2-f4d1c3d6a727/19787-AH16.pdf.aspx?inline=true>.

Bandura, A 2006, 'Guide for constructing self-efficacy scales', in F Pajares & T Urdan (eds), *Self-efficacy Beliefs of Adolescents*, 5th edn, Information Age Publishing, USA, pp. 307-337.

Barbash, GI & Glied, SA 2010, 'New technology and health care costs: the case of robot-assisted surgery', *New England Journal of Medicine*, vol. 363, no. 8, pp. 701-704.

Barnes, SJ & Vidgen, RT 2006, 'Data triangulation and web quality metrics: a case study in e-government', *Information & Management*, vol. 43, no. 6, pp. 767-777.

Barrington, J, Wereko-Brobby, O, Ward, P, Mwafongo, W & Kungulwe, S 2010, 'SMS for Life: a pilot project to improve anti-malarial drug supply management in rural Tanzania using standard technology', *Malaria Journal*, vol. 9, no. 1, pp. 1-9.

Baruch, Y & Holtom, BC 2008, 'Survey response rate levels and trends in organizational research', *Human Relations*, vol. 61, no. 8, pp. 1139-1160.

Bashir, M, Afzal, MT & Azeem, M 2008, 'Reliability and validity of qualitative and operational research paradigm', *Pakistan Journal of Statistics and Operation Research*, vol. 4, no. 1, pp. 35-45.

Bawack, RE & Kala Kamdjoug, JR 2018, 'Adequacy of UTAUT in clinician adoption of health information systems in developing countries: the case of Cameroon', *International Journal of Medical Informatics*, vol. 109, pp. 15-22.

Bazeley, P & Jackson, K 2013, *Qualitative data analysis with NVivo*, 2nd edn, Sage Publications, London.

Benbasat, I & Barki, H 2007, 'Quo vadis TAM?', *Journal of the Association for Information Systems*, vol. 8, no. 4, pp. 211-218.

Bennett-Levy, J, Singer, J, DuBois, S & Hyde, K 2017, 'Translating e-mental health into practice: what are the barriers and enablers to e-mental health implementation by aboriginal and Torres Strait Islander health professionals?', *Journal of Medical Internet Research*, vol. 19, no. 1, pp. 1-12.

Bernstein, ML, McCreless, T & Cote, MJ 2007, 'Five constants of information technology adoption in healthcare', *Hospital Topics*, vol. 85, no. 1, pp. 17-25.

Bhattacherjee, A, Hikmet, N, Menachemi, N, Kayhan, VO & Brooks, RG 2007, 'The differential performance effects of Healthcare Information Technology adoption', *Information Systems Management*, vol. 24, no. 1, pp. 5-14.

Borish, D & Forbes, R n.d., *NTDs and food security*, viewed 18 January 2017, <http://worldaccord.org/wp-content/uploads/2017/01/IDEV-4500-Report-World-Accord-Part-2.pdf>.

Bort-Roig, J, Gilson, N, Puig-Ribera, A, Contreras, R & Trost, S 2014, 'Measuring and influencing physical activity with smartphone technology: a systematic review', *Sports Medicine*, vol. 44, no. 5, pp. 671-686.

Boruff, JT & Storie, D 2014, 'Mobile devices in medicine: a survey of how medical students, residents, and faculty use smartphones and other mobile devices to find information', *Journal of the Medical Library Association*, vol. 102, no. 1, pp. 22-30.

Bowen, GA 2008, 'Naturalistic inquiry and the saturation concept: a research note', *Qualitative Research*, vol. 8, no. 1, pp. 137-152.

Bradford, NK, Armfield, NR, Young, J, Ehmer, M & Smith, AC 2012, 'Safety for home care: the use of Internet video calls to double-check interventions', *Journal of Telemedicine & Telecare*, vol. 18, no. 8, pp. 434-437.

Bradford, NK, Young, J, Armfield, NR, Herbert, A & Smith, AC 2014, 'Home telehealth and paediatric palliative care: clinician perceptions of what is stopping us?', *BMC Palliative Care*, vol. 13, no. 1, pp. 1-10.

Bradford, S & Rickwood, D 2014, 'Electronic psychosocial assessment tool: concept development and identification of barriers to successful implementation', *Journal of Technology in Human Services*, vol. 32, no. 4, pp. 275-296.

Brod, M, Tesler, LE & Christensen , TL 2009, 'Qualitative research and content validity: developing best practices based on science and experience', *Quality of Life Research*, vol. 18, no. 9, pp. 1263-1278.

Brown-III, W, Yen, P-Y, Rojas, M & Schnall, R 2013, 'Assessment of the health IT usability evaluation model (health-ITUEM) for evaluating mobile health (mhealth) technology', *Journal of Biomedical Informatics*, vol. 46, no. 6, pp. 1080-1087.

Brown, KM, Lindenberger, JH & Bryant, CA 2008, 'Using pretesting to ensure your messages and materials are on strategy', *Health Promotion Practice*, vol. 9, no. 2, pp. 116-122.

Bryman, A & Bell, E 2007, *Business research methods*, 2nd edn, Oxford University Press, Oxford.

Bugler, M, McGeown, SP & Clair-Thompson, H 2015, 'Gender differences in adolescents' academic motivation and classroom behaviour', *Educational Psychology*, vol. 35, no. 5, pp. 541-556.

Burke, LE, Ma, J, Azar, KM, Bennett, GG, Peterson, ED, Zheng, Y, Riley, W, Stephens, J, Shah, SH & Suffoletto, B 2015, 'Current science on consumer use of mobile health for cardiovascular disease prevention', *Circulation*, vol. 132, no. 12, pp. 1157-1213.

Bursell, S-E, Jenkins, AJ, Brazionis, L, Rowley, KG & Brown, AD 2013, 'Telehealth in Australia: an evolution in health care services', *The Medical Journal of Australia*, vol. 199, no. 1, pp. 23-24.

Caison, AL, Bulman, D, Pai, S & Neville, D 2008, 'Exploring the technology readiness of nursing and medical students at a Canadian university', *Journal of Interprofessional Care*, vol. 22, no. 3, pp. 283-294.

Calgary Scientific 2017, *ResoulationMD*, viewed 18 January 2018, <http://www.calgaryscientific.com/resolutionmd>.

Cameron, R 2011, 'Mixed methods research: the five Ps framework', *The Electronic Journal of Business Research Methods*, vol. 9, no. 2, pp. 96-108.

Canada's Health Informatics Association 2013, *2013 Canadian telehealth report*, Canada's Health Informatics Association, Toronto, viewed 2 February 2016, <https://www.coachorg.com/en/communities/resources/TeleHealth-Public-FINAL-web-062713-secured.pdf>.

Carreiro, S, Smelson, D, Ranney, M, Horvath, KJ, Picard, RW, Boudreaux, ED, Hayes, R & Boyer, EW 2014, 'Real-time mobile detection of drug use with wearable biosensors: a pilot study', *Journal of Medical Toxicology*, vol. 11, no. 1, pp. 73-79.

Casper, E 2007, 'The Theory of Planned Behavior applied to continuing education for mental health professionals', *Psychiatric Services*, vol. 58, no. 10, pp. 1324-1329.

Castro, D, Miller, B & Nager, A 2014, *Unlocking the potential of physician-to-patient telehealth services*, The Information Technology and Innovation Foundation Washington, viewed 15 June 2015,

<https://www.google.com.au/gfe_rd=cr&ei=yMqpVNTyIsaN8Qf0yYCgBg&gws_rd=ssl#q=unlocking+the+potential+of+physician-to-patient+telehealth+services>.

Cavana, RY, Delahaye, BL & Sekaran, U 2001, *Applied business research : qualitative and quantitative methods*, John Wiley & Sons Queensland, Australia.

Cellucci, L, Spil, CLT & Wiggins, C 2014, 'Introduction to IT adoption, diffusion, and evaluation in healthcare', *Proceedings of the 47th Hawaii International Conference on System Sciences(HICSS)*, 6-9 January, Hawaii, USA, pp. 2685.

Chang, A-M & Kannan, P 2006, 'Employee technology readiness and adoption of wireless technology and services', *Proceedings of the 39th Hawaii International Conference on System Sciences - 2006*, 4-7 January, Washington, DC, USA pp. 1-9.

Chang, LW, Njie-Carr, V, Kalenge, S, Kelly, JF, Bollinger, RC & Alamo-Talisuna, S 2013, 'Perceptions and acceptability of mHealth interventions for improving patient care at a community-based HIV/AIDS clinic in Uganda: a mixed methods study', *AIDS Care*, vol. 25, no. 7, pp. 874-880.

Chau, PYK & Hu, PJ-H 2002a, 'Examining a model of information technology acceptance by individual professionals: an exploratory study', *Journal of Management Information Systems*, vol. 18, no. 4, pp. 191-229.

Chau, PYK & Hu, PJ-H 2002b, 'Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories', *Information & Management*, vol. 39, no. 4, pp. 297-311.

Chen, J, Lieffers, J, Bauman, A, Hanning, R & Allman-Farinelli, M 2017, 'The use of smartphone health apps and other mobile health (mHealth) technologies in dietetic practice: a three country study', *Journal of Human Nutrition and Dietetics*, vol. 30, no. 4, pp. 439-452.

Cho, J 2016, 'The impact of post-adoption beliefs on the continued use of health apps', *International Journal of Medical Informatics*, vol. 87, pp. 75-83.

Chow, CK, Redfern, J, Hillis, GS, Thakkar, J, Santo, K, Hackett, ML, Jan, S, Graves, N, de Keizer, L & Barry, T 2015, 'Effect of lifestyle-focused text messaging on risk factor modification in patients with coronary heart disease: a randomized clinical trial', *Journal of the American Medical Association* vol. 314, no. 12, pp. 1255-1263.

Christensen, MC & Remler, D 2009, 'Information and communications technology in U.S. health care: why is adoption so slow and is slower better?', *Journal of Health Politics, Policy & Law*, vol. 34, no. 6, pp. 1011-1034.

Cimperman, M, Brenčič, MM, Trkman, P & Stanonik, MdL 2013, 'Older adults' perceptions of home telehealth services', *Telemedicine & e-Health*, vol. 19, no. 10, pp. 786-790.

Cisco System Inc 2017, *Cisco visual networking index: global mobile data traffic forecast update, 2016–2021*, Document ID 1454457600805266, Cisco System Inc, San Jose, CA.

Clarke, J, Proudfoot, J, Birch, M-R, Whitton, A, Parker, G, Manicavasagar, V, Harrison, V, Christensen, H & Hadzi-Pavlovic, D 2014, 'Effects of mental health self-efficacy on outcomes of a mobile phone and web intervention for mild-to-moderate depression, anxiety and stress: secondary analysis of a randomised controlled trial', *BMC Psychiatry*, vol. 14, no. 1, pp. 1-19.

Cleary, M, Horsfall, J & Hayter, M 2014, 'Data collection and sampling in qualitative research: does size matter?', *Journal of Advanced Nursing*, vol. 70, no. 3, pp. 473-475.

Clifford, GD & Clifton, D 2012, 'Wireless technology in disease management and medicine', *Annual Review of Medicine*, vol. 63, pp. 479-492.

Coiera, E & Magrabi, F 2015, Information system safety, in E Coiera (ed.) *Guide to Health Informatics*, 3rd edn, CRC Press, Taylor and Francis, Boca Ratan, USA, pp. 195-220.

Collis, J 2009, *Business research: a practical guide for undergraduate & postgraduate students*, 3rd edn, Palgrave Macmillan, Basingstoke Hampshire UK.

Cook, JV, Dickinson, HO & Eccles, MP 2009, 'Response rates in postal surveys of healthcare professionals between 1996 and 2005: an observational study', *BMC Health Services Research*, vol. 9, no. 1, pp. 1-8.

Coughlin, SS, Besenyi, GM, Bowen, D & De Leo, G 2017, 'Development of the physical activity and your nutrition for cancer (pync) smartphone app for preventing breast cancer in women', *mHealth*, vol. 3, no. 5, pp. 1-8.

Creswell, JW 2002, *Educational research: planning, conduction and evaluating quantitative and qualitative research*, 3rd edn, Merrill Prentice Hall, Upper Saddle River, New Jersey.

Creswell, JW 2008, *Research design: qualitative, quantitatvie and mixed methods approaches*, 3rd edn, Sage Publications, India.

Creswell, JW 2013, *Business research methods*, 9th edn, South-Western, Mason, OH.

Creswell, JW & Miller, DL 2000, 'Determining validity in qualitative inquiry', *Theory into Practice*, vol. 39, no. 3, pp. 124-130.

Creswell, JW, Klassen, AC, Plano Clark, VL & Smith, KC 2013, *Best practices for mixed methods research in the health sciences 2011*, Office of Behavioral and Social Sciences Research (OBSSR) National Institutes of Health, Bethesda, Maryland, United State.

Croll, J, Norton, CJ, Gray, LC, Bryett, A & Smith, AC 2012, 'Telehealth opportunities in regional Queensland: a scoping study', *Journal of Telemedicine and Telecare*, vol. 18, no. 8, pp. 451-454.

Crombie, IK, Irvine, L, Williams, B, Sniehotta, FF, Petrie, D, Evans, JMM, Emslie, C, Jones, C, Ricketts, IW, Humphris, G, Norrie, J, Rice, P & Slane, PW 2014, 'A mobile phone intervention to reduce binge drinking among disadvantaged men: study protocol for a randomised controlled cost-effectiveness trial', *Trials*, vol. 15, no. 1, pp. 325-342.

Daim, TU, Basoglu, N & Topacan, U 2013, 'Adoption of health information technologies: the case of a wireless monitor for diabetes and obesity patients', *Technology Analysis & Strategic Management*, vol. 25, no. 8, pp. 923-938.

Daniel, LG 1989, *Comparisons of exploratory and confirmatory factor analysis*, viewed 30 March 2017, <https://files.eric.ed.gov/fulltext/ED314447.pdf>.

Daniel, S 2017, *Free statistics calculators*, viewed 2 October 2017, <http://www.danielsoper.com/statcalc/default.aspx>.

Danish Ministry of Health 2012, *eHealth in Denmark,* , Danish Ministry of Health, Copenhagen, viewed 05 February 2016, <http://www.sum.dk/~/media/Filer%20-%20Publikationer_i_pdf/2012/Sundheds-IT/Sundheds_IT_juni_web.ashx>.

De'Ath, HDI, Stechman, MJ, Gibson, P & Bicknell, C 2011, 'A pilot study examining the use of mobile camera phones as a teleconsultation tool in surgical practice', *Journal of Communication in Healthcare*, vol. 4, no. 2, pp. 102-105.

Decrop, A 1999, 'Triangulation in qualitative tourism research', *Tourism Management*, vol. 20, no. 1, pp. 157-161.

Dellinger, AB & Leech, NL 2007, 'Toward a unified validation framework in mixed methods research', *Journal of Mixed Methods Research*, vol. 1, no. 4, pp. 309-332.

Deng, Z, Mo, X & Liu, S 2013, 'Comparison of the middle-aged and older users' adoption of mobile health services in China', *International Journal of Medical Informatics*, vol. 83, no. 3, pp. 210-224.

Denscombe, M 2008, 'Communities of practice a research paradigm for the mixed methods approach', *Journal of Mixed Methods Research*, vol. 2, no. 3, pp. 270-283.

Donders, ART, van der Heijden, GJ, Stijnen, T & Moons, KG 2006, 'A gentle introduction to imputation of missing values', *Journal of Clinical Epidemiology*, vol. 59, no. 10, pp. 1087-1091.

Dingwall, KM, Puszka, S, Sweet, M, Mills, PPJR & Nagel, T 2015, 'Evaluation of a culturally adapted training course in Indigenous e-mental health', *Australasian Psychiatry*, vol. 23, no. 6, pp. 630-635.

Dubé, L & Paré, G 2003, 'Rigor in information systems positivist case research: current practices, trends, and recommendations', *MIS Quarterly*, vol. 27, no. 4, pp. 597-636.

Duffy, ME 1987, 'Methodological triangulation: a vehicle for merging quantitative and qualitative research methods', *Image: The Journal of Nursing Scholarship*, vol. 19, no. 3, pp. 130-133.

Dworkin, SL 2012, 'Sample size policy for qualitative studies using in-depth interviews', *Archives of Sexual Behavior*, vol. 41, no. 6, pp. 1319–1320.

Eisinga, R, Te Grotenhuis, M & Pelzer, B 2013, 'The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown?', *International Journal of Public Health*, vol. 58, no. 4, pp. 637-642.

Eskinder, AE, Chew, L & Yi-LwernYap, K 2016, 'Evolution and current status of mhealth research: a systematic review', *BMJ Innovations*, vol. 2, no. 1, pp. 1-8.

Ethridge, DE 2004, *Research methodology in applied economics: organizing, planning, and conducting economic research*, 2nd edn, Blackwell Publishing, Ames, Iowa.

Evans, N, Harris, N & Kuppuswamy, A 2011, 'A smarter future: technology to enhance an independent lifestyle for our future selves', *International Journal of Therapy and Rehabilitation*, vol. 18, no. 12, pp. 694-699.

Fan, W & Yan, Z 2010, 'Factors affecting response rates of the web survey: a systematic review', *Computers in Human Behavior*, vol. 26, no. 2, pp. 132-139.

Farrell, K & Holmes-Walker, DJ 2011, 'Mobile phone support is associated with reduced ketoacidosis in young adults', *Diabetic Medicine*, vol. 28, no. 8, pp. 1001-1004.

Fatehi, F & Wootton, R 2012, 'Telemedicine, telehealth or e-health? A bibliometric analysis of the trends in the use of these terms', *Journal of Telemedicine & Telecare*, vol. 18, no. 8, pp. 460-464.

Fatehi, F, Armfield, NR, Dimitrijevic, M & Gray, LC 2015, 'Technical aspects of clinical videoconferencing: a large scale review of the literature', *Journal of Telemedicine and Telecare*, vol. 21, no. 3, pp. 160-166.

Feigin, VL, Norrving, B & Mensah, GA 2017, 'Primary prevention of cardiovascular disease through population-wide motivational strategies: insights from using smartphones in stroke prevention', *BMJ Global Health*, vol. 2, no. 2, pp. 1-10.

Feilzer, MY 2010, 'Doing mixed methods research pragmatically: implications for the rediscovery of pragmatism as a research paradigm', *Journal of Mixed Methods Research*, vol. 4, no. 1, pp. 6-16.

Foster, J 1998, *Data analysis using SPSS for windows: a beginner's guide*, Sage Publications, London.

Fox, S 2011, *The social life of health information 2011*, Pew Research Center, Washngton, DC, viewed 10 December 2016, <http://pewinternet.org/Reports/2011/Social-Life-of-Health-Info.asp>.

Furukawa, MF, Raghu, TS, Spaulding, TJ & Vinze, A 2008, 'Adoption of health information technology for medication safety in U.S. hospitals, 2006', *Health Affairs*, vol. 27, no. 3, pp. 865-875.

Gaggioli, A 2012, 'CyberSightings', *CyberPsychology, Behavior & Social Networking*, vol. 15, no. 9, pp. 512-513.

Gagnon, M-P, Ngangue, P, Payne-Gagnon, J & Desmartis, M 2016, 'm-Health adoption by healthcare professionals: a systematic review', *Journal of the American Medical Informatics Association*, vol. 23, no. 1, pp. 212-220.

Gagnon, M-P, Lamothe, L, Fortin, J-P, Cloutier, A, Godin, G, Gagné, C & Reinharz, D 2005, 'Telehealth adoption in hospitals: an organisational perspective', *Journal of Health Organization and Management*, vol. 19, no. 1, pp. 32-56.

Gagnon, MP, Desmartis, M, Labrecque, M, Car, J, Pagliari, C, Pluye, P, Fremont, P, Gagnon, J, Tremblay, N & Legare, F 2012, 'Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals', *Journal of Medical System*, vol. 36, no. 1, pp. 241-277.

Gao, S, Krogstie, J & Siau, K 2011, 'Developing an questionnaire to measure the adoption of mobile services', *Mobile Information Systems*, vol. 7, no. 1, pp. 45-67.

Gao, T, Greenspan, D, Welsh, M, Juang, RR & Alm, A 2005, 'Vital signs monitoring and patient tracking over a wireless network', *Proceedings of Engineering in Medicine and Biology 27th Annual Conference*, 1-4 September, Shanghai, China,, pp. 102-105.

Garritty, C & El Emam, K 2006, 'Who's using PDAs? Estimates of PDA use by health care providers: a systematic review of surveys', *Journal of Medical Internet Research*, vol. 8, no. 2, pp. 1-20.

Gee, M 2015, *Is Australia ready for mobile health?*, Frost and Sullivan, Medical Health - IDG viewed 12 December 2015, <http://health.idg.com.au/article/580787/australia-ready-mobile-health/>.

Gelo, O, Braakmann, D & Benetka, G 2008, 'Quantitative and qualitative research: beyond the debate', *Integrative Psychological and Behavioral Science*, vol. 42, no. 3, pp. 266-290.

Gill, P, Stewart, K, Treasure, E & Chadwick, B 2008, 'Methods of data collection in qualitative research: interviews and focus groups', *British Dental Journal*, vol. 204, no. 6, pp. 291-295.

Gillham, B 2007, *Developing a questionnaire*, 2nd edn, Continuum, New York, London.

Glantz, SA & Jamieson, P 2000, 'Attitudes toward secondhand smoke, smoking, and quitting among young people', *Pediatrics*, vol. 106, no. 6, pp.1-5.

Goswami, S & Chandra, B 2013, 'Convergence dynamics of consume innovativeness vis-à-vis technology acceptance propensity: an empirical study on adoption of mobile devices', *The IUP Journal of Marketing Management*, vol. 12, no. 3, pp. 63-87.

Government of Western Australia 2011, *Telehealth*, viewed 23 February 2018, <http://www.wacountry.health.wa.gov.au/telehealth>.

Green, SB 1991, 'How many subjects does it take to do a regression analysis', *Multivariate Behavioral Research*, vol. 26, no. 3, pp. 499-510.

Greene, JC, Caracelli, VJ & Graham, WF 1989, 'Toward a conceptual framework for mixed-method evaluation designs', *Educational Evaluation and Policy Analysis,* vol. 11, no. 3, pp. 255-274.

Guadagnoli, E & Velicer, WF 1988, 'Relation to sample size to the stability of component patterns', *Psychological Bulletin*, vol. 103, no. 2, pp. 265-275.

Guarte, JM & Barrios, EB 2006, 'Estimation under purposive sampling', *Communications in Statistics: simulation and Computation*, vol. 35, no. 2, pp. 277-284.

Guba, EG & Lincoln, YS 1982, 'Epistemological and methodological bases of naturalistic inquiry', *Educational Communication and Technology: a Journal of Theory, Research, and Development*, vol. 30, no. 4, pp. 233-252.

Guba, EG & Lincoln, YS 1989, *Fourth generation evaluation*, Sage Publications, Newbury park, London.

Gururajan, R, Sturgess, J, Hafeez-Baig, A, Clark, K, Gururajan, V & Moller, S 2013, 'An exploratory study to identify factors that influence the use of electronic patient journey boards in queensland health', *International Journal of Management & Information Technology*, vol. 7, no. 2, pp. 1033-1041.

Gururajan, R, Clark, K, Moller, S, Sankaran, P, Hafeez-Baig, A, Wickramasinghe, N & Gururajan, R 2014, 'Reliability of qualitative data using text analysis: a Queensland Health case study', *Proceedings of 3rd International Conference on Eco-friendly Computing and Communication Systems*, 18-21 December, Mangalore, India, pp. 1-13.

Hafeez-Baig, A 2010, 'Study to investigate the adoption of wireless technology in the Australian healthcare system', PhD thesis, University of Southern Queensland, Toowoomba.

Hafeez-Baig, A & Gururajan, R 2010, 'Adoption phenomena for wireless handheld devices in the healthcare environment', *Journal of Communication in Healthcare*, vol. 3, no. 3-4, pp. 228-239.

Hafeez-Baig, A, Gururajan, R & Wickramasinghe, N 2018, 'Readiness as a novel construct of Readiness Acceptance Model (RAM) for the wireless handheld technology', *Technology Adoption and Social Issues: Concepts, Methodologies, Tools, and Applications*, IGI Global, USA, pp.27.

Hafeez-Baig, A, Gururajan, R, Mula, JM & Lin, MK 2009, 'Study to investigate the determinants for the use of wireless technology in healthcare setting: a case of Pakistan', *Proceedings of Fourth International Conference on Cooperation and Promotion of Information Resources in Science and Technology, COINFO'09*, 21-23 November, Beijing, China, pp. 35-41.

Haffey, F, Brady, R & Maxwell, S 2013, 'A comparison of the reliability of smartphone apps for opioid conversion', *Drug Safety*, vol. 36, no. 2, pp. 111-117.

Hair, JF, Black, WC, Babin, BJ, Anderson, RE & Tatham, RL 1998, *Multivariate data analysis*, 6th edn, Prentice Hall, Upper Saddle River, New Jersey.

Hao, W-R, Hsu, Y-H, Chen, K-C, Li, H-C, Iqbal, U, Nguyen, P-A, Huang, C-W, Yang, H-C, Lee, P, Li, M-H, Hlatshwayo, SL, Li, Y-C & Jian, W-S 2015, 'LabPush: a pilot study of providing remote clinics with laboratory results via short message service (SMS) in Swaziland, Africa –a Qualitative study', *Computer Methods & Programs in Biomedicine*, vol. 118, no. 1, pp. 77-83.

Hebden, L, Cook, A, Ploeg, HP, King, L, Bauman, A & Allman-Farinelli, M 2014, 'A mobile health intervention for weight management among young adults: a pilot randomised controlled trial', *Journal of Human Nutrition & Dietetics*, vol. 27, no. 4, pp. 322-332.

Hebden, L, Balestracci, K, McGeechan, K, Denney-Wilson, E, Harris, M, Bauman, A & Allman-Farinelli, M 2013, 'TXT2BFiT' a mobile phone-based healthy lifestyle program for preventing unhealthy weight gain in young adults: study protocol for a randomized controlled trial', *Trials*, vol. 14, no. 1, pp. 1-9.

Hebert, MA, Korabek, B & Scott, RE 2006, 'Moving research into practice: a decision framework for integrating home telehealth into chronic illness care', *International Journal of Medical Informatics*, vol. 75, no. 12, pp. 786-794.

Heerden, Av, Tomlinson, M & Swartz, L 2012, 'Point of care in your pocket: a research agenda for the field of m-health', *Bulletin of the World Health Organization*, vol. 90, no. 5, pp. 393-394.

Heidarian, A & Mason, D 2013, 'Health information technology adoption in New Zealand optometric practices', *Clinical & Experimental Optometry*, vol. 96, no. 6, pp. 557-565.

Henson, RK & Roberts, JK 2006, 'Use of exploratory factor analysis in published research: common errors and some comment on improved practice', *Educational and Psychological Measurement*, vol. 66, no. 3, pp. 393-416.

HIT Consultant Media 2015, 'Ask the doctor acquires UK’s largest telehealth services provider', *HIT Consultant Media*, 11 December, viewed 16 February 2018, <http://hitconsultant.net/2015/11/12/ask-the-doctor-acquires-uks-largest-telehealth-services-provider/>.

Holtz, B 2011, 'Understanding nurse perceptions of a newly implemented electronic medical record system', *Journal of Technology in Human Services*, vol. 29, no. 4, pp. 247-262.

Honka, A, Kaipainen, K, Hietala, H & Saranummi, N 2011, 'Rethinking health: ICT-enabled services to empower people to manage their health', *IEEE Reviews in Biomedical Engineering* vol. 4, pp. 119-139.

Hoque, MR 2016, 'An empirical study of mHealth adoption in a developing country: the moderating effect of gender concern', *BMC Medical Informatics and Decision Making*, vol. 16, no. 51 pp. 1-10.

Hoque, MR, Bao, YK & Sorwarb, G 2017, 'Investigating factors influencing the adoption of e-Health in developing countries: a patient's perspective', *Informatics for Health and Social Care*, vol. 42, no. 1, pp. 1-17.

Hoque, R & Sorwar, G 2017, 'Understanding factors influencing the adoption of mHealth by the elderly: an extension of the UTAUT model', *International Journal of Medical Informatics*, vol. 101, pp. 75-84.

Houghton, C, Murphy, K, Meehan, B, Thomas, J, Brooker, D & Casey, D 2017, 'From screening to synthesis: using Nvivo to enhance transparency in qualitative evidence synthesis', *Journal of Clinical Nursing*, vol. 26, no. 5-6, pp. 873-881.

Howe, KR 1988, 'Against the quantitative-qualitative incompatibility thesis or dogmas die hard', *Educational Researcher*, vol. 17, no. 8, pp. 10-16.

Htat, KK, Williams, PA & McCauley, V 2017, 'Security of ePrescriptions: data in transit comparison using existing and mobile device services', *Proceedings of the Australasian Computer Science Week Multiconference*, 31 January - 03 February, Geelong, Australia, pp. 14-22.

Hu, PJ-H, Chau, PYK & Sheng, ORL 2002, 'Adoption of telemedicine technology by health care organizations: an exploratory study', *Journal of Organizational Computing and Electronic Commerce*, vol. 12, no. 3, pp. 197-221.

Hufstader Gabriel, M, Jones, EB, Samy, L & King, J 2014, 'Progress and challenges: implementation and use of health information technology among critical-access hospitals', *Health Affairs*, vol. 33, no. 7, pp. 1262-1270.

Huizingh, E 2007, *Applied statistics with SPSS*, Sage Publications, London.

Huq, G, Maeder, A, Basilakis, J & Pirnejad, H 2015, 'Trialling a personal falls monitoring system using smart phone', *Proceedings of 8th Australasian Workshop on Health Informatics and Knowledge Management (HIKM 2015)*, 27-30 January, Sydney, Australia, pp. 41-45.

Hurst, S, Arulogun, OS, Owolabi, MO, Akinyemi, R, Uvere, E, Warth, S & Ovbiagele, B 2015, 'Pretesting qualitative data collection procedures to facilitate methodological adherence and team building in Nigeria', *International Journal of Qualitative Methods*, vol. 14, no. 1, pp. 53-64.

Igbaria, M, Zinatelli, N, Cragg, P & Cavaye, AL 1997, 'Personal computing acceptance factors in small firms: a Structural Equation Model', *MIS Quarterly*, pp. 279-305.

Imtiaz, SA, Krishnaiah, S, Yadav, SK, Bharath, B & Ramani, RV 2017, 'Benefits of an android based tablet application in primary screening for eye diseases in a rural population, India', *Journal of Medical Systems*, vol. 41, no. 4, pp. 41-49.

Istepanian, RSH 2014, 'm-health: a decade of evolution and impact on services and global health', *British Journal of Healthcare Management*, vol. 20, no. 7, pp. 334-337.

Ivanoff, SD, Sjöstrand, J, Klepp, K, Lind, LA & Lindqvist, BL 1996, 'Planning a health education programme for the elderly visually impaired person: a focus group study', *Disability and Rehabilitation*, vol. 18, no. 10, pp. 515-522.

Jack, EP & Raturi, AS 2006, 'Lessons learned from methodological triangulation in management research', *Management Research News*, vol. 29, no. 6, pp. 345-357.

Johnson, B & Christensen, L 2010, *Educational research: quantitative, qualitative, and mixed approaches*, 3rd edn, Sage, Thousands Oaks.

Joslin, R & Müller, R 2016, 'Identifying interesting project phenomena using philosophical and methodological triangulation', *International Journal of Project Management*, vol. 34, no. 6, pp. 1043-1056.

Kai-Wen, C 2014, 'A study on applying focus group interview on education', *Reading Improvement*, vol. 51, no. 4, pp. 381-384.

Kamaruzaman, KN, Hussein, Z & Fikry, A 2018, 'A conceptual study on the factors influencing behavioural intention to use mobile health application among young women in Malaysia', *Proceedings of the 2nd Advances in Business Research International Conference (ABRIC2016)*, 16-17 November, Kedah, Malaysia, pp. 325-335.

Kaplan, B & Duchon, D 1988, 'Combining qualitative and quantitative methods in information systems research: a case study', *MIS Quarterly*, vol. 12, no. 4, pp. 571-586.

Kapoor, KK, Dwivedi, YK & Williams, MD 2014, 'Rogers' innovation adoption attributes: a systematic review and synthesis of existing research', *Information Systems Management*, vol. 31, no. 1, pp. 74-91.

Karahanna, E, Straub, DW & Chervany, NL 1999, 'Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs', *MIS Quarterly*, vol. 23, no. 2, pp. 183-213.

Kargin, B & Basoglu, N 2006, 'Adoption factors of mobile services', *Proceedings of the International Conference on Mobile Business (ICMB'06)*, 26-27 June 2006, Copenhagen, Denmark, pp. 41-52.

Karr, AF, Sanil, AP & Banks, DL 2006, 'Data quality: a statistical perspective', *Statistical Methodology*, vol. 3, no. 2, pp. 137-173.

Katerattanakul, P & Siau, K 2008, 'Factors affecting the information quality of personal Web portfolios', *Journal of the American Society for Information Science and Technology*, vol. 59, no. 1, pp. 63-76.

Kay, M 2011, *mHealth: new horizons for health through mobile technologies*, Switzerland, viewed 31 January 2016, <http://www.who.int/goe/publications/goe_mhealth_web.pdf>.

Kerr, AW, Hall, HK & Kozub, S 2002, *Doing statistics with SPSS*, Sage Publications, Thousand Oaks, London.

Kershaw, JA, Beers, TW, Ducey, MJ & Husch, B 1942, *Forest mensuration*, 2nd edn, McGraw-Hill, London, UK.

Khoumbati, K (ed.) 2009, *Handbook of research on advances in health informatics and electronic healthcare applications: global adoption and impact of information communication technologies*, IGI Global, Hershey, Pennsylvania, USA.

Kieffer, KM 1999, 'An introductory primer on the appropriate use of exploratory and confirmatory factor analysis', *Research in the Schools*, vol. 6, no. 2, pp. 75-92.

Kim, KJ & Shyam, SS 2014, 'Does screen size matter for smartphones? Utilitarian and hedonic effects of screen size on smartphone adoption', *CyberPsychology, Behavior & Social Networking*, vol. 17, no. 7, pp. 466-473.

Kim, S & Garrison, G 2008, 'Investigating mobile wireless technology adoption: an extension of the Technology Acceptance Model', *Information Systems Frontiers*, vol. 11, no. 3, pp. 323-333.

Kim, S, Lee, K-H, Hwang, H & Yoo, S 2016, 'Analysis of the factors influencing healthcare professionals' adoption of mobile Electronic Medical Record (EMR) using the Unified Theory of Acceptance and Use of Technology (UTAUT) in a tertiary hospital', *BMC Medical Informatics and Decision Making*, vol. 16, no. 1, pp. 1-12.

Kim, SH 2008, 'Moderating effects of job relevance and experience on mobile wireless technology acceptance: adoption of a smartphone by individuals', *Information & Management*, vol. 45, no. 6, pp. 387-393.

Kitzinger, J 1995, 'Qualitative research. Introducing focus groups', *BMJ: British Medical Journal*, vol. 311, no. 7000, pp. 299-302.

Klassen, AC, Creswell, JW, Plano Clark, VL, Smith, KC & Meissner, HI 2012, 'Best practices in mixed methods for quality of life research', *Quality of Life Research*, vol. 21, no. 3, pp. 377-380.

Klein, HK & Myers, MD 1999, 'A set of principles for conducting and evaluating interpretive field studies in information systems', *MIS Quarterly*, vol. 23, no. 1, pp. 67-93.

Klonoff, DC 2013, 'The current status of mHealth for diabetes: will it be the next big thing?', *Journal of Diabetes Science and Technology*, vol. 7, no. 3, pp. 749-758.

Krueger, RA 2014, *Focus groups: a practical guide for applied research*, 5th edn, Sage Publications, New Delhi.

Kuo, Y-C & Cheng, S-H 2017, 'Adoption of medication alert systems in hospital outpatient departments in Taiwan', *International Journal of Medical Informatics*, vol. 102, pp. 111-117.

Lance, CE, Butts, MM & Michels, LC 2006, 'The sources of four commonly reported cutoff criteria what did they really say?', *Organizational Research Methods*, vol. 9, no. 2, pp. 202-220.

Lim, S, Xue, L, Yen, CC, Chang, L, Chan, HC, Tai, BC, Duh, HBL & Choolani, M 2011, 'A study on Singaporean women's acceptance of using mobile phones to seek health information', *International Journal of Medical Informatics*, vol. 80, no. 12, pp. 189-202.

Lin, TT & Bautista, JR 2017, 'Understanding the relationships between mhealth apps' characteristics, trialability, and mhealth literacy', *Journal of Health Communication*, vol. 22, no. 4, pp. 345-354.

Litwack, SD, Jackson, CE, Chen, M, Sloan, DM, Hatgis, C, Litz, BT & Marx, BP 2014, 'Validation of the use of video teleconferencing technology in the assessment of PTSD', *Psychological Services*, vol. 11, no. 3, pp. 290-294.

Liu, D & Guo, X 2017, 'Exploring gender differences in acceptance of mobile computing devices among college students', *Information Systems and e-Business Management*, vol. 15, no. 1, pp. 197-223.

Liu, L, Miguel Cruz, A, Rios Rincon, A, Buttar, V, Ranson, Q & Goertzen, D 2015, 'What factors determine therapists' acceptance of new technologies for rehabilitation– a study using the Unified Theory of Acceptance and Use of Technology (UTAUT)', *Disability and Rehabilitation*, vol. 37, no. 5, pp. 447-455.

Liu, Y & Zumbo, BD 2007, 'The impact of outliers on Cronbach's coefficient alpha estimate of reliability: visual analogue scales', *Educational and Psychological Measurement*, vol. 67, no. 4, pp. 620-634.

Lo, Y-S, Lee, W-S, Chen, G-B & Liu, C-T 2014, 'Improving the work efficiency of healthcare-associated infection surveillance using electronic medical records', *Computer Methods & Programs in Biomedicine*, vol. 117, no. 2, pp. 351-359.

Louise Barriball, K & While, A 1994, 'Collecting data using a semi-structured interview: a discussion paper', *Journal of Advanced Nursing*, vol. 19, no. 2, pp. 328-335.

Lu, B-Y & Wu, H-D 2015, 'Auscultation using modern mobile communication', *Acoustics Australia*, vol. 43, no. 3, pp. 303-309.

Lyngstad, M, Hofoss, D, Grimsmo, A & Hellesø, R 2015, 'Predictors for assessing electronic messaging between nurses and general practitioners as a useful tool for communication in home health care services: a cross-sectional study', *Journal of Medical Internet Research*, vol. 17, no. 2, pp. 1-10.

Lyzwinski, LN, Caffery, LJ, Bambling, M & Edirippulige, S 2017, 'Consumer perspectives on mHealth for weight loss: a review of qualitative studies', *Journal of Telemedicine and Telecare*, pp. 1-13.

MacKinnon, DP 2011, 'Integrating mediators and moderators in research design', *Research on Social Work Practice*, vol. 21, no. 6, pp. 675-681.

Malterud, K, Siersma, VD & Guassora, AD 2016, 'Sample size in qualitative interview studies: guided by information power', *Qualitative Health Research*, vol. 26, no. 13, pp. 1753-1760.

Manfreda, KL, Bosnjak, M, Berzelak, J, Haas, I & Vehovar, V 2008, 'Web surveys versus other survey modes', *International Journal of Market Research*, vol. 50, no. 1, pp. 79-104.

Marasinghe, RB, Edirippulige, S, Kavanagh, D, Smith, A & Jiffry, MT 2012, 'Effect of mobile phone-based psychotherapy in suicide prevention: a randomized controlled trial in Sri Lanka', *Journal of Telemedicine and Telecare*, vol. 18, no. 3, pp. 151-155.

Magrabi, F, Ford, D, Arachi, D & Williams, H 2015, Death despite known drug allergy: the story of Zoya (Australia), *Case Studies in Patient Safety: Foundations for Core Competencies*, Jones & Bartlett Learning, Burlington MA, pp. 247-60.

Marshall, A & Heginbotham, C 2013, 'Adopting telehealth innovations: when evidence is not enough', *International Journal of Integrated Care (IJIC)*, vol. 13, no. 7, pp. 1-2.

Mason, M 2010, 'Sample size and saturation in PhD studies using qualitative interviews', *Forum Qualitative Sozialforschung*, vol. 11, no. 3, pp.1-19.

Maxwell, JA 1992, 'Understanding and validity in qualitative research', *Harvard Educational Review*, vol. 62, no. 3, pp. 279-301.

Mayo Foundation 2015, *Stroke telemedicine (telestroke)*, viewed 31 December 2016, <http://www.mayoclinic.org/tests-procedures/stroke-telemedicine/basics/definition/prc-20021080>.

Milward, J, Day, E, Wadsworth, E, Strang, J & Lynskey, M 2015, 'Mobile phone ownership, usage and readiness to use by patients in drug treatment', *Drug and Alcohol Dependence*, vol. 146, pp. 111-115.

Mitchell, KJ, Bull, S, Kiwanuka, J & Ybarra, ML 2011, 'Cell phone usage among adolescents in Uganda: acceptability for relaying health information', *Health Education Research*, vol. 26, no. 5, pp. 770-781.

Mkansi, M & Acheampong, EA 2012, 'Research philosophy debates and classifications: students' dilemma', *Electronic Journal of Business Research Methods*, vol. 10, no. 2, pp. 132-140.

Moffatt, J & Eley, D 2011, 'Barriers to the up-take of telemedicine in Australia: a view from providers', *Rural and Remote Health Journal,* vol. 11, no. 1581, pp. 1-6.

Mone, G 2014, 'The new digital medicine', *Communications of the ACM*, vol. 57, no. 9, pp. 18-20.

Mooi, JK, Whop, LJ, Valery, PC & Sabesan, SS 2012, 'Teleoncology for Indigenous patients: the responses of patients and health workers', *Australian Journal of Rural Health*, vol. 20, no. 5, pp. 265-269.

Moon, J-W & Kim, Y-G 2001, 'Extending the TAM for a World-Wide-Web context', *Information & Management*, vol. 38, no. 4, pp. 217-230.

Moore, GC & Benbasat, I 1991, 'Development of an questionnaire to measure the perceptions of adopting an information technology innovation', *Information Systems Research*, vol. 2, no. 3, pp. 192-222.

Morgan, DL 1997, *Focus groups as qualitative research*, 2nd edn, Sage Publications, Thousand Oaks, California.

Morgan, DL 2007, 'Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods', *Journal of Mixed Methods Research*, vol. 1, no. 1, pp. 48-76.

Morilla, MDR, Sans, M, Casasa, A & N, Gimenez, G 2017, 'Implementing technology in healthcare: insights from physicians', *BMC Medical Informatics and Decision Making*, vol. 12, no. 92, pp. 1-9.

Morse, JM 2000, 'Determining sample size', *Qualitative Health Research*, vol. 10, no. 1, pp. 3-5.

Morse, JM, Barrett, M, Mayan, M, Olson, K & Spiers, J 2002, 'Verification strategies for establishing reliability and validity in qualitative research', *International Journal of Qualitative Methods*, vol. 2, no. 1, pp. 1-19.

Mun, YY, Jackson, JD, Park, JS & Probst, JC 2006, 'Understanding information technology acceptance by individual professionals: toward an integrative view', *Information & Management*, vol. 43, no. 3, pp. 350-363.

Mundfrom, DJ, Shaw, DG & Ke, TL 2005, 'Minimum sample size recommendations for conducting factor analyses', *International Journal of Testing*, vol. 5, no. 2, pp. 159-168.

Muralidharan, S, Ranjani, H, Anjana, RM, Allender, S & Mohan, V 2017, 'Mobile health technology in the prevention and management of Type 2 diabetes', *Indian Journal of Endocrinology and Metabolism*, vol. 21, no. 2, pp. 334-340.

Nahar, P, Kannuri, NK, Mikkilineni, S, Murthy, G & Phillimore, P 2017, 'mHealth and the management of chronic conditions in rural areas: a note of caution from Southern India', *Anthropology & Medicine*, vol. 24, no. 1, pp. 1-16.

Nair, A & Dreyfus, D 2018, 'Technology alignment in the presence of regulatory changes: the case of meaningful use of information technology in healthcare', *International Journal of Medical Informatics*, vol. 110, pp. 42-51.

Nathan, Z 2009, *The minimum sample size in factor analysis* viewed 25 February 2017, <https://www.encorewiki.org/display people/~nzhao/The+Minimum+Sample+Size+in+Factor+Analysis>.

Neuman, WL 2003, *Social research methods: qualitative and quantitative approaches*, 5th edn, Allyn and Bacon, Boston, London.

Newsted, PR, Huff, SL & Munro, MC 1998, 'Survey questionnaires in information systems', *MIS Quarterly*, vol. 22, no. 4, pp. 553-554.

Ngwenyama, OK & Lee, AS 1997, 'Communication richness in electronic mail: critical social theory and the contextuality of meaning', *MIS Quarterly*, vol. 21, no. 2, pp. 145-167.

Nikou, S 2015, 'Mobile technology and forgotten consumers: the young-elderly', *International Journal of Consumer Studies*, vol. 39, no. 4, pp. 294-304.

Nohr, C, Villumsen, S, Ahrenkiel, SB & Hulbvæk, L 2015, 'Monitoring Telemedicine Implementation in Denmark' *Proceedings of the 15th World Congress on Health and Biomedical Informatics*, 19-23 August 2015, Sao Paulo, Brazil, pp. 497-500,

Nour, MM, McGeechan, K, Wong, AT, Partridge, SR, Balestracci, K, Roy, R, Hebden, L & Allman-Farinelli, M 2015, 'Diet quality of young adults enrolling in

TXT2BFiT, a mobile phone-based healthy lifestyle intervention', *JMIR Research Protocols*, vol. 4, no. 2, pp. 1-11.

NSW Ministry of Health 2015, *Strategic review of telehealth in NSW: final report*, Nous Group, viewed 15 February 2018, <http://www.health.nsw.gov.au/telehealth/Documents/strategic-review-of-telehealth-in-NSW.PDF>.

Nulty, DD 2008, 'The adequacy of response rates to online and paper surveys: what can be done?', *Assessment & Evaluation in Higher Education*, vol. 33, no. 3, pp. 301-314.

O'Connor, H & Gibbson, N 2003, 'A step-by-step guide to qualitative data analysis', *A Journal of Aboriginal and Indigenous Community Health*, vol. 1, no. 1, pp. 63-90.

Obstfelder, A, Engeseth, KH & Wynn, R 2007, 'Characteristics of successfully implemented telemedical applications', *Implementation Science*, vol. 2, no. 1, pp. 1-11.

Oliver-Williams, CT, Brown, E, Devereux, S, Fairhead, C & Holeman, I 2017, 'Using mobile phones to improve vaccination uptake in 21 low and middle income countries: a systematic review', *JMIR mHealth and uHealth*, vol. 5, no. 10, pp. 1-15.

Onwuegbuzie, AJ & Leech, NL 2005, 'On becoming a pragmatic researcher: the importance of combining quantitative and qualitative research methodologies', *International Journal of Social Research Methodology*, vol. 8, no. 5, pp. 375-387.

Onwuegbuzie, AJ & Johnson, RB 2006, 'The validity issue in mixed research', *Research in the Schools*, vol. 13, no. 1, pp. 48-63.

Onwuegbuzie, AJ & Leech, NL 2007, 'Validity and qualitative research: an oxymoron?', *Quality & Quantity*, vol. 41, no. 2, pp. 233-249.

Onwuegbuzie, AJ & Collins, KM 2007, 'A typology of mixed methods sampling designs in social science research', *Qualitative Report*, vol. 12, no. 2, pp. 281-316.

Orlikowski, WJ & Baroudi, JJ 1991, 'Studying information technology in organizations: research approaches and assumptions', *Information Systems Research*, vol. 2, no. 1, pp. 1-28.

Pajares, F & Urdan, TC 2006, *Self-efficacy beliefs of adolescents*, Information Age Publications, Greenwich, Connecticut.

Palmier-Claus, JE, Rogers, A, Ainsworth, J, Machin, M, Barrowclough, C, Laverty, L, Barkus, E, Kapur, S, Wykes, T & Lewis, SW 2013, 'Integrating mobile-phone based assessment for psychosis into people's everyday lives and clinical care: a Qualitative study', *BMC Psychiatry*, vol. 13, no. 1, pp. 1-12.

Palvia, P 2012, 'Information system issues in healthcare: hospital CEO and CIO perspectives', *Communication of the Association for Information System*, vol. 30, no. 19, pp. 295-312.

Parasuraman, A 2000, 'Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies', *Journal of Service Research*, vol. 2, no. 4, pp. 307-320.

Parliament of Australia 2013, *Health in Australia: a quick guide*, viewed 16 February 2018, <https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/QG/HealthAust>.

Parliamentary Committees 2014, *Inquiry into telehealth services in Queensland*, 55, Queensland, viewed 29 July 2015, <http://www.parliament.qld.gov.au/documents/tableOffice/TabledPapers/2014/5414T5969.pdf>.

Pearson, RH 2008, 'Recommended sample size for conducting exploratory factor analysis on dichotomous data', *Journal of Modern Applied Statistical Methods*, vol. 9, no. 2, pp. 359-368.

Peddle, K 2007, 'Telehealth in context: socio-technical barriers to telehealth use in Labrador, Canada', *Computer Supported Cooperative Work (CSCW)*, vol. 16, no. 6, pp. 595-614.

Perkins, M, Jensen, P, Jaccard, J, Gollwitzer, P, Oettingen, G, Pappadopulos, E & Hoagwood, K 2007, 'Applying theory-driven approaches to understanding and modifying clinicians' behavior: what do we know?', *Psychiatric Services*, vol. 58, no. 3, pp. 342-348.

Pett, MA, Lackey, NR & Sullivan, JJ 2003, Making sense of factor analysis: the use of factor analysis for instrument development in health care research, Sage Publications, Thousand Oaks, California.

Pope, C, Ziebland, S & Mays, N 2000, 'Qualitative research in health care: analysing qualitative data', *BMJ: British Medical Journal*, vol. 320, no. 722, pp. 114-116.

Powell, RA & Single, HM 1996, 'Focus groups', *International Journal for Quality in Health Care*, vol. 8, no. 5, pp. 499-504.

Premarathne, U, Han, F, Liu, H & Khalil, I 2015, *Mobile health: a technology road map*, Springer International Publishing, New York, London, viewed 1 October 2016 <https://books.google.com.au/books>.

Qiang, CZ, Yamamichi, M, Hausman, V & Altman, D 2011, *Mobile applications for the health sector*, Report no. 72604, World Bank, Washington DC, USA.

Queensland Health 2014, *Telehealth support unit*, viewed 29 January 2016, <https://www.health.qld.gov.au/telehealth/>.

Queensland Health 2016, *Statewide telehealth services telehealth support unit*, viewed 27 December 2017, <https://www.health.qld.gov.au/telehealth>.

Rabbi, M, Pfammatter, A, Zhang, M, Spring, B & Choudhury, T 2015, 'Automated personalized feedback for physical activity and dietary behavior change with mobile phones: a randomized controlled trial on adults', *JMIR mHealth and uHealth*, vol. 3, no. 2, pp. 1-14.

Rabiee, F 2004, 'Focus-group interview and data analysis', *Proceedings of the Nutrition Society*, vol. 63, no. 4, pp. 655-660.

Rahm, E & Do, HH 2000, 'Data cleaning: problems and current approaches', *Bulletin of the IEEE Computer Society Technical Committee on Data Engineering*, vol. 23, no. 4, pp. 3-13.

Rahman, A, Akhter, S, Nisha, MK, Islam, SS, Ashraf, F, Rahman, M, Begum, N, Chowdhury, ME, Austin, A & Anwar, I 2017, 'Can mHealth improve access to safe blood for transfusion during obstetric emergency?', *International Journal of Women's Health*, vol. 9, pp. 235-243.

Rahn, M 2017, *Factor analysis: a short introduction, part 4–how many factors should I find?*, viewed 1 December 2017, <http://www.theanalysisfactor.com/factor-analysis-how-many-factors/>.

Ramirez, AG, Chalela, P, Akopian, D, Munoz, E, Gallion, KJ, Despres, C, Morales, J, Escobar, R & McAlister, AL 2017, 'Text and mobile media smoking cessation service for young adults in South Texas: Operation and cost-effectiveness estimation', *Health Promotion Practice*, vol. 20, no. 10, pp. 581-585.

Randle, M, Mackay, H & Dudley, D 2014, 'A comparison of group-based research methods', *Market & Social Research*, vol. 22, no. 1, pp. 22-38.

Rehman, H, Kamal, AK, Sayani, S, Morris, PB, Merchant, AT & Virani, SS 2017a, 'Using mobile health (mhealth) technology in the management of diabetes mellitus, physical inactivity, and smoking', *Current Atherosclerosis Reports*, vol. 19, no. 4, pp. 1-11.

Rehman, H, Kamal, AK, Morris, PB, Sayani, S, Merchant, AT & Virani, SS 2017b, 'Mobile health (mhealth) technology for the management of hypertension and hyperlipidemia: slow start but loads of potential', *Current Atherosclerosis Reports*, vol. 19, no. 12, pp.1-8.

Renahy, E, Parizot, I & Chauvin, P 2008, 'Health information seeking on the Internet: a double divide? Results from a representative survey in the Paris metropolitan area, France, 2005-2006', *BMC Public Health*, vol. 69, no. 8, pp. 1-10.

Rogers, EM 2003, *Diffusion of innovations*, 5th edn, Free Press, New York.

Rowell, PD, Pincus, P, White, M & Smith, AC 2014, 'Telehealth in paediatric orthopaedic surgery in Queensland: a 10-year review', *ANZ Journal of Surgery*, vol. 84, no. pp. 12, 955-959.

Saad, NM, Alias, RA & Ismail, Z 2013, 'Initial framework on identifying factors influencing individuals' usage of telehealth', *Proceedings of the 3rd International Conference on Research and Innovation in Information Systems – 2013 (ICRIIS'13)*, 27-28 November, Malaysia, Kuala Lumpur, pp. 174-179.

Sandelowski, M 1995, 'Sample size in qualitative research', *Research in Nursing and Health*, vol. 18, no. 2, pp. 179-183.

Sanders, C, Rogers, A, Bowen, R, Bower, P, Hirani, S, Cartwright, M, Fitzpatrick, R, Knapp, M, Barlow, J & Hendy, J 2012, 'Exploring barriers to participation and adoption of telehealth and telecare within the whole system demonstrator trial: a Qualitative study', *BMC Health Services Research*, vol. 12, no. 220, pp. 1-12.

Sarker, S, Urbaczewski, A & Wells, JD 2002, 'Understanding hybrid wireless device use and adoption: an integrative framework based on an exploratory study', *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)*, 6-9 January, Hawaii.

Sarkis, N & Mwanri, L 2014, 'The role of information technology in strengthening human resources for health: the case of the Pacific Open Learning Health Network', *Health Education*, vol. 114, no. 1, pp. 67-79.

Saunders, M, Lewis, P & Thornhill, A 2009, *Research methods for business students*, 5th edn, Prentice Hall, New York.

Saunders, M, Lewis, P & Thornhill, A 2012, *Research methods for business students*, 6th edn, Pearson, New York.

Sezgin, E, Özkan-Yildirim, S & Yildirim, S 2016, 'Understanding the perception towards using mHealth applications in practice: physicians' perspective', *Information Development*, vol. 34, no. 2, pp. 1-19.

Shand, FL, Ridanir, R, Tighe, J & Christensen, H 2013, 'The effectiveness of a suicide prevention app for Indigenous Australian youths: study protocol for a randomized controlled trial', *Trials*, vol. 14, no. 1, pp. 1-15.

Shareef, MA, Kumar, V & Kumar, U 2014, 'Predicting mobile health adoption behaviour: a demand side perspective', *Journal of Customer Behaviour*, vol. 13, no. 3, pp. 187-205.

Sharma, A, Shinde, A & Kar, A 2017, 'Prevalence in the utilization of text message services under the mother and child tracking system of India: a cross sectional study from Pune district, Maharashtra, India', *International Journal of Community Medicine and Public Health*, vol. 3, no. 8, pp. 2319-2324.

Shrivastava, U, Misra, A, Mohan, V, Unnikrishnan, R & Bachani, D 2017, 'Obesity, diabetes and cardiovascular diseases in India: public health challenges', *Current Diabetes Reviews*, vol. 13, no. 1, pp. 65-80.

Sim, J 1998, 'Collecting and analysing qualitative data: issues raised by the focus group', *Journal of Advanced Nursing*, vol. 28, no. 2, pp. 345-352.

Singh, KD 2015, 'Creating your own qualitative research approach: selecting, integrating and operationalizing philosophy, methodology and methods', *Vision*, vol. 19, no. 2, pp. 132-146.

Singh, P & Sullivan, S 2011, *'One million community health workers: technical task force report*', Earth Institute at Columbia University, New York, pp. 304-310.

Singh, R, Mathiassen, L, Stachura, ME & Astapova, EV 2010, 'Sustainable rural telehealth innovation: a public health case study', *Health Services Research*, vol. 45, no. 4, pp. 985-1004.

Singh, R, Lichter, MI, Danzo, A, Taylor, J & Rosenthal, T 2012, 'The adoption and use of health information technology in rural areas: results of a national survey', *Journal of Rural Health*, vol. 28, no. 1, pp. 16-27.

Slaper, MR & Conkol, K 2014, 'mHealth tools for the pediatric patient-centered medical home', *Pediatric Annals*, vol. 43, no. 2, pp. 39-43.

Smith, AC, Armfield, NR, Croll, J & Gray, LC 2012, 'A review of Medicare expenditure in Australia for psychiatric consultations delivered in person and via videoconference', *Journal of Telemedicine and Telecare*, vol. 18, no. 3, pp. 169-171.

Sobnath, DD, Philip, N, Kayyali, R, Nabhani-Gebara, S, Pierscionek, B, Vaes, AW, Spruit, MA & Kaimakamis, E 2017, 'Features of a mobile support app for patients with chronic obstructive pulmonary disease: literature review and current applications', *JMIR mHealth and uHealth*, vol. 5, no. 2, pp. 1-11.

Sofaer, S 1999, 'Qualitative methods: what are they and why use them?', *Health Services Research*, vol. 34, no. 5 pp. 1101-1118.

Sood, RV, Gururajan, R & Hafeez-Baig, A 2016, 'What factors determine healthcare professionals'(HCPs) acceptance of mobile devices for telehealth: a Qualitative study conducted in Queensland, Australia', *Proceedings of Rural and Remote Telehealth at Home*, 5-6 October 2016, Toowoomba, Australia.

Sood, RV, Gururajan, R, Hafeez-Baig, A & Wickramasinghe, N 2016, 'Adoption of mobile devices in the Australian healthcare: a conceptual framework approach', in *Handbook of Research on Healthcare Administration and Management*, IGI Global, pp. 662-685 viewed 1 December 2016, <https://ebookcentral-proquest-com.ezproxy.usq.edu.au/lib/usq/detail.action?docID=4653938>.

Soron, TR 2017, 'Telepsychiatry: from a dream to reality in Bangladesh', *Journal of the International Society for Telemedicine and eHealth*, vol. 5, pp. 1-3.

Spencer, L, Ritchie, J, Lewis, J & Dillon, L 2003, *Quality in qualitative evaluation: a framework for assessing research evidence*, National Centre for Social Research, Cabinet Office, London, pp. 1-18.

Starr, F, Ciclitira, K, Marzano, L, Brunswick, N & Costa, A 2013, 'Comfort and challenge: a thematic analysis of female clinicians' experiences of supervision', *Psychology and Psychotherapy: Theory, Research and Practice*, vol. 86, no. 3, pp. 334-351.

State Government of Victoria n.d., *Telehealth projects* viewed 15 January 2018, <https://www2.health.vic.gov.au/hospitals-and-health-services/rural-health/telehealth/telehealth-projects>.

Stenbacka, C 2001, 'Qualitative research requires quality concepts of its own', *Management Decision*, vol. 39, no. 7, pp. 551-556.

Stone, D 1993, 'Design a questionnaire', *BMJ*, vol. 307, no. 6914, pp. 1264-1266.

Straub, DW 1989, 'Validating questionnaires in MIS research', *MIS Quarterly*, vol. 13, no. 2, pp. 147-169.

Straub, ET 2009, 'Understanding technology adoption: theory and future directions for informal learning', *Review of Educational Research*, vol. 79, no. 2, pp. 625-649.

Sun, J & Qu, Z 2014, 'Understanding health information technology adoption: a synthesis of literature from an activity perspective', *Information Systems Frontiers*, vol. 17, no. 5, pp. 1177-1190.

Tamrat, T & Kachnowski, S 2012, 'Special delivery: an analysis of mhealth in maternal and newborn health programs and their outcomes around the world', *Maternal & Child Health Journal*, vol. 16, no. 5, pp. 1092-1101.

Tan, PJB 2013, 'Applying the UTAUT to understand factors affecting the use of english e-learning websites in Taiwan', *Sage Open*, vol. 3, no. 4, pp. 1-12.

Tang, PC, Ash, JS, Bates, DW, Overhage, JM & Sands, DZ 2006, 'Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption', *Journal of the American Medical Informatics Association*, vol. 13, no. 2, pp. 121-126.

Tangorra, L 2015, *Mobile technology: a new era of telehealth*, viewed 24 December 2016, <http://www.itnonline.com/article/mobile-technology-new-era-telehealth>.

Tavares, J & Oliveira, T 2016, 'Electronic health record patient portal adoption by health care consumers: an acceptance model and survey', *Journal of Medical Internet Research*, vol. 18, no. 3, pp.1-19.

Tavares, J & Oliveira, T 2017, 'Electronic health record portal adoption: a cross country analysis', *BMC Medical Informatics and Decision Making*, vol. 17, no. 1, pp. 1-17.

Tay, I, Garland, S, Gorelik, A & Wark, JD 2017, 'Development and testing of a mobile phone app for self-monitoring of calcium intake in young women', *JMIR mHealth and uHealth*, vol. 5, no. 3, pp. 1-17.

Teddlie, C & Tashakkori, A 2003, *Handbook of Mixed Methods in Social and Behavioral Research*, 2nd edn, Sage Publications, USA.

Teddlie, C & Yu, F 2007, 'Mixed methods sampling a typology with examples', *Journal of Mixed Methods Research*, vol. 1, no. 1, pp. 77-100.

Teddlie, C & Tashakkori, A 2012, 'Common “core” characteristics of mixed methods research a review of critical issues and call for greater convergence', *American Behavioral Scientist*, vol. 56, no. 6, pp. 774-788.

Thabane, L, Ma, J, Chu, R, Cheng, J, Ismaila, A, Rios, LP, Robson, R, Thabane, M, Giangregorio, L & Goldsmith, CH 2010, 'A tutorial on pilot studies: the what, why and how', *BMC Medical Research Methodology*, vol. 10, no. 1, pp. 1-10.

The Scottish Centre For Telehealth and Telecare 2018, *The Scottish Centre For Telehealth and Telecare*, viewed 16 February 2018, <https://sctt.org.uk/>.

Thomas, D, Yao, Y & Guo, X 2014, 'Environment versus partnering experience: an exploration of Chinese healthcare IT manager attitudes toward innovation of services', *Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS)*, 6-9 January, Hawaii, USA, pp. 2741-2750.

Tian, M, Zhang, J, Luo, R, Chen, S, Petrovic, D, Redfern, J, Xu, DR & Patel, A 2017, 'mhealth interventions for health system strengthening in China: a systematic review', *JMIR mHealth and uHealth*, vol. 5, no. 3, pp. 1-14.

Tighe, J, Shand, F, Ridani, R, Mackinnon, A, De La Mata, N & Christensen, H 2017, 'Ibobbly mobile health intervention for suicide prevention in Australian Indigenous youth: a pilot randomised controlled trial', *BMJ Open*, vol. 7, no. 1, pp. 1-10.

Tiong, I, Hafeez-Baig, A, Gururajan, R & Soar, J 2006, 'Preliminary investigation to explore perceptions of security issues associated with wireless technology in healthcare in Australia', *Proceedings of HIC 2006 Bridging the Digital Divide: Clinician, Consumer and Computer, Health Informatics Society of Australia Ltd. (HIC 2006)*, 20-22 August, Sydney, Australia.

Tomlinson, M, Rotheram-Borus, MJ, Swartz, L & Tsai, AC 2013, 'Scaling up mHealth: where is the evidence?', *POLS Medicine*, vol. 10, no. 2, pp. 1-5.

Tong, A, Sainsbury, P & Craig, J 2007, 'Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups', *International Journal for Quality in Health Care*, vol. 19, no. 6, pp. 349-357.

Triantafyllidis, A, Velardo, C, Salvi, D, Shah, SA, Koutkias, V & Tarassenko, L 2015, 'A survey of mobile phone sensing, self-reporting and social sharing for pervasive healthcare', *IEEE Journal of Biomedical and Health Informatics*, vol. 21, no. 1, pp. 218-227.

Trotter, RT 2012, 'Qualitative research sample design and sample size: resolving and unresolved issues and inferential imperatives', *Preventive Medicine*, vol. 55, no. 5, pp. 398-400.

Tsai, H-SA & Kong, E 2013, 'Using electronic and mobile data services in the Australian healthcare sector: the challenges from end-users' viewpoints', *International Journal of Technology, Knowledge and Society*, vol. 9, no. 3, pp. 63-71.

Tsourela, M & Roumeliotis, M 2015, 'The moderating role of technology readiness, gender, and sex in consumer acceptance and actual use of technology-based services', *The Journal of High Technology Management Research*, vol. 26, no. 2, pp. 124-136.

Tuckett, AG 2005, ' Part II Rigour in qualitative research: complexities and solutions', *Nurse Researcher*, vol. 13, no. 1, pp. 29-42.

Turner III, DW 2010, 'Qualitative interview design: a practical guide for novice investigators', *The Qualitative Report*, vol. 15, no. 3, pp. 754-760.

Uddin, J, Biswas, T, Adhikary, G, Ali, W, Alam, N, Palit, R, Uddin, N, Uddin, A, Khatun, F & Bhuiya, A 2017, 'Impact of mobile phone-based technology to improve health, population and nutrition services in Rural Bangladesh: a study protocol', *BMC Medical Informatics and Decision Making*, vol. 17, no. 1, pp. 1-9.

Van Dijk, MR, Oostingh, EC, Koster, MP, Willemsen, SP, Laven, JS & Steegers-Theunissen, RP 2017, 'The use of the mHealth program Smarter Pregnancy in preconception care: rationale, study design and data collection of a randomized controlled trial', *BMC Pregnancy and Childbirth*, vol. 17, no. 1, pp. 1-7.

Van Teijlingen, ER, Rennie, AM, Hundley, V & Graham, W 2001, 'The importance of conducting and reporting pilot studies: the example of the Scottish Births Survey', *Journal of Advanced Nursing*, vol. 34, no. 3, pp. 289-295.

Venkaiah, K, Brahmam, GNV & Vijayaraghavan, K 2011, 'Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations', *Journal of Health Population and Nutrition*, vol. 29, no. 4, pp. 327-338.

Venkatesh, V, Morris, MG & Ackerman, PL 2000, 'A longitudinal field investigation of gender differences in individual technology adoption decision-making processes', *Organizational Behavior and Human Decision Processes*, vol. 83, no. 1, pp. 33-60.

Venkatesh, V, Brown, SA & Bala, H 2013, 'Bridging the qualitative-quantitative divide: guidelines for conducting mixed methods research in Information Systems', *MIS Quarterly*, vol. 37, no. 1, pp. 21-54.

Venkatesh, V, Morris, MG, Davis, GB & Davis, FD 2003, 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, vol. 27, no. 3, pp. 425-478.

Victor, C 2011, 'Healthcare mobile information flow', *Information Services & Use*, vol. 31, no. 1-2, pp. 23-30.
Voelkl, KE & Gerber, SB 1999, U*sing SPSS for Windows: data analysis and graphics*, 2nd edn, Springer, New York.

Vuononvirta, T, Timonen, M, Keinänen-Kiukaanniemi, S, Timonen, O, Ylitalo, K, Kanste, O & Taanila, A 2011, 'The compatibility of telehealth with health-care delivery', *Journal of Telemedicine and Telecare*, vol. 17, no. 4, pp. 190-194.

Wang, A, Redington, L, Steinmetz, V & Lindeman, D 2010, 'The ADOPT model: accelerating diffusion of proven technologies for older adults', *Ageing International*, vol. 36, no. 1, pp. 29-45.

Wang, B, Park, J-Y, Chung, K & Choi, I 2014, 'Influential factors of smart health users according to usage experience and intention to use', *Wireless Personal Communications*, vol. 79, no. 4, pp. 2671-2683.

'War Memorial Hospital: Michigan to deploy JEMS telehealth system across all divisions, specialists,' 2014, *Newswire PR*, 29 July, viewed 20 September 2014 <https://www.prnewswire.com/news-releases/war-memorial-hospital---michigan-to-deploy-jems-telehealth-system-across-all-divisions-specialists-269035221.html>.

Weber, R 2000, 'Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior', *MIS Quarterly*, vol. 24, no. 1, pp. 115-139.

West, D 2012, 'How mobile devices are transforming healthcare', *Issues in Technology Innovation*, vol. 18, no. 1, pp. 1-11.

Westbrook, JI, Coiera, EW, Brear, M, Stapleton, S, Rob, MI, Murphy, M & Cregan, P 2008, 'Impact of an ultrabroadband emergency department telemedicine system on the care of acutely ill patients and clinicians' work', *Medical Journal of Australia*, vol. 188, no. 12, pp. 704-708.

Whittaker, R, Borland, R, Bullen, C, Lin, RB, McRobbie, H & Rodgers, A 2009, 'Mobile phone-based interventions for smoking cessation', *Cochrane Database of Systematic Reviews*, no. 4, pp. 1-17.

WHO 2013, *Health systems strengthening glossary*, viewed 29 January 2016, <http://www.who.int/healthsystems/hss_glossary/en/index5.html>.

Willcox, JC, Campbell, KJ, McCarthy, EA, Wilkinson, SA, Lappas, M, Ball, K, Fjeldsoe, B, Griffiths, A, Whittaker, R, Maddison, R, Shub, A, Pidd, D, Fraser, E, Moshonas, N & Crawford, DA 2015, 'Testing the feasibility of a mobile technology intervention promoting healthy gestational weight gain in pregnant women (txt4two): study protocol for a randomised controlled trial', *Trials*, vol. 16, no. 1, pp. 1-8.

Williams, B, Onsman, A & Brown, T 2010, 'Exploratory factor analysis: a five-step guide for novices', *Australasian Journal of Paramedicine*, vol. 8, no. 3, pp. 1-13.

Winter, G 2000, 'A comparative discussion of the notion of'validity'in qualitative and quantitative research', *The Qualitative Report*, vol. 4, no. 3, pp. 1-16.

Wireless sensor networks markets will be driven by the adoption of 8.5 billion smart phones by 2019 says recent report, 2014, Business Wire, viewed 1 September 2015, <https://www.businesswire.com/news/home/20140130006293/en/Research-Markets-Wireless-Sensor-Networks-Markets-Driven>.

Wong, LP 2008, 'Focus group discussion: a tool for health and medical research', *Singapore Medical Journal*, vol. 49, no. 3, pp. 256-260.

Worringham, C, Rojek, A & Stewart, I 2011, 'Development and feasibility of a smartphone, ECG and GPS based system for remotely monitoring exercise in cardiac rehabilitation', *PLoS ONE*, vol. 6, no. 2, pp. 1-6.

Wu, I-L, Li, J-Y & Fu, C-Y 2011, 'The adoption of mobile healthcare by hospital's professionals: an integrative perspective', *Decision Support Systems*, vol. 51, no. 3, pp. 587-596.

Wu, J-H, Wang, S-C & Lin, L-M 2007, 'Mobile computing acceptance factors in the healthcare industry: a structural equation model', *International Journal of Medical Informatics*, vol. 76, no. 1, pp. 66-77.

Wu, Y, Yao, X, Vespasiani, G, Nicolucci, A, Dong, Y, Kwong, J, Li, L, Sun, X, Tian, H & Li, S 2017, 'Mobile app-based interventions to support diabetes self-management: a systematic review of randomized controlled trials to identify functions associated with glycemic efficacy', *JMIR mHealth and uHealth*, vol. 5, no. 3, pp. 1-18.

Xue, L, Yen, CC, Chang, L, Chan, HC, Tai, BC, Tan, SB, Duh, HBL & Choolani, M 2012, 'An exploratory study of ageing women's perception on access to health informatics via a mobile phone-based intervention', *International Journal of Medical Informatics*, vol. 81, no. 9, pp. 637-648.

Yangil, P & Chen, JV 2007, 'Acceptance and adoption of the innovative use of smartphone', *Industrial Management & Data Systems*, vol. 107, no. 9, pp. 1349-1365.

Yu, P, Li, H & Gagnon, M-P 2009, 'Health IT acceptance factors in long-term care facilities: a cross-sectional survey', *International Journal of Medical Informatics*, vol. 78, no. 4, pp. 219-229.

Yurdugul, H 2008, 'Minimum sample size for Cronbach's coefficient alpha: a Monte-Carlo study', *Hacettepe University Journal of Education*, vol. 35, pp. 397-405.

Zangbar, B, Pandit, V, Rhee, P, Aziz, H, Hashmi, A, Friese, RS, Weinstein, R & Joseph, B 2014, 'Smartphone surgery: how technology can transform practice', *Telemedicine & e-Health*, vol. 20, no. 6, pp. 590-592.

Zapata, BC, Fernández-Alemán, JL, Idri, A & Toval, A 2015, 'Empirical studies on usability of mHealth apps: a systematic literature review', *Journal of Medical Systems*, vol. 39, no. 1, pp. 1-19.

Zhang, M, Luo, M, Nie, R & Zhang, Y 2017, 'Technical attributes, health attribute, consumer attributes and their roles in adoption intention of healthcare wearable technology', *International Journal of Medical Informatics*, vol. 108, pp. 97-109.

Zhang, MWB & Ho, RCM 2015, 'Enabling psychiatrists to explore the full potential of e-health', *Frontiers in Psychiatry*, vol. 6, no. 177, pp. 1-3.

Zhao, Y, Ni, Q & Zhou, R In Press, 'What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age', *International Journal of Information Management*.

Zikmund, WG 2010, *Business research methods*, 8th edn, South-Western, Mason, Ohio.

Zinszer, K, Tamblyn, R, Bates, DW & Buckeridge, DL 2013, 'A Qualitative study of health information technology in the Canadian public health system', *BMC Public Health*, vol. 509, no. 13, pp. 1-7.

List of Appendices

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Appendix 2. 1 : Summary of worldwide mobile devices adoption scenario in healthcare

No	*Country, Methods and Authorship*	*Research objective*	*Results*	*Future*
1.	-Australia -Pilot randomised controlled trial (Tighe et al. 2017)	To evaluate the effectiveness of a self-help mobile app (ibobbly), targeting suicidal ideation, depression, psychological distress and impulsivity among Indigenous youth in remote Australia.	Applications for suicide prevention reduce distress and depression but do not show significant reductions in suicide ideation or impulsivity.	A feasible and acceptable means of lowering symptoms for mental health disorders in remote communities is via appropriately designed self-help apps.
2.	-Australia -Training and follow up consultation session (Bennett-Levy et al. 2017)	To report barriers and enablers of e-Mental Health (e-MH) uptake among health professionals	Organisational barriers for e-Mental health uptake are: administrative procedures, administrative problems, demanding workload, policies and lack of fit between organisational culture and new technology. Personal barriers for adoption of e-Mental health are: participants' beliefs about the applicability of e-Mental health to certain population and workers' lack of confidence and skills.	In future the emphases can be placed on expanding the focus of e-MH rather than focussing only on educational possibilities.
3.	-Australia -The Calci-app is developed in four steps: conceptualization, development and pretesting, pilot testing and mixed method evaluation (Tay et al. 2017)	To develop and test the usability and acceptability of Calci-app which is a dietary app to monitor the consumption of calcium intake among women aged 18-35	Calci-app was found to be easy and convenient to use but it was time consuming and participants expressed a lack of motivation to use it	The feedback from this research will be used to design an m-health intervention for better bone health in young women.
4.	-Netherlands -Trial (Van Dijk et al. 2017)	In this research a mobile app named: 'smart pregnancy' was developed to provide coaching to couples to improve their health during the preconception period	This study results indicated an improvement in unhealthy life style and reduction in smoking in women and men contemplating pregnancy. Also both men and women trusted the application.	The researchers claimed that the 'smart pregnancy' application will be useful in providing preconception care.
5.	-USA -To develop the application eight steps process was used (Coughlin et al. 2017)	This was a 12 month project aimed to develop and test a smartphone breast cancer application	This app will be beneficial for users to connect and sync with their "Fitbit" and "Lose it" to access information from one portal	Future directions will include testing the efficacy of the m-health intervention in increasing physical activity, improving diet and nutrition, and weight management through a randomized controlled trial, and widespread dissemination and implementation research.

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No	Country, Methods and Authorship	Research objective	Results	Future
6.	-This is a literature review article of reviewed literature from various countries (Rehman et al. 2017b)	To evaluate the effectiveness of m-health interventions in the management of hypertension and hyperlipidaemia	There are many research studies on m-health intervention in hypertension but limited studies in hyperlipidaemia. Test messaging was explored as the most frequent use in this research but now the trend is changing to mobile phone applications and wireless devices. Most of the m-health interventions in developing countries have been designed to fulfil the needs of local settings and indicated positive outcomes.	Future research requires evaluating the role of m-health in the management of hyperlipidaemia management. Also, studies assessing the long-term impact of m-health interventions, comparing different interventions and analysing their relative cost effectiveness, are also needed.
7.	-China -Literature review (Tian et al. 2017)	To evaluate m-health initiatives in China, characterise them and determine the contribution of m-health in strengthening the health system in China	Most m-health interventions in China are mainly used for text messaging for consumer education and behaviour change. Most of the m-health interventions were insufficient in scope and inadequate to generate scalable solutions. In China's health system there were limited numbers of m-health based interventions that were based on health information management, health workforce issues, use of medicine, technology, leadership and governance.	Future studies in the Chinese health system should not focus on evaluation of technology use in the social context. Future studies should focus on evaluating m-health intervention used to reduce the inequalities among the population, develop the m-health interventions to serve the existing health system and evaluate large-scale real world m-health interventions focussed on strengthening the health system.
8.	-Maharashtra, India -Semi structured questionnaire (Sharma, Shinde & Kar 2017)	This study focussed on determining the use of SMS by recipients of MCTS (mother and child tracking system) MCTS is a surveillance system launched by the government of India in 2009, which is used to care for pregnant women and children up to five years of age.	The result of this research showed that a limited percentage of only 17% of respondents had heard of, and only 14% received text message from the MCTS system. Also, use of local language in SMS has an advantage over English language.	In future, awareness is required to use SMS for MCTS recipients. Text messages in a local language have an advantage over the English language at the community level.
9.	- Andhra Pradesh, India -Combine interviews with focus group discussions, ethnographic conversation and observation (Nahar et al. 2017)	Aimed to assess medical treatment, adult use of mobile phones in their daily life and uptake of m-health initiatives for type 2 diabetes and depression	This research explored different pathways: to care for diabetes and depression patients. There is limited use of mobile phones by the majority of older people in rural populations Uptake of m-health initiative for type 2 diabetes and depression is difficult. Promotion of patient self-management in India is too early.	-------
10.	- India -Survey (Imtiaz et al. 2017)	To investigate the effectiveness, efficiency and cost gains through an Android based tablet application: Sankara Electronic Remote Vision Information System (SERVIS)	The SERVIS application is cost effective and efficient to prevent blindness and visual impairment.	In future the SERVIS application will be helpful to plan blindness prevention initiatives in India

Appendix 2.1: Continued from previous Page 324

No	Country, Methods and Authorship	Research objective	Results	Future
11.	-Bangladesh -Quasi experiments (Uddin, Biswas, Adhikary, Ali, Alam, Palit, Uddin, Uddin, Khatun & Bhuiya 2017)	To develop and test a mobile phone based system.	Results are not yet available.	The experiences from these research studies can be used in other similar settings in low and middle income countries
12.	-Bangladesh -Pilot study (Rahman et al. 2017)	To evaluate the effectiveness of an online Blood Information Management Application (BIMA)	It was observed that after the introduction of BIMA, the time lag between the identified need for blood and transfusion was reduced by 24 minutes.	Implementation of BIMA has the potential to streamline a blood transfusion system in Bangladesh
13.	-U.K., New Zealand and Australia -Online survey (Chen et al. 2017)	To evaluate health applications and test messaging in dietetic practice	Health apps in dietetic practice are used for information resources and patients self-monitoring. The main applications used are MyFitPal and FODMAP Diet. Text messaging was used for appointment purposes.	m-health technology is not used for behaviour change and is not an integral part of the nutrition care process. Training, education and advocacy is required to use mobile technology in dietetic practice.
14.	-Literature review on chronic obstructive pulmonary disease (COPD) apps (Sobnath et al. 2017)	To identify any missing information to evaluate the effectiveness of COPD mobile apps	Out of the 20 apps downloaded, 13 had an education section, 5 consisted of medication and guidelines, 6 included a calendar or diary and other features such as reminders or symptom tracking.	The features identified from the literature and from the apps can be considered in the initial design of an integrated care system for the WELCOME European Union project to fill the missing links of a COPD support tool.
15.	-Review of qualitative studies (Lyzwinski et al. 2017)	Aimed to identify common themes after reviewing the studies focussed on user preference for m-health intervention for weight loss	Key optimization themes for weight loss apps were: personalization, simplicity with appeal and engagement/entertainment. Common benefits of m-health for weight loss apps were: self-monitoring, goal setting, feedback, ability to motivate, educate, and remind. Common barriers identified were: technological and psychological issues as well as message overload/inappropriate timing of messages. When planning a m-health weight loss intervention, critical factors are: the message tone, structure and the frequency of message delivery. Designing simple apps while still ensuring that they engage the user is also essential. Additionally, it seems important to tailor the content in accordance with different target group demographic preferences	Future research can consider the results of this study when planning to design an application for weight loss and can also conduct exploratory research with their target group.
16.	-Literature review (Feigin, Norrving & Mensah 2017)	To overview the gaps in, pros and cons for, population-wide and high-risk prevention strategies for prevention of Cardio Vascular Disease (CVD).	Increased use of smartphone technologies would bridge the gap in population-wide high risk stroke/CVD prevention strategies.	For effective primary stroke prevention the focus should be shifted from high-risk prevention to prevention at any level of CVD risk, with the focus on behavioural risk factors.

Appendix 2.1: Continued from previous Page 325

No	Country, Methods and Authorship	Research objective	Results	Future
17.	-Latin -Survey (Arora, Ford, Terp, Abramson, Ruiz, Camilon, Coyne, Lam, Menchine & Burner 2016)	To describe the change in mobile technology used from 2011-2014 in Latin and compare the results with the national estimate.	Patients with chronic diseases have reduced access to mobile devices. Published national estimates do not accurately reflect the mobile technology use of Latino patients.	--------
18.	-Taiwan -Survey (Sezgin, Özkan-Yildirim & Yildirim 2016)	To explore physician's perceptions about using mobile health applications in practice and identify influential factors to use mobile technology	The most influencial factors for physicians' acceptance of mobile technology in Taiwan are: effort expectancy, mobile anxiety, perceived service availability, technical training and support.	-------
19.	-United States -Randomised control trial (daily diary, interview and survey) (Rabbi, Pfammatter, Zhang, Spring & Choudhury 2015)	To investigate the technical feasibility, impact of suggestions on users' physical activity and eating behaviour, and user perceptions of automatically generated suggestions on MyBehavior app.	Mybehaviour was an effective app to improve the physical activities and eating behaviour of individuals.	The suggestion for future improvement was: provide an easier logging mechanism for food and exercise. Future research can focus on improving the shortcomings of this app and then testing how health behaviours change in a larger longitudinal trial.
20.	-Sydney, Australia -Randomised control trial (Chow et al. 2015)	Aimed to evaluate the effect of the Tobacco, Exercise and Diet Message (TEXT ME) mobile phone based application on cardiovascular disease	Most of the participants reported that the TEXT ME app was useful, easy to understand and appropriate in frequency.	In future, the effectiveness of this intervention can be studied with a larger number of patients.
21.	-Melbourne, Australia -Pilot randomised control trial (Willcox et al. 2015)	Aimed to test the feasibility of m-health intervention: test4two for pregnant women who begin pregnancy overweight or obese	The primary outcome of the research will be feasibility of the app and the secondary outcome will be gestational weight gain and participant's knowledge and behaviour regarding diet and physical activities.	Findings will be useful for the development of a larger scale m-health program for pregnant women
22.	-Africa -Systematic Literature review (Aranda-Jan, Mohutsiwa-Dibe & Loukanova 2014)	Review strengths, weaknesses, opportunities and threat (SWOT) of m-health projects in Africa	m-health projects have positive health related outcomes in Africa. Success of m-health projects depends on: acceptance and low cost of technology, effective adaptation to local context, strong stakeholder collaboration and government involvement. Threat to m-health projects are: funding, unclear health system responsibilities, unreliable infrastructure and lack of evidence on cost effectiveness challenges.	Future research is required to scale up m-health projects.
23.	-Australia -Pilot randomised control trial (Hebden et al. 2014)	To measure the effect of 12 weeks mobile health intervention.	The m-health intervention shows positive changes in weight, nutrition and physical activities using low cost convenient delivery methods for participants.	For this application to be effective, then further research needs to be conducted on assessing the practical aspects on how this intervention can be made available to broader communities.

Appendix 2.1: Continued from previous Page 326

No	Country, Methods and Authorship	Research objective	Results	Future
24.	-Australia -Randomised control trial (Shand et al. 2013)	To examine the effectiveness of a mobile phone based self-help app for suicide prevention.	The outcome would be reduction of the intensity and frequency of suicidal thoughts, depression, anxiety and impulsivity.	-------
25.	-Shri Lanka -Randomised control trial (Marasinghe et al. 2012)	To test the outcome of Brief Mobile Treatment (BMT) intervention among suicide attempters.	The BMT intervention reduced the suicide ideation and depression among the participants.	In future, the research can be conducted to see whether the group who did not receive mobile phones or call credit had a similar decline in the suicide ideation and depression symptoms.

Appendix 2. 2: List of various Health Information Technology adoption factors

Contexts	Factors	References
Individual context factors	Age	(Yangil & Chen 2007; Tavares & Oliveira 2016; Zhao, Ni & Zhou In Press; Bawack & Kala Kamdjoug 2018)
	Attitude	(Yangil & Chen 2007; Bawack & Kala Kamdjoug 2018)
	Culture	(Peddle 2007; Bradford et al. 2014)
	Experience	(Morilla et al. 2017; Yu, Li & Gagnon 2009; Kay 2011; Yangil & Chen 2007; Kargin & Basoglu 2006)
	Gender	(Hoque, Bao & Sorwarb 2017; Zhang et al. 2017)
	Hedonic motivation/Motivation	(Tavares & Oliveira 2017; Tay et al. 2017)
	Individual personality	(Honka et al. 2011)
	Individual psychological state	(Wu, Li & Fu 2011)
	Intention	(Tavares & Oliveira 2017; Wu, Wang & Lin 2007; Yangil & Chen 2007; Deng, Mo & Liu 2013; Hoque, Bao & Sorwarb 2017; Hoque & Sorwar 2017; Mun et al. 2006; Alaiad & Zhou 2014; Tsourela & Roumeliotis 2015)
	Initial data entry is too labour intensive	(Singh et al. 2012)
	Initial loss of productivity while converting all paper based work to electronic records	(Singh et al. 2012)
	Lack of skills	(Bennett-Levy et al. 2017)
	Linguistic	(Bradford et al. 2014)
	People	(Tsai & Kong 2013)
	Patients' acceptance of technology	(Huq, Maeder, Basilakis & Pirnejad 2015)
	Personal traits	(Yangil & Chen 2007)
	Education	(Yangil & Chen 2007)
	Resistance to change	(Hoque & Sorwar 2017)
	Self-actualization needs	(Deng, Mo & Liu 2013)
	Self-efficacy/Confidence	(Bennett-Levy et al. 2017; Wu, Wang & Lin 2007; Deng, Mo & Liu 2013; Mun et al. 2006; Wu, Li & Fu 2011; Gagnon et al. 2016; Yangil & Chen 2007; Lin & Bautista 2017)
	Social influences	(Tavares & Oliveira 2017; Yu, Li & Gagnon 2009; Honka et al. 2011; Tiong et al. 2006; Hoque & Sorwar 2017; Mun et al. 2006; Wu, Li & Fu 2011; Ajzen 1988; Alaiad & Zhou 2014; Tsourela & Roumeliotis 2015; Bawack & Kala Kamdjoug 2018)
	Technology anxiety/Mobile anxiety	(Deng, Mo & Liu 2013; Sezgin, Özkan-Yildirim & Yildirim 2016; Hoque & Sorwar 2017)
	Training burden for physicians and staff	(Singh et al. 2012)
Usage context factors	Compatibility/Lack of fit between the organisational culture and technology	(Hafeez-Baig & Gururajan 2010; Wu, Wang & Lin 2007; Castro, Miller & Nager 2014; Daim, Basoglu & Topacan 2013; Bennett-Levy et al. 2017; Lin & Bautista 2017)
	Complexity/Perceived ease of use/ Effort expectancy	(Tavares & Oliveira 2017; Yangil & Chen 2007; Yu, Li & Gagnon 2009; Tiong et al. 2006; Huq et al. 2015; Tay et al. 2017; Wu, Wang & Lin 2007; Daim, Basoglu & Topacan 2013; Castro, Miller & Nager 2014; Hoque, Bao & Sorwarb 2017; Sezgin, Özkan-Yildirim & Yildirim 2016; Hoque & Sorwar 2017; Mun et al. 2006; Wu, Li & Fu 2011; Lin & Bautista 2017; Tsourela & Roumeliotis 2015; Bawack & Kala Kamdjoug 2018)
	Ethical concerns	(Alaiad & Zhou 2014)
	Observability	(Yangil & Chen 2007; Lin & Bautista 2017)
	Relative advantages/Performance expectancy/Perceived usefulness/Outcome	(Morilla et al. 2017; Tavares & Oliveira 2017; Yangil & Chen 2007; Yu, Li & Gagnon 2009; Hafeez-Baig, Gururajan, Mula & Lin 2009; Tiong et al. 2006; Huq et al. 2015; Kim et al. 2016; Wu, Wang & Lin 2007; Daim, Basoglu & Topacan 2013; Hoque, Bao & Sorwarb 2017; Hoque & Sorwar 2017; Lin & Bautista 2017; Alaiad & Zhou 2014; Tsourela & Roumeliotis 2015; Bawack & Kala Kamdjoug 2018)
	Setting up equipment	(Bradford et al. 2014)
	Trialability	(Yangil & Chen 2007; Lin & Bautista 2017)
	Trust	(Peddle 2007; Hoque, Bao & Sorwarb 2017; Alaiad & Zhou 2014)
	User context	(Peddle 2007)

Appendix 2.2: Continued from previous Page 328

Contexts	Factors	References
Technological context factors	Design user friendly and relevant technology	(Wang et al. 2010)
	Usernames and passwords	(Bradford et al. 2014)
	Design and technical concerns	(Kim et al. 2016; Gagnon et al. 2016; Boruff & Storie 2014)
	Network issues	(Parliamentary Committees 2014)
	Perceived privacy	(Peddle 2007; Hoque, Bao & Sorwarb 2017; Gagnon et al. 2016; Alaiad & Zhou 2014)
	Perceived security	(Peddle 2007; Hoque, Bao & Sorwarb 2017; Gagnon et al. 2016)
	Perceived service availability	(Sezgin, Özkan-Yildirim & Yildirim 2016; Wu, Li & Fu 2011)
	Perceived value	(Deng, Mo & Liu 2013)
	Pervasiveness	(Wu, Li & Fu 2011)
	Quality of information presented	(Daim, Basoglu & Topacan 2013)
	Quality of video call	(Bradford et al. 2012)
	Technology updates	(Heidarian & Mason 2013)
	Time consuming	(Tay et al. 2017)
	Usage time	(Daim, Basoglu & Topacan 2013)
Organisational context factor	Accreditation status	(Furukawa et al. 2008)
	Administrative demand	(Kay 2011; Bennett-Levy et al. 2017)
	Administrative procedures	(Bennett-Levy et al. 2017)
	Administrative problems	(Bennett-Levy et al. 2017)
	Applicability of technology	(Bennett-Levy et al. 2017)
	Appropriate funding	(Morilla et al. 2017)
	Appropriate technology	(Morilla et al. 2017)
	Clinical practices	(Hafeez-Baig & Gururajan 2010)
	Create a business model	(Wang et al. 2010)
	Demanding workload	(Bennett-Levy et al. 2017)
	Equipment integration	(Heidarian & Mason 2013)
	Establishing clinical standards	(Tang, Ash, Bates, Overhage & Sands 2006)
	Establish technology value	(Wang et al. 2010)
	Facilitating conditions	(Tsourela & Roumeliotis 2015; Bawack & Kala Kamdjoug 2018(Tiong, Hafeez-Baig, Gururajan & Soar 2006))
	Feedback from and evaluation of ongoing programs	(Tamrat & Kachnowski 2012)
	Form partnerships	(Wang et al. 2010)
	Hospital geographic environment	(Gagnon et al. 2005)
	Hospital size/Organisation size	(Furukawa et al. 2008; Gagnon et al. 2005; Yangil & Chen 2007)
	Identify technology champions	(Wang et al. 2010)
	Image accessibility	(Daim, Basoglu & Topacan 2013)
	Infrastructure	(Kay 2011)
	Incentive	(Parliamentary Committees 2014)
	Insurance coverage	(Castro, Miller & Nager 2014)
	Lack of remuneration	(Parliamentary Committees 2014)
	Lack of staff	(Bradford et al. 2014)
	Lack of time for implementation	(Heidarian & Mason 2013)
	Look for an EHR with clinical decision support capabilities	(Tang et al. 2006)
	Legal	(Kay 2011; Tsai & Kong 2013)
	Management	(Tsai & Kong 2013; Parliamentary Committees 2014)
	Ownership	(Furukawa et al. 2008)
	Payer mix	(Furukawa et al. 2008)
	Policies	(Zinszer et al. 2013; Peddle 2007; Parliamentary Committees 2014; Bennett-Levy et al. 2017; Kay 2011)
	Process of implementation of technology	(Bernstein, McCreless & Cote 2007)
	Price/Cost/Finance	(Heidarian & Mason 2013; Kay 2011; Tavares & Oliveira 2017; Castro, Miller & Nager 2014; Singh et al. 2012)
	Priorities	(Kay 2011)
	Process	(Tsai & Kong 2013)
	Promote technology	(Wang et al. 2010)

Appendix 2.1: Continued from previous Page 329

Contexts	Factors	References
Organisational context factor	Standard of care	(Castro, Miller & Nager 2014)
	Significance of end user involvement	(Bernstein, McCreless & Cote 2007)
	Socio political environment	(Gagnon et al. 2005)
	Social variations	(Bradford et al. 2014)
	Standardisation of applications	(Haffey, Brady & Maxwell 2013)
	State licence requirements	(Castro, Miller & Nager 2014)
	Support (management)	(Sezgin, Özkan-Yildirim & Yildirim 2016)
	Supportive leadership	(Bernstein, McCreless & Cote 2007)
	System membership	(Furukawa et al. 2008)
	Talk to clinicians early	(Tang et al. 2006)
	Teaching status	(Furukawa et al. 2008)
	Timely usages	(Wu, Li & Fu 2011)
	Training	(Parliamentary Committees 2014; Sezgin, Özkan-Yildirim & Yildirim 2016; Wang et al. 2010; Morilla et al. 2017; Bennett-Levy et al. 2017; Chang et al. 2013; Agarwal et al. 2015)
	Usability of technology	(Huq et al. 2015)
	Use of project management	(Bernstein, McCreless & Cote 2007)
	Proper use and maintenance of the IT budget	(Bernstein, McCreless & Cote 2007)
	Quality of services	(Daim, Basoglu & Topacan 2013)
	Quality of support	(Daim, Basoglu & Topacan 2013)
	Return on investment issues	(Singh et al. 2012)
	Resource issues	(Gagnon et al. 2016)

Appendix 3. 1: Various research methodologies used in the HIT adoption literature

No	Method	Participants and Technology	Country	Authorship
1.	Literature review and survey	• Medical directors • Telehealth	Canada Quebec	(Gagnon et al. 2005)
2.	Qualitative	• Clinicians • Wireless technology	Australia	(Tiong et al. 2006)
3.	Qualitative	• Physicians, nurses, administrators and administrative assistants • Telehealth	Canada	(Peddle 2007)
4.	Quantitative	• Medical doctors and nurses • Smartphone	USA	(Yangil & Chen 2007)
5.	Quantitative	• HCPs (medical directors and chief of information system) • Mobile computing	Taiwan	(Wu, Wang & Lin 2007)
6.	Quantitative	• Korean university employees • Mobile wireless technology	Korea	(Kim & Garrison 2008)
7.	Meta-analysis (systematic literature review)	• Health information technology (HIT)	US	(Furukawa et al. 2008)
8.	Meta- analysis	• Literature review • Home-tele monitoring	------	(Wang et al. 2010)
9.	Qualitative Longitudinal study (case study)	• HCPs • Telehealth	Georgia	(Singh et al. 2010)
10.	Mixed methodology	• HCPs • Wireless handheld devices	Australia	(Hafeez-Baig & Gururajan 2010)
11.	Quantitative	• Hospital professionals • Mobile healthcare	Taiwan	(Wu, Li & Fu 2011)
12.	Qualitative	• People who declined to participate in the trial and who withdrew from the intervention Telehealth and tele care	UK	(Sanders et al. 2012)
13.	Quantitative (Survey)	• Rural health officers • Adoption of electronic health record	New York	(Singh et al. 2012)
14.	Meta-analysis (systematic literature review)	• HCPs • Information communication technology (ICT)	------	(Gagnon et al. 2012)
15.	Mixed methodology (Semi- structured interview and survey)	• Optometrist • HIT	New Zealand	(Heidarian & Mason 2013)
16.	Qualitative (case study)	• Senior professionals and administrators • HIT	Canada	(Zinszer et al. 2013)
17.	Mixed methodology (interview, analytic hierarchy study, pilot study , experimental study)	• Diabetic and obesity patients • Wireless service protocol used in e-Health	Turkey	(Daim, Basoglu & Topacan 2013)

Appendix 3. 2: Continued from previous Page 331

No	Method	Participants and Technology	Country	Authorship
18.	Research model is proposed. Further data will be collected using semi-structured interviews and questionnaires	• The people who have earlier experienced MyHealthPortal • MyHealthPortal	Malaysia	(Saad, Alias & Ismail 2013)
19.	Quantitative	• Middle aged and older people • M-health	China	(Deng, Mo & Liu 2013)
20.	Quantitative (Surveys)	• IT manager • Mobile and Internet technologies	China	(Thomas, Yao & Guo 2014)
21.	Report on Telehealth services	• Telehealth	US	(Castro, Miller & Nager 2014)
22.	Qualitative	• Palliative care clinicians • Telehealth	Royal Children's Hospital Brisbane Queensland Australia	(Bradford et al. 2014)
23.	Developmental (A urinary tract infection surveillance was developed)	• Electronic medical record	Taiwan	(Lo, Lee, Chen & Liu 2014)
24.	Pilot study used qualitative method (one on one in depth interview) to test the 'LabPush' system	• Health professionals • 'LabPush' system in mobile devices	Swaziland Africa	(Hao et al. 2015)
25.	Systematic literature review	• HCPs • M-health	-----	(Gagnon et al. 2016)
26.	Online survey	• Young adults • m-health apps	Korea	(Cho 2016)
27.	Online survey tool	• Physicians (i.e. general practitioners, specialist and medical practitioners) • m-health	Turkey	(Sezgin, Özkan-Yildirim & Yildirim 2016)
28.	A face-to-face structured questionnaire survey method was used to collect data.	• Elderly users' • m-health	Bangladesh	(Hoque & Sorwar 2017)
29.	Online survey (597)	• People who provide education and research services • Electronic health record	US and Portugal	(Tavares & Oliveira 2017)

Appendix 4. 1: Qualitative study Discussion Questions Guide

Discussion Questions Guide

It is expected that this project will not directly benefit you. However, it may benefit to the healthcare domain. It will provide better understanding of the importance of using mobile devices in healthcare, which will help to improve communication tools used in the healthcare environment. Improved communication tools can lead to high quality of care, reduced workload of healthcare professionals and can bridge time and distance barriers between doctors and patients, lower the cost of healthcare system and can save the travelling time of the patients. This research will also help to reform policies for using mobile devices in primary care in the Australian healthcare context.

- Time for this session is approximately 40-50 minutes.
- This session will be audio recorded and the researcher will also take some written notes of your discussion because all the information provided by you is important to the researcher.
- No-one will be able to identify your personal responses. Anonymised data will be used for research.
- This session is about to know your experiences or perception about the use of mobile devices in healthcare.
- Participation in this session is voluntary. You are free to end this session at any time.

Part I

1. Can you please tell me your intention in regard to the use/ adoption of mobile devices in healthcare? Do you want to use mobile devices such as smartphone and tablets in the Telehealth event for example remote monitoring and consultation with patients?
2. What do you think about your readiness for the adoption of mobile devices in healthcare event? If mobile devices are available to use in your hospital do you think you are ready to use them in Telehealth?
3. What features of mobile devices do you think may affect their use/adoption in Telehealth?
4. What is your perception about the complexity level for the use of mobile devices in Telehealth? Do you think mobile devices are too difficult to use in Telehealth event events such as remote monitoring and consultation with patient?
5. Do you think you may be influenced by your social circle for adoption/use of mobile devices in Telehealth? Do you think you will use mobile devices in healthcare event such as remote monitoring and consultation with patient if your friends will be using them?
6. Do you think use of mobile devices will be compatible with the ways you used to work with in Telehealth environment? Do you think there will be drastic change in your style of working by using mobile devices in Telehealth?
7. Do you think you would be confident to use mobile devices in Telehealth?
8. Do you think there are some advantages of using mobile devices in Telehealth?
9. Are there any other factors which may influence to use adoption of mobile devices in the Telehealth environment?

Appendix 4. 2: Consent Form for Focus Group

Project Details		
Title of Project:	Study to investigate factors influencing adoption of mobile devices in the healthcare environment.	
Human Research Ethics Approval Number:	H15REA142	
Research Team Contact Details		
Principal Investigator Details	Other Investigator/Supervisor Details	
Mrs. Vasundhara Rani Email: Vasundhara.Rani@usq.edu.au Telephone: Mobile: 0450418371	Professor Raj Gururajan Email: raj.gururajan@usq.edu.au Telephone: +61 7 3470 4539 Mobile:	
Statement of Consent		

By signing below, you are indicating that you:

- Your participation in this project is entirely voluntary.
- If you do not wish to take part you are not obliged to.
- If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.
- Have read and understood the information document regarding this project.
- Have had any questions answered to your satisfaction.
- Understand that if you have any additional questions you can contact the research team.
- Understand that the focus group will be audio recorded.
- Understand that you are free to withdraw at any time, without comment or penalty.
- Understand that you can contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au if you do have any concern or complaint about the ethical conduct of this project.
- Are over 19 years of age
- Agree to participate in the project.

Please provide your personal details by checking the appropriate box and sign off the consent form.

1. **What type of organization you are working in?** □Private hospital □Public hospital □Others please specify------
2. **What is your job position:** □Doctors □ Nurse □Others please specify------
3. **How long have you been working in the healthcare domain?** □Less than 2 years □3–10 years □More than 10 years
4. **Have you been using smartphone or tablet in Healthcare environment?** □Yes (if yes please proceed to question 6) □No (if no please proceed to question 7)
5. **How long you have been using smartphone or tablet in Healthcare environment:** □Less than 2 years □3–10 years □More than 10 years

6. **Have you been using any kind of mobile technology in Healthcare environment?** □Yes (if yes please proceed to question 8) □No (if no please proceed to question 9)
7. **What kind of mobile technology you are using in the healthcare environment? If possible please write the name and short description**

    ____

    ____
8. **How long you have been using any kind of mobile technology in Healthcare environment:** □Less than 2 years □3–10 years □More than 10 years
9. **Gender:** □Female □Male
10. **Age:** □below30 years old □31–40 years old □41–50 years old □51 or more than 51 years old

Participant Name:

Participant Signature:

Date:

Please return this sheet to a Research Team member prior to undertaking the focus group.

Appendix 4. 3: Sample of Participant Information Sheet used for qualitative data collection

Participants Information Sheet for Group Discussion

Project Details		
Title of Project:	Study to investigate factors influencing adoption of mobile devices in the healthcare environment.	
Human Research Ethics Approval Number:	H15REA142	
Research Team Contact Details		
Principal Investigator Details	Supervisor Details	
Mrs. Vasundhara Rani Email: Vasundhara.Rani@usq.edu.au Telephone: Mobile: 0450418371	Professor Raj Gururajan Email: raj.gururajan@usq.edu.au Telephone: +61 7 3470 4539 Mobile:	
Description		

This project is being undertaken as part of a Doctor of Philosophy.

The purpose of this project is to understand healthcare professionals including doctors and nurses perception about the use of mobile devices in the healthcare environment.

This research will not have direct benefits to the participants. However, the finding of this research will be useful in healthcare domain. The findings of this research will be useful to improve communication among healthcare professionals and patients. As using the results of this research developers/designers and IT professionals and software engineers (who develop Information Communication Tools for healthcare) can improve the design of communication devices such as iPad and smart phones used in the healthcare domain. Improved mobile devices in healthcare can lead to high quality of care, reduced workload of healthcare professionals and can bridge time and distance barriers between doctors and patients. Moreover, health care policy makers can redesign their policies to implement or use mobile devices in healthcare by considering the findings of this research.

The research team requests your assistance because you meet the study criteria and can provide data which is important in this research.

Consolidated summary (not identifying participant's identity) of focus group discussions will be available to participants upon request. If participants like they can request consolidated summary from the principal investigator: Vasundhara.Rani@usq.edu.au.

Participation

Your participation will involve contributing your thoughts and ideas in a group discussion (focus group) that will take approximately 60 minutes of your time.

It is anticipated that the focus group discussion will take place at the Toowoomba Base Hospital in central hall and the Prince Charles Hospital Brisbane in the month of November/December 2015 (tentative date). The researcher may go for other sites in

Queensland if desired number of responses will not be collected. In focus group discussion each participant will discuss their views for each question.

Questions will include:

1. Can you please tell me your intention in regard to the use/ adoption of mobile devices in remote monitoring and consultation? Do you want to use mobile devices such as smartphone and tablets in remote monitoring and consultation with patients?
2. What do you think about your readiness for the adoption of mobile devices in healthcare? If mobile devices are available to use in your hospital do you think you are ready to use them for remote monitoring and consultation with patients?
3. What features of mobile devices do you think may affect their use/adoption in healthcare in remote monitoring and consultation with patient?
4. What is your perception about the complexity level for the use of mobile devices in healthcare? Do you think mobile devices are too difficult to use in remote monitoring and consultation with patient?
5. Do you think you may influence by your social circle for adoption of mobile devices in healthcare? Do you think you will use mobile devices in remote monitoring and consultation with patient if you friends will be using them?
6. Do you think use of mobile devices will be compatible with face to face monitoring and consultation? Do you think there will be drastic change in your style of working by using mobile devices in remote monitoring and consultation with patients?
7. Do you think you would be confident to use mobile devices in healthcare?
8. Do you think there are some advantages of using mobile devices in healthcare?
9. Are there any other factors which may influence to use adoption of mobile devices in healthcare for remote monitoring and consultation with patients?

Focus group will be audio recorded and during discussion session principal researcher will also take written notes. A copy of recording which will not contain any information identifying the participants will be used for transcription.

Your participation in this project is entirely voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. However, you will be unable to withdraw the data collected about yourself after you have participated in the focus group. If you wish to withdraw from the project, please contact the Research Team (contact details are given at the top of this form).

You will have at least two weeks to decide whether to take part or do not take part in this research. Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland, the research team and with your hospital. This research study is for 3 years (03/05/2015 to 02/03/2017). Participants' involvements in this research is for five months (30/10/2015 to 01/03/2016).

Expected Benefits

It is expected that this project will not directly benefit you. However, it may benefit to healthcare domain. It will provide better understanding of the importance of using mobile devices in healthcare, which will help to improve communication tools used in healthcare domain. Improved communication tools such as mobile devices in healthcare can lead to high quality of care, reduced workload of healthcare professionals and can bridge time and distance barriers between doctors and patients, lower the cost of healthcare system and can save the travelling time of the patients. This research will also help to reform policies for using mobile devices in primary care in the Australian healthcare context.

Risks

There are minimal risks associated with your participation in this project. The only risk is time imposition. However, participants will be given full freedom to withdraw at any time from this research.

Privacy and Confidentiality

All comments and responses will be treated confidentially unless required by law.

Any data collected as a part of this project will be stored securely as per the University of Southern Queensland's Research Data Management policy.

Consent to Participate

We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate in this project. Please return your signed consent form to a member of the Research Team prior to participating in your focus group discussion.

We reassure that participation in this research is voluntary. Your decision whether you take part, do not take part, or to take part and then withdraw, will in no way impact your current or future relationship with the University of Southern Queensland, research team and with your hospital.

Questions or Further Information about the Project

If you have any questions regarding this project please do not hesitate to contact principal investigator or supervisor.

Concerns or Complaints Regarding the Conduct of the Project

This study has been reviewed and approved by the Royal Brisbane & Women's Hospital Human Research Ethics Committee (EC00172). Should you wish to discuss the study in relation to your rights as a participant, or should you wish to make an independent complaint, you may contact the Coordinator or Chairperson, Human Research Ethics Committee, Royal Brisbane & Women's Hospital, Herston, Qld, 4029 or telephone (07) 3646 5490, email: RBWH-Ethics@health.qld.gov.au"

Further, you may also contact the University of Southern Queensland Ethics Coordinator on (07) 4631 2690 or email ethics@usq.edu.au. The Ethics Coordinator is not connected with the research project and can facilitate a resolution to your concern in an unbiased manner.

Appendix 6. 1: Sample of the Pretesting questions

No	Pre evaluation questions	Yes	No
1	Is the survey questionnaire easy to read?	☐	☐
2	Are you able to understand the questions? If no please mention the difficulty you found in understanding the questions.	☐	☐
3	Are there any ambiguous questions? If yes please mention which question number is ambiguous?	☐	☐
4	Are there any confusing questions? If yes please mention which question number is confusing?	☐	☐
5	Is there any emotional words or phrases? If yes please mention which question number contains motional language?	☐	☐
6	Are the survey questionnaire response choices sufficient to cover the complete range of choices?	☐	☐
7	Are 10-15 minutes sufficient to answer the questions?	☐	☐
8	Is the survey questionnaire able to follow the sequence?	☐	☐
9	Is the text size in survey questionnaire adequate? If no would you prefer bigger or smaller size text?	☐	☐
10	Do you think the items look like they make sense with the concept? For example, do you think the items given for intention from 1IN-5IN make sense with the Intention factor? If no, please give your suggestions to improve the items.	☐	☐
11	Do you think the items cover entire scope but not go beyond the concept? If no, please give your suggestions to improve the items.	☐	☐
12	Do you think this survey will work well in practical situations when distributed among participants? If no, please explain why?	☐	☐
13	If you like to give any comments regarding the design of this survey questionnaire please write your comments below.		

Source: Adapted from Renahy, Parizot and Chauvin (2008) and Zikmund (2010) with some modifications.

Appendix 6. 2: Summary of the items modified, rewarded or shifted for inclusion in the final draft of the survey questionnaire

No	Intention	Comments
1IN	I intend to use mobile devices to finish my work timely.	Re-worded as: I intend to use mobile devices to make more efficient use of my time
2IN	If I have mobile devices, I intend to use them in Telehealth context.	✓
3IN	I intend to use mobile devices in Telehealth context, whenever I need them.	Modified as: I intend to use mobile devices in Telehealth context, whenever it is required in my health facility. Merged with Management support
4IN	I intend to use mobile devices in Telehealth context to do different things.	Modified as: I intend to use mobile devices in Telehealth context to do different clinical work.
5IN	I intend to use mobile devices in Telehealth context to improve my work.	Modified as: I intend to use mobile devices in Telehealth context to improve my work processes and outcomes.
6IN	I intend to increase my use of mobile devices in Telehealth context in the future.	✓
7IN	If I have access to the required equipment.	Shifted to Resource issues factor
No	**Self-efficacy**	**Comments**
1SE	I am able to use mobile devices in the Telehealth context.	✓
2SE	I have adequate knowledge to use mobile devices in the Telehealth context.	✓
3SE	Using mobile devices in Telehealth context is entirely under my control.	✓
4SE	Using mobile devices in the Telehealth context is wise.	×
5SE	I am confident to use mobile devices in Telehealth context because it is easy to use them.	Shifted to Complexity factor
6SE	I know various benefit of using them	Shifted to Relative advantages factor
7SE	I am confident to use mobile devices in Telehealth context because I have knowledge to use them in my daily life.	✓
8SE	I am confident to use mobile devices in Telehealth context because I had used them earlier in the Telehealth	✓
9SE	I am confident to use mobile devices in Telehealth context because my health facility allows me to use them.	Shifted to Management support factor
10SE	I am confident to use mobile devices in Telehealth context because I get continuous training to use them.	Shifted to Training factor
11SE	I am confident to use mobile devices in Telehealth context because I can use them on trial basis before their actual use.	Shifted to Trialability factor
12SE	I am confident to use mobile devices in Telehealth context because I have many years job experience	Shifted to Demographic factor Experience
13SE	My use of mobile devices in the Telehealth context depend upon my age.	Shifted to Demographic factor Age
14SE	I am confident to use mobile devices in Telehealth context if the software used is too easy.	Shifted to Complexity factor
No	**Functional features**	**Comments**
1FF	I like to use mobile devices in the Telehealth context because screen size of mobile device is bigger than 5 inches.	✓
2FF	I like to use mobile devices in the Telehealth context because battery last for at least one shift.	✓
3FF	I like to use mobile devices in the Telehealth context because it has sufficient data storage to store one shift work.	✓
4FF	I like to use mobile devices in the Telehealth context because its sound quality is clear.	✓
5FF	I like to use mobile devices in the Telehealth context because its image quality is good.	✓
6FF	I like to use mobile devices in the Telehealth context because clinical software installed is easy to use.	×
7FF	I like to use mobile devices in the Telehealth context because it facilitate clinical/ ward related work.	Merged with Complexity factor

Appendix 6.2: Continued from previous Page 340

No	Complexity	Comments
1CX	Using mobile devices in the Telehealth context is understandable to me.	✓
2CX	Using mobile devices in the Telehealth context is easy to me for the things which I want to do.	Modified to facilitate work in high demand and emergency environment
3CX	Using mobile devices in the Telehealth context does not require much mental efforts.	✓
4CX	Using mobile devices in the Telehealth context require training to reduce the difficulty.	Shifted to Training factor
5 CX	Using mobile devices in Telehealth is easier to me if most of the people in my health facility are using it.	Shifted to Social influences factor
6 CX	Using mobile devices in Telehealth is easier to me if most of the people in the health facility are using them.	Modified to easier to use application software
7 CX	Using mobile devices in Telehealth is easier to me if initially I use them on trial basis.	Shifted to Trialability factor
No	**Social-influences**	**Comments**
1SI	I Like to use mobile devices in Telehealth context because my top management prefer them.	Re-worded as: I use mobile devices in Telehealth context because my manager prefers the team to use them.
2SI	I Like to use mobile devices in Telehealth context because my colleagues are using it.	✓
3SI	I Like to use mobile devices in Telehealth context because my close friends prefer them.	✓
4SI	I Like to use mobile devices in Telehealth context because my peer group people are using them.	✓
5SI	I Like to use mobile devices in Telehealth context because people who are important to me prefer it.	×
6SI	I Like to use mobile devices in Telehealth context because people whose opinions are valued to me prefer it.	×
7SI	I Like to use mobile devices in Telehealth context because people who influence me prefer them.	×
8SI	I Like to use mobile devices in Telehealth context because it is my own mind setup.	✓
9SI	I Like to use mobile devices in Telehealth context because my management think so.	Shifted to Management support
No	**Compatibility**	**Comments**
1CM	Using mobile devices in Telehealth fits with my current Telehealth work process.	✓
2CM	Using mobile devices in Telehealth fits with my most Telehealth work process.	✓
3CM	Using mobile devices in Telehealth fits with all aspects of my Telehealth work.	✓
4CM	Using mobile devices in Telehealth fits with my style of working in Telehealth.	Modified to: Using mobile devices in the Telehealth context matches and supports the way I prefer to work in the Telehealth context.
5CM	I need certain transition time to understand the compatibility of mobile devices with the healthcare process.	Merged with trialability factor
No	**Relative advantages**	**Comments**
1RA	Using mobile devices in the Telehealth context would improve my work quality.	✓
2 RA	Using mobile devices in the Telehealth context would improve my job performance.	✓
3RA	Using mobile devices in the Telehealth context would be effective in my Telehealth work context.	✓
4RA	Using mobile devices in the Telehealth context would perform tasks more quickly.	×
5RA	Using mobile devices in the Telehealth context would reduce organisation cost.	×
6RA	Using mobile devices in the Telehealth context would reduce patient cost.	×
7RA	Overall using mobile devices in Telehealth context is beneficial for me.	✓

Appendix 6.2: Continued from previous Page 341

No	Training	Comments
1TR	Using mobile devices in the Telehealth context requires sufficient training.	✓
2TR	I Like to use mobile devices in Telehealth context if specific training is provided.	✓
3TR	I Like to use mobile devices in Telehealth context if printed manual is provided to use them.	✓
4TR	I like to use mobile devices in the Telehealth context if some video clippings are provided to refresh my knowledge.	✓
5TR	I Like to use mobile devices in Telehealth context if regular seminars are provided to update my knowledge about new mobile devices.	Items 5TR, 6TR and 7TR were merged together and represented as: requires regular information sessions to update my knowledge
6TR	I Like to use mobile devices in Telehealth context if some guidance is provided on how to use them.	
7TR	I like to use mobile devices in the Telehealth context if I get practice environment to refresh my knowledge.	
No	**Management support**	**Comments**
1MS	I like to use mobile devices in the Telehealth context if management approve them.	✓
2MS	I like to use mobile devices in the Telehealth context if management supports me.	✓
3MS	I like to use mobile devices in the Telehealth context if appropriate policies of management guide me.	✓
4MS	I like to use mobile devices in the Telehealth context if my management allows me.	✓
5MS	I like to use mobile devices in the Telehealth context if my health facility requires it.	×
6MS	I like to use mobile devices in the Telehealth context if my management force me.	×
No	**Network coverage**	**Comments**
1NC	My use of mobile devices depend upon adequate network coverage.	✓
2NC	I like to use mobile devices in the Telehealth context because network reception is good in my health facility.	✓
3NC	I like to use mobile devices in the Telehealth context because network coverage is adequate in remote areas.	✓
4NC	I like to use mobile devices in the Telehealth context because network coverage is easily accessible whenever I need it.	Modified to : Secure network
5NC	I like to use mobile devices in the Telehealth context because network coverage is available anytime, from anywhere.	✓
6NC	I like to use mobile devices in the Telehealth context because network coverage is easily accessible where ever I need it.	Re-worded as: Network coverage in my Telehealth environment is available anytime and anywhere to support the use of mobile devices.
No	**Privacy and security**	**Comments**
1PS	I like to use mobile devices for Telehealth context because location privacy with patient's communication is assured.	✓
2PS	I like to use mobile devices for Telehealth context because secure access to the network is assured.	✓
3PS	I like to use mobile devices for Telehealth context because authentication processes are assured.	✓
4PS	I like to use mobile devices for Telehealth context because secure photographing of patients is permitted.	✓
5PS	I like to use mobile devices for Telehealth context because privacy is ensured while providing patient care.	✓
6PS	I like to use mobile devices for Telehealth context because privacy of patient data is assured.	✓
7PS	I like to use mobile devices for Telehealth context because security of patient data is assured	✓
8PS	I like to use mobile devices for Telehealth context because I think there is no Danger of stealing them in my health facility.	×
9PS	I like to use mobile devices for Telehealth context because I think there is no Danger of stealing them in my health facility.	×

Appendix 6.2: Continued from previous Page 342

No	Demographic factors	Comments
1DC	Using mobile devices by health care professionals in the Telehealth context depends upon the age of the individual.	Re-worded as: New staff are more likely to use mobile devices in the Telehealth environment.
2DC	Using mobile devices by health care professionals in the Telehealth context depends upon the job experience in the healthcare context.	Re-worded as: Staff who have worked in the hospital environment for a number of years do not prefer to use mobile devices in the Telehealth environment. Also, kept in Part II of the survey questionnaire named socio-demographic information
3DC	Using mobile devices by health care professionals in the Telehealth context depends upon the job experience in the Telehealth context.	Shifted to: Part II of the survey questionnaire named socio-demographic information
4DC	Using mobile devices by health care professionals in the Telehealth context depends upon the mobile device experience in the healthcare context.	Re-worded as: Staff who use mobile devices in the health care context are more likely to use them in the Telehealth environment. Also, kept in part II of the survey questionnaire named socio-demographic information
5DC	Using mobile devices by health care professionals in the Telehealth context depends upon the mobile device experience in the Telehealth context.	Shifted to: Part II of the survey questionnaire named socio-demographic information
6DC	The mobile devices experience in daily routine.	Re-worded as: Staff who use mobile devices in their daily routine are more likely to use them in the Telehealth environment.
No	**Resource issues**	**Comments**
1RS	My use of mobile devices in Telehealth context depends upon sufficient allocation of sufficient funds.	✓
2RS	I like to use mobile devices in the Telehealth context if funding is available.	✓
3RS	I like to use mobile devices in the Telehealth context if funding of implementing wireless network is available.	✓
4RS	I like to use mobile devices in the Telehealth context if I have access to all the necessary equipment.	✓
5RS	My use of mobile devices in Telehealth context depends on the availability of the funds required to buy necessary equipment.	×
6RS	My use of mobile devices in Telehealth context depends upon the funds required to buy necessary equipment.	×
No	**Trialability**	**Comments**
1TRI	I like to use mobile devices in the Telehealth context if initially given on a trial basis.	Re-worded as: I would use mobile devices on a trial basis prior to embedding into normal clinical practices
2TRI	I like to use mobile devices in the Telehealth context if initially given for a certain period to understand how to use it.	These two items were merged together as a single item as follows: I need time to be allocated to trialling the mobile devices so I can understand how to use them in the Telehealth environment.
3TRI	I like to use mobile devices in the Telehealth context if initially given for a certain period to feel satisfied before the actual use.	
4TRI	I like to use mobile devices in the Telehealth context if initially given for a certain period to see what it can do.	Re-worded as: I would use mobile devices in the Telehealth context if these were available for a certain time period so I could become familiar with their use before the actual use.
5TRI	Before deciding on whether or not to adopt mobile devices in Telehealth context, I like to properly try it out.	Re-worded as: I would use mobile devices on a trial basis prior to embedding into normal clinical practices.

✓ *Means used in the final version of survey*
× *Means not used in the final version of survey*

Appendix 6. 3: A sample of the survey questionnaire used for the quantitative data collection

The aim of this survey form is to understand healthcare professionals' experience and perception about the use of mobile devices such as tablets and smartphones in the Telehealth environment. A Telehealth environment in this research is 'An interactive real-time clinical activity provided for an admitted patients or outpatient within a Telehealth session'. Mobile devices in this research is defined as any device such as mobile phone or tablet which can transfer data wirelessly in the health domain.

Abbreviations used in the below table are as follows:

SD (Strongly Disagree)	D (Disagree)	N (Neutral)	A (Agree)	SA (Strongly Agree)

No.	PART 1 Survey questions	SD	D	N	A	SA
IN1	I intend to increase my use of mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
IN2	If I have mobile devices, I intend to use them in the Telehealth context.	☐	☐	☐	☐	☐
IN3	I intend to use mobile devices in the Telehealth context, if required by my health facility.	☐	☐	☐	☐	☐
IN4	I intend to use mobile devices in the Telehealth context to improve my work processes and outcome.	☐	☐	☐	☐	☐
*IN5	I intend to use mobile devices to make more efficient use of my time.	☐	☐	☐	☐	☐
SE1	I am able to use mobile devices effectively in the Telehealth context.	☐	☐	☐	☐	☐
SE2	I have adequate knowledge to use mobile devices effectively in the Telehealth context.	☐	☐	☐	☐	☐
SE3	How, why and when I use mobile devices in the Telehealth context is entirely up to me.	☐	☐	☐	☐	☐
SE4	Because I have good experience using mobile devices in my personal life, I am confident using them in the Telehealth context.	☐	☐	☐	☐	☐
FF1	The screen sizes of mobile devices such as smart phones and tablets are adequate for use in Telehealth.	☐	☐	☐	☐	☐
FF2	Battery backup of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	☐	☐	☐	☐	☐
FF3	Data storage of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	☐	☐	☐	☐	☐
FF4	Sound quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	☐	☐	☐	☐	☐
FF5	Image quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	☐	☐	☐	☐	☐
FF6	The weight of mobile devices such as smart phones and tablets does not present a problem when using them in Telehealth.	☐	☐	☐	☐	☐
CX1	I understand how I would use a mobile device in the Telehealth context.	☐	☐	☐	☐	☐
CX2	It is easy for me to use mobile devices for the Telehealth context for the things I want to do.	☐	☐	☐	☐	☐
CX3	Using mobile devices in the Telehealth context **does not** require much mental effort from me.	☐	☐	☐	☐	☐
*CX4	Using mobile devices for Telehealth facilitates my work in high demand and emergency environments.	☐	☐	☐	☐	☐
CX5	It is easy for me to use the application software installed on mobile devices in the Telehealth environment.	☐	☐	☐	☐	☐
SI1	I would use mobile devices in the Telehealth context if my manager prefers the team to use them.	☐	☐	☐	☐	☐
SI2	I would use mobile devices in the Telehealth context if my colleagues prefer to use them.	☐	☐	☐	☐	☐
SI3	I would use mobile devices in the Telehealth context if my friends prefer to use them.	☐	☐	☐	☐	☐
SI4	I would use mobile devices in the Telehealth context if people in my peer group are using them.	☐	☐	☐	☐	☐
*SI5	Using mobile devices in the Telehealth context is my own choice.	☐	☐	☐	☐	☐
CP1	Using mobile devices in the Telehealth context fits well with all aspects of Telehealth work.	☐	☐	☐	☐	☐
CP2	Using mobile devices in the Telehealth context fits into my current Telehealth work process.	☐	☐	☐	☐	☐
CP3	Using mobile devices in the Telehealth context matches and supports the way I prefer to work in the Telehealth context.	☐	☐	☐	☐	☐
CP4	Using mobile devices in the Telehealth context is compatible with different clinical processes.	☐	☐	☐	☐	☐
CP5	Using mobile devices in the Telehealth context brings positive change in the Telehealth process.	☐	☐	☐	☐	☐
RA1	Using mobile devices in the Telehealth context improves my work quality.	☐	☐	☐	☐	☐
RA2	Using mobile devices in the Telehealth context improves my job performance.	☐	☐	☐	☐	☐

No.	PART 1 Survey questions	SD	D	N	A	SA
RA3	Using mobile devices in the Telehealth context is effective in my Telehealth work context.	☐	☐	☐	☐	☐
RA4	Overall, using mobile devices in the Telehealth context is beneficial for me.	☐	☐	☐	☐	☐
*TR1	Using mobile devices in the Telehealth requires sufficient training.	☐	☐	☐	☐	☐
*TR2	Using mobile devices in the Telehealth requires specific training.	☐	☐	☐	☐	☐
*TR3	Using mobile devices in the Telehealth requires regular information sessions to update my knowledge.	☐	☐	☐	☐	☐
*TR4	Using mobile devices in the Telehealth context requires printed manuals to support my learning.	☐	☐	☐	☐	☐
*TR5	Using mobile devices in the Telehealth context requires video clips to help me to refresh my knowledge.	☐	☐	☐	☐	☐
MS1	I would use mobile devices in the Telehealth context if management approves them.	☐	☐	☐	☐	☐
MS2	I would use mobile devices in the Telehealth context if management supports me.	☐	☐	☐	☐	☐
MS3	I would use mobile devices in the Telehealth context if appropriate policies of management guide me.	☐	☐	☐	☐	☐
MS4	I would use mobile devices in the Telehealth context if my management allows me.	☐	☐	☐	☐	☐
NC1	Network coverage in my Telehealth environment is adequate to effectively use mobile devices.	☐	☐	☐	☐	☐
NC2	Network reception is good in my health facility to support the use of mobile devices in the Telehealth environment.	☐	☐	☐	☐	☐
NC3	Network coverage in remote area for Telehealth is adequate for the effective use of mobile devices.	☐	☐	☐	☐	☐
NC4	Network coverage in my Telehealth environment is available anytime and anywhere to support the use of mobile devices.	☐	☐	☐	☐	☐
*NC5	Network coverage in my Telehealth environment is poor for the effective use of mobile devices.	☐	☐	☐	☐	☐
*PS1	Secured access to the network *does not* need to be assured for me to use mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS2	Authentication processes needs to be assured before I would use mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS3	Permission must be obtained from the patients or a responsible other before photographing patients' using mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS4	Secure transmission of patient data needs to be assured before I would use mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS5	Patients need to have appropriate location privacy assured before using mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS6	Privacy is ensured while providing patient care before using mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
PS7	The privacy of patient's data needs to be assured before using mobile devices in the Telehealth context.	☐	☐	☐	☐	☐
RS1	I would use mobile devices in the Telehealth context if sufficient funds are allocated to my health facility.	☐	☐	☐	☐	☐
RS2	I would use mobile devices in the Telehealth context if sufficient funding is available in my health facility.	☐	☐	☐	☐	☐
RS3	I would use mobile devices in the Telehealth context if sufficient funding is available to implement good wireless network in my health facility.	☐	☐	☐	☐	☐
RS4	I would use mobile devices in the Telehealth context if all the necessary equipment is available in my health facility.	☐	☐	☐	☐	☐
RS5	I would use mobile devices in the Telehealth context if I have access to all necessary equipment.	☐	☐	☐	☐	☐
TRI1	I would use mobile devices on a trial basis prior to embedding into normal clinical practices.	☐	☐	☐	☐	☐
TRI2	I would use mobile devices in the Telehealth context if these were available for a certain time period so I could become familiar with their use before the actual use.	☐	☐	☐	☐	☐
TRI3	I would try out certain features of mobile devices prior to embedding into clinical practices.	☐	☐	☐	☐	☐
TRI4	I need time to be allocated to trialing the mobile devices so I can understand how to use them in the Telehealth environment.	☐	☐	☐	☐	☐
TR15	A trial environment is required so I can refresh my knowledge for using mobile devices in the Telehealth environment.	☐	☐	☐	☐	☐
DC1	New staff are more likely to use mobile devices in the Telehealth environment.	☐	☐	☐	☐	☐
DC2	Staff who have worked in the hospital environment for a number of years do not prefer to use mobile devices in the Telehealth environment.	☐	☐	☐	☐	☐
DC3	Staff who use mobile devices in the health care context are more likely to use them in the Telehealth environment.	☐	☐	☐	☐	☐
DC4	Staff who use mobile devices in their daily routine are more likely to use them in the Telehealth environment.	☐	☐	☐	☐	☐

Part 2 Socio-Demographic questions								
Gender:	□Female	□Male	□Do not wish to disclose					
Age (in years):	□<20	□20-29	□30–39	□40–49	□50-59	□60-69	□70-79	□80-80+
Healthcare job experience (in years):	□<5	□5–15	□16–25	□>25				
Telehealth **job experience** (in years):	□0	□<5	□5–15	□16–25	□>25			
Experience using mobile devices in the health domain (including Telehealth): (in years)	□0	□<5	□5–15	□16–25	□>25			
Experience using mobile devices ONLY in the Telehealth context (in years):	□0	□<5	□5–15	□16–25	□>25			
Experience using mobile devices in your personal life (in years)**:**	□<5	□5–15	□16–25	□>25				
Job position:	□Physician	□Nurse	□Other (please specify):_____________________________					
Type of hospital:	□ Public	□Private	□Other (please specify):______________________________					
Bed Size:	□<500	□500-1000	□1001-1500	□>1501				

Thanks for your time to complete this survey. If you have any concern about this research or interested in this study. Kindly contact me 0450418371or my supervisory team Professor Raj Gururajan (gururaja@usq.edu.au) and Dr Abdul Hafeez-Baig (abdulhb@usq.edu.au).

Appendix 7. 1: Variance table for Intention

Items	Minimum	Maximum	Mean	Std. Deviation
I intend to increase my use of mobile devices in Telehealth.	1	5	3.95	1.050
If I have mobile devices, I intend to use them in the Telehealth context.	1	5	3.92	1.061
I intend to use mobile devices in the Telehealth context, if required by my health facility.	1	5	4.41	.938
I intend to use mobile devices in the Telehealth context to improve my work processes and outcome.	1	5	4.15	1.014
I intend to use mobile devices to make more efficient use of my time.	2	5	4.31	.950

Appendix 7. 2: Variance table for Self-efficacy

Items	Minimum	Maximum	Mean	Std. Deviation
I am able to use mobile devices effectively in the Telehealth context.	2	5	3.85	.988
I have adequate knowledge to use mobile devices effectively in the Telehealth context.	1	5	3.49	1.144
How, why and when I use mobile devices in the Telehealth context is entirely up to me.	1	5	2.77	.902
Because I have good experience using mobile devices in my personal life, I am confident using them in the Telehealth context.	1	5	3.49	1.097

Appendix 7. 3: Variance table for Social influences

Items	Minimum	Maximum	Mean	Std. Deviation
I would use mobile devices in the Telehealth context if my manager prefers the team to use them.	1	5	4.10	.995
I would use mobile devices in the Telehealth context if my colleagues prefer to use them.	2	5	3.90	1.021
I would use mobile devices in the Telehealth context if my friends prefer to use them.	1	5	3.33	1.243
I would use mobile devices in the Telehealth context if people in my peer group are using them.	1	5	3.62	1.138
Using mobile devices in the Telehealth context is my own choice.	1	5	3.41	1.208

Appendix 7. 4: Variance table for Demographic factors

Items	Minimum	Maximum	Mean	Std. Deviation
New staff are more likely to use mobile devices in the Telehealth environment.	1	5	3.54	1.097
Staff who have worked in the hospital environment for a number of years do not prefer to use mobile devices in the Telehealth environment.	1	5	3.15	1.040
Staff who use mobile devices in the health care context are more likely to use them in the Telehealth environment.	1	5	3.90	.968
Staff who use mobile devices in their daily routine are more likely to use them in the Telehealth environment.	1	5	3.90	1.095

Appendix 7. 5: Variance table for Relative advantage

items	Minimum	Maximum	Mean	Std. Deviation
Using mobile devices in the Telehealth context improves my work quality.	3	5	3.95	.759
Using mobile devices in the Telehealth context improves my job performance.	3	5	3.87	.801
Using mobile devices in the Telehealth context is effective in my Telehealth work context.	2	5	3.87	.801
Overall, using mobile devices in the Telehealth context is beneficial for me.	2	5	4.03	.843

Appendix 7. 6: Variance table for Complexity

Items	Minimum	Maximum	Mean	Std. Deviation
I understand how I would use a mobile device in the Telehealth context.	1	5	3.79	1.005
It is easy for me to use mobile devices for the Telehealth context for the things I want to do.	1	5	3.85	1.113
Using mobile devices in the Telehealth context does not require much mental effort from me.	1	5	3.33	1.155
Using mobile devices for Telehealth facilitates my work in high demand and emergency environments.	1	5	3.54	1.097
It is easy for me to use the application software installed on mobile devices in the Telehealth environment.	1	5	3.79	.978

Appendix 7. 7: Variance table for Compatibility

Items	Minimum	Maximum	Mean	Std. Deviation
Using mobile devices in the Telehealth context fits well with all aspects of Telehealth work.	1	5	3.54	1.097
Using mobile devices in the Telehealth context fits into my current Telehealth work process.	2	5	3.77	.872
Using mobile devices in the Telehealth context matches and supports the way I prefer to work in the Telehealth context.	2	5	3.69	.893
Using mobile devices in the Telehealth context is compatible with different clinical processes.	2	5	3.87	.833
Using mobile devices in the Telehealth context brings positive change in the Telehealth process.	2	5	4.15	.904

Appendix 7. 8: Variance table for Trialability

Items	Minimum	Maximum	Mean	Std. Deviation
I would use mobile devices on a trial basis prior to embedding into normal clinical practices.	3	5	4.33	.772
I would use mobile devices in the Telehealth context if these were available for a certain time period so I could become familiar with their use before the actual use.	2	5	4.15	.812
I would try out certain features of mobile devices prior to embedding into clinical practices.	2	5	4.18	.790
I need time to be allocated to trialling the mobile devices so I can understand how to use them in the Telehealth environment.	2	5	3.95	.724
A trial environment is required so I can refresh my knowledge for using mobile devices in the Telehealth environment.	2	5	3.87	.801

Appendix 7. 9: Variance table for Functional features

Items	Minimum	Maximum	Mean	Std. Deviation
The screen sizes of mobile devices such as smart phones and tablets are adequate for use in Telehealth.	2	5	3.67	.982
Battery backup of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	1	5	3.56	1.021
Data storage of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	1	5	3.38	.990
Sound quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	1	5	3.67	.982
Image quality of mobile devices such as smart phones and tablets is adequate for use in Telehealth.	1	5	3.85	.961
The weight of mobile devices such as smart phones and tablets does not present a problem when using them in Telehealth.	1	5	3.95	1.025

Appendix 7. 10: Variance table for Network coverage

Items	Minimum	Maximum	Mean	Std. Deviation
Network coverage in my Telehealth environment is adequate to effectively use mobile devices.	1	5	3.28	1.337
Network reception is good in my health facility to support the use of mobile devices in the Telehealth environment.	1	5	3.05	1.099
Network coverage in remote area for Telehealth is adequate for the effective use of mobile devices.	1	5	2.87	1.128
Network coverage in my Telehealth environment is available anytime and anywhere to support the use of mobile devices.	1	5	2.95	1.191
Network coverage in my Telehealth environment is poor for the effective use of mobile devices.	1	5	3.28	1.191

Appendix 7. 11: Variance table for Privacy and security

Items	Minimum	Maximum	Mean	Std. Deviation
Secured access to the network does not need to be assured for me to use mobile devices in the Telehealth context.	1	5	2.72	1.376
Authentication processes needs to be assured before I would use mobile devices in the Telehealth context.	1	5	4.03	1.013
Permission must be obtained from the patients or a responsible other before photographing patients' using mobile devices in the Telehealth context.	1	5	4.36	.903
Secure transmission of patient data needs to be assured before I would use mobile devices in the Telehealth context.	1	5	4.31	1.004
Patients need to have appropriate location privacy assured before using mobile devices in the Telehealth context.	1	5	4.31	1.080
Privacy is ensured while providing patient care before using mobile devices in the Telehealth context.	1	5	4.21	1.031
The privacy of patient's data needs to be assured before using mobile devices in the Telehealth context.	2	5	4.49	.914

Appendix 7. 12: Variance table for Training

Items	Minimum	Maximum	Mean	Std. Deviation
Using mobile devices in the Telehealth requires sufficient training.	3	5	4.28	.724
Using mobile devices in the Telehealth requires specific training.	3	5	4.13	.801
Using mobile devices in the Telehealth requires regular information sessions to update my knowledge.	2	5	4.05	.857
Using mobile devices in the Telehealth context requires printed manuals to support my learning.	1	5	3.62	1.091
Using mobile devices in the Telehealth context requires video clips to help me to refresh my knowledge.	1	5	3.82	1.048

Appendix 7. 13: Variance table for Management support

Items	Minimum	Maximum	Mean	Std. Deviation
I would use mobile devices in the Telehealth context if management approves them.	1	5	4.36	.932
I would use mobile devices in the Telehealth context if management supports me.	2	5	4.36	.778
I would use mobile devices in the Telehealth context if appropriate policies of management guide me.	1	5	4.31	.950
I would use mobile devices in the Telehealth context if my management allows me.	1	5	4.31	.950

Appendix 7. 14: Variance table for Resource issues

Items	Minimum	Maximum	Mean	Std. Deviation
I would use mobile devices in the Telehealth context if sufficient funds are allocated to my health facility.	3	5	4.31	.731
I would use mobile devices in the Telehealth context if sufficient funding is available in my health facility.	3	5	4.23	.777
I would use mobile devices in the Telehealth context if sufficient funding is available to implement good wireless network in my health facility.	1	5	4.18	.942
I would use mobile devices in the Telehealth context if all the necessary equipment is available in my health facility.	2	5	4.36	.843
I would use mobile devices in the Telehealth context if I have access to all necessary equipment.	2	5	4.33	.838