A mixed methods study of factors influencing health managers acceptance of eHealth services in the Kingdom of Saudi Arabia.

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A MIXED METHODS STUDY OF FACTORS INFLUENCING HEALTH MANAGERS ACCEPTANCE OF EHEALTH SERVICES IN THE KINGDOM OF SAUDI ARABIA

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ABSTRACT

Introduction: The Kingdom of Saudi Arabia (KSA) is a country with one of the largest land masses and difficult geographical terrain in the Middle East. The accessibility of advanced health services, especially for people in rural areas, has been considered one of the main health challenges. Health services across the country are accessible through three categories of providers. The Ministry of Health (MOH) which is the dominant health provider responsible for 60% of all health services and facilities. Private health sector and other government run health authorities are the providers for the remaining 40%. Many initiatives to embrace technology in healthcare were launched by the MOH to advance the level of acceptance. One of the initiatives was the ambitious National eHealth Strategy which was launched in 2011 to govern eHealth projects across the country and set consistent standards, policies, and procedures for the practice activities. This study is sponsored by the MOH as part of a bigger plan to involve stakeholders in the digital transformation.

Objective: the overall aim of this doctoral research was to explore the factors that influence health managers' acceptance of eHealth services in KSA.

Methods: The 1st phase was a systematic review (SR): based on a PRISMA-P guided protocol published with CRD Prospero, five databases were searched for studies published between 1993 and 2017. One reviewer performed the search; two reviewers screened the titles and abstracts. Exclusions were recorded with reasons. Tools appropriate to study design were applied independently by two reviewers to assess the quality of included studies.

2nd phase survey: An online questionnaire in both Arabic and English language was designed around the Unified Theory of Acceptance and Use of Technology (UTAUT) model determinants. Professionals with a health managerial role from multiple disciplines such as: health professions, administration, and health IT were invited to take part in the study. Ethical approval had been gained. Participation links were distributed across a range of social media platforms. SPSS v25 was used for data analysis.

3rd phase interviews: In-depth face-to-face and telephone interviews with 21 health managers from Aseer province, KSA. Four umbrella domains were derived from the UTAUT model. The pre-defined themes from phases 1 and 2 were explored and mapped against the domains. Ethical approval had been gained. Microsoft Excel and NVivo were used for the data analysis.

Results: 1st phase SR: After duplicates were removed, 110 papers were screened, and 15 studies met the inclusion criteria. From these 15 papers, 39 factors were identified as influencing varying levels of eHealth adoption and acceptance in KSA. Lack of studies on the views of health managers and limited studies from only a few geographical settings were also identified as knowledge gaps.
2nd phase survey: Findings showed the significance ($p<0.05$) of Performance Expectancy and Social Influence moderated by age to the Behavioural Intention of health managers as well as the Performance Expectancy and Facilitating Conditions to the actual Use Behaviour. Some ambiguous results need further investigations.
3rd phase interviews: Ambiguity in the previous phase was clarified and the most influential factors based on the views of health managers in Aseer province, KSA were identified. Three domains out of four showed significance: Performance Expectancy, Social Influence, and Facilitating Conditions.

Conclusion: In this doctoral research, a mixed methods design presented in three phases was adopted with the findings from each phase informing the next. Overall, the research confirmed the influence of the same factors on health managers' acceptance of eHealth services in KSA and generated original findings. First, by providing evidence that this area has not been previously studied through registering a protocol and publishing a systematic review. Second, by using social media platforms to support a novel recruitment approach for the study. Third, by employing UTAUT as a theoretical framework in both quantitative and qualitative phases. Finally, exploring eHealth practice in Aseer province, a part of KSA that has not previously been explored, in the published literature.

These original findings draw a clearer picture of the potential challenges faced by health managers in KSA in accepting and using eHealth services. The findings may also work as a foundational basis from which to better prepare other stakeholder groups for accepting eHealth services. By doing so, staff can more effectively

utilise health technology interventions as key concepts in making successful and positive transformational and sustainable change to the delivery of healthcare.

Keywords: eHealth services; systematic review; health managers; UTAUT model; cross-sectional survey; interviews; Aseer province; Kingdom of Saudi Arabia.

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EXTERNAL OUTPUT

Published peer reviewed papers

1. Abdullah Alshahrani, Katie MacLure, Derek Stewart. Status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia: a systematic review protocol. PROSPERO 2017 CRD42017065009 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42017065009
2. Alshahrani A, Stewart D, MacLure K. A systematic review of the adoption and acceptance of eHealth in Saudi Arabia: Views of multiple stakeholders. International Journal of Medical Informatics. 128, 7–17. https://doi.org/10.1016/j.ijmedinf.2019.05.007
3. Alshahrani A, Williams H, MacLure K. Investigating health managers' perspectives of factors influencing their acceptance of eHealth services in the Kingdom of Saudi Arabia: A quantitative study. Health Policy and Technology (Under review since October 2020).

The following paper is under development:

An exploration of factors influencing health managers acceptance of eHealth services: Views of health managers in Aseer province, KSA. (Health and Technology journal)

Published Peer reviewed conference proceedings

1. Alshahrani A, MacLure K. A Study of Factors Influencing Health Managers' Acceptance of eHealth Services in the Kingdom of Saudi Arabia. eTELEMED 2020: The Twelfth International Conference on eHealth, Telemedicine, and Social Medicine, Valencia, Spain. March 2020. Available from: http://www.thinkmind.org/index.php?view=instance&instance=eTELEMED+2020

Published Peer reviewed conference abstracts

1. Abdullah Alshahrani, Derek Stewart, Katie MacLure. Factors influencing health managers' acceptance of eHealth services in Saudi Arabia. HIMSS Saudi Arabia Conference and Exhibition 2018, Riyadh, Kingdom of Saudi

Arabia, 7-11 October 2018. Computer Methods and Programs in Biomedicine. April 2019.

2. Abdullah Alshahrani, Derek Stewart, Katie MacLure. An exploration of factors influencing health managers' acceptance of eHealth services in the Kingdom of Saudi Arabia. Health services research and pharmacy practice conference (HSRPP 2019), 8-9 April 2019, Birmingham, UK. International Journal of Pharmacy Practice. April 2019.

Conferences and presentations

1. Alshahrani A, Stewart D, MacLure K. A systematic review of the status of eHealth research in Saudi Arabia: Views of multiple stakeholders (Oral presentation at the 3rd Health Professions Conference at King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Kingdom of Saudi Arabia, 17-19 April 2018).
2. Alshahrani A, Stewart D, MacLure K. A systematic review of the status of eHealth research in Saudi Arabia: Views of multiple stakeholders (Poster presentation at the School of Pharmacy and Life Sciences, Robert Gordon University, Aberdeen, UK. Postgraduate Research Day May 2018).
3. Abdullah Alshahrani, Derek Stewart, Katie MacLure. Factors influencing health managers' acceptance of eHealth services in Saudi Arabia (Poster presentation at HIMSS Saudi Arabia Conference and Exhibition 2018, Riyadh, Kingdom of Saudi Arabia, 7-11 October 2018, won an outstanding poster presentation award).
4. Abdullah Alshahrani, Derek Stewart, Katie MacLure. A systematic review of the status of eHealth research in Saudi Arabia: Views of multiple stakeholders (Oral presentation at the School of Pharmacy and Life Sciences, Robert Gordon University, Aberdeen, UK. Students and Staff Seminar Series, October 2018).
5. Abdullah Alshahrani, Derek Stewart, Katie MacLure. An exploration of factors influencing health managers' acceptance of eHealth services in the Kingdom of Saudi Arabia (Poster presentation at the 2019 Health Services Research and Pharmacy Practice conference (HSRPP 2019), 8-9 April 2019, Birmingham, UK).

6. Abdullah Alshahrani, Katie MacLure. Factors influencing health managers' acceptance of eHealth services in Saudi Arabia (Oral presentation at Robert Gordon University, Aberdeen, UK. 3 Minutes Thesis Competition (3MT), 16 May 2019.
7. Abdullah Alshahrani, Katie MacLure. An exploration of factors influencing health managers' acceptance of eHealth services in the Kingdom of Saudi Arabia (Oral presentation at the graduate school symposium, Robert Gordon University, Aberdeen, UK), 19 June 2019.

ABBREVIATIONS

BA	Bachelor of Arts
BI	Behavioural Intention
CASP	Critical Appraisal Skills Programme
CDSR	Cochrane Database of Systematic Reviews
CDSS	Clinical Decision Support System
CIO	Chief Information Officer
CPOE	Computerised Physician Order Entry
CRD	Centre for Review and Dissemination
DOI	Diffusion Of Innovation
eCommerce	Electronic Commerce
eGovernment	Electronic Government
eConsultations	Electronic Consultations
EE	Effort Expectancy
eHealth	Electronic Health
email	Electronic Mail
ePrescriptions	Electronic Prescriptions
eServices	Electronic Services
FC	Facilitating Conditions
HM	Health Managers
HP	Health Professionals
ICT	Information and Communication Technology
IT	Information Technology
JBI	Joanna-Briggs Institute
KFSH&RC	King Faisal Specialist Hospital & Research Centre
KSA	Kingdom of Saudi Arabia
IDP	Innovation Diffusion Theory
MCIT	Ministry of Communication and Information Technology
mHealth	Mobile Health
MM	Motivational Model
MPA	Master of Public Administration
MOH	Ministry of Health
NPT	Normalisation Process Theory
NTP	National Transformation Programme

PCA	Principal Component Analysis
PE	Performance Expectancy
PgCert	Postgraduate Certificate
PHCC	Primary Health Care Centre
PhD	Doctor of Philosophy
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-P	Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols
RGU	Robert Gordon University
RII	Relative Importance Index
SI	Social Influence
SR	Systematic Review
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
UK	United Kingdom
UTAUT	Unified Theory of Acceptance and Use of Technology
WHO	World Health Organization

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CHAPTER 1: GENERAL INTRODUCTION

1.1 Introduction

This chapter aims to describe the flow of the thesis to set the scene. It starts with demonstrating the research contribution followed by the thesis structure. It will give a general description of the key terms with definitions, a broad background of the study context, healthcare services in the Kingdom of Saudi Arabia (KSA) will be highlighted before setting out the overall aims and objectives of this programme of research for the award of Doctor of Philosophy.

1.1.1 Research contribution

The aim of this research was to explore the factors that influence health managers' acceptance of eHealth services in KSA. It has been conducted in three sequential phases. The original contributions from each phase of this research were:

Phase I – Systematic Review:

- Identification of thirty-nine potential factors influential to eHealth acceptance in KSA from multiple stakeholder views such as health professionals, health managers, and health IT (Information Technology) managers.
- Evidence of the lack of peer-reviewed published studies that address the views of health manager groups was acknowledged as a gap in the literature.
- Geographically limited eHealth studies from only a few provinces of KSA, and few health organisations in the country, were acknowledged as further gaps in the literature.
- The first comprehensive application of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in the healthcare context in KSA.

Phase II – Cross-sectional Social Media based Survey:

- The UTAUT model was adopted in this research as a theoretical framework and justification for its' use provided and reflected on its' utility.

- Social media platforms were utilised to distribute the questionnaire which reflected the novelty in using technology to support research into the acceptance of technology.
- The thirty-nine identified factors were clustered into seventeen themes of related nature and then were tested against the UTAUT constructs.
- Social Influence and Performance Expectancy factors showed significance, however, Facilitating Conditions significance was ambiguous, thus further investigation is indicated.

Phase III – Semi-structured interviews:

- Health managers in Aseer province perceived that Facilitating Conditions are inadequate in their healthcare facilities indicating a major cause for lack of acceptance and use of eHealth services in Aseer province.
- With few exceptions, health managers in Aseer Province perceived that health technology use is not difficult or complex, however, this perception may vary from one professional to another based on their technical ability, awareness of technology benefits, and willingness to utilise technology at work.
- Although basic training on using eHealth services is provided, there is a perceived lack of specialised technical training indicating a major barrier to accepting eHealth.
- Health managers believe in the willingness of the top management to make the transformation into digital eHealth, however, question whether they have adequate resources and authority to manage this major step.

1.1.2 Thesis structure

This thesis provides a comprehensive investigation into the research topic: A mixed methods study of factors influencing health managers' acceptance of eHealth services in the KSA. The research was conducted in three years over three sequential phases. This thesis will comprehensibly cover all the research conducted, starting with the background, aim, and objectives, research methodology and approaches, details of the three phases, and finally, discussion, conclusions, and recommendations for future research.

Chapter 1

General introduction to give a background of the research topic, definition of the key terms, identification of the study context, and finally the overall aim, objectives, and overview of each phase.

Chapter 2

Methodology and philosophy to underpin the research. An overview of different methodological options, description of the range of methods and approaches for data collection and analysis. Finally, a focus on the justification for the research design and methodology selection with justification for each of the three phases.

Chapter 3

Based on the research design and methodology selection from Chapter 2, a systematic review (SR) that critically appraised, synthesised and presented the available evidence on the status of eHealth adoption and acceptance in Saudi Arabia from the perspectives of multiple stakeholders.

Chapter 4

Based on findings from the phase 1 (SR), a survey which investigated factors that influenced health managers' acceptance of eHealth services in KSA. The Unified Theory of Acceptance and Use of Technology (UTAUT) model was utilised in this chapter as a theoretical framework to gain more understanding through validated questionnaire and structured analysis. The methodology adopted, mapping factors against UTAUT constructs, development, dissemination and analysis of the questionnaire, with findings, and recommendations described in detail.

Chapter 5

Based on findings from phase 2 (Survey), semi-structured interviews explored health managers views towards acceptance of eHealth services in KSA, in a sample of health managers from Aseer province, KSA. Aseer is a province not previously explored thru research. Themes derived from the findings of phase 2 of the research were under analysis for further investigation and confirmation through in-depth interviews in a selected province.

Chapter 6

Revisits the aims and objectives stated from the outset to pull together the story of the research for discussion, conclusions and recommendations for future research. Original research contribution and impact will be re-highlighted. Work published and still underway as well as plans for potential future work will be described.

1.2 Context of the study, Kingdom of Saudi Arabia, a profile overview

The Kingdom of Saudi Arabia (KSA) is an Arab state located in South West Asia (World Atlas 2016) and it gained its importance religiously for being the home of the two holy mosques in Makkah and Medina that millions of Muslims visit every year. Economically, it is well known as the world's leading oil exporter (Alnatheer and Nelson 2009). The modern country was founded by King Abdulaziz Bin Abdulrahman Al-Saud in 1902 (Figure 1.1). The whole country was unified and given its current name in 1932 (General Authority for Statistics in KSA 2015). Saudi Arabia is surrounded by water from both East and West and has land borders with eight Arab countries. Internally, it consists of 13 provinces that extend over a distance of approximately 2,149,690 square kilometres (World Atlas 2016) which makes it one of the biggest countries in the Middle East by land mass with a total population above 31 million and annual growth rate of 2.02% (Statistics Yearbook, MOH, KSA 2016). Three provinces in the map were highlighted in grey as the literature showed that most eHealth studies were conducted in these provinces (See chapter 3). Aseer province was also highlighted in red as the province where part of this study took place in the third phase. Aseer is 80,000 square kilometres by land with total population of 2.8 million (General Authority for Statistics in KSA 2015).

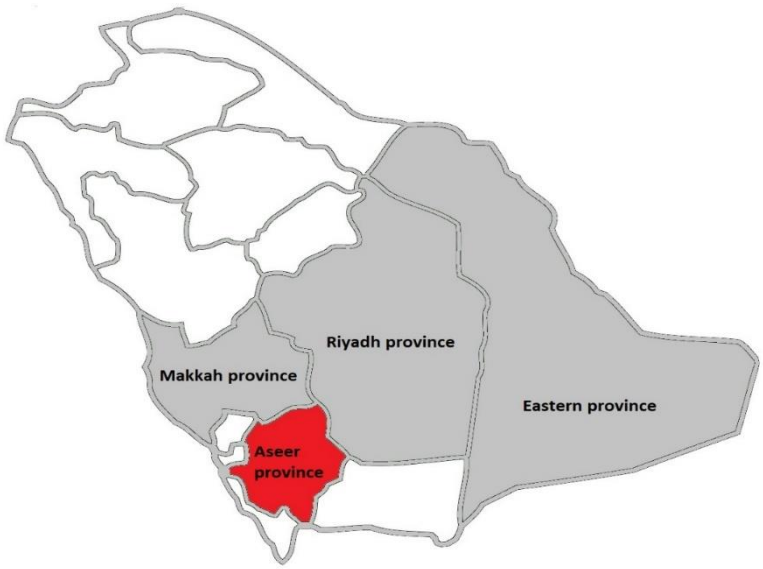


Figure 1.1: Kingdom of Saudi Arabia map

1.2.1 Health services in the Kingdom of Saudi Arabia

Before discovering oil in Saudi Arabia, no official health system was in practice and people at that period of time were relying on traditional medicine to help with their illnesses (Yusuf 2014). This traditional practice vanished after the opening of the first public health clinic in 1926. The MOH kept expanding and opening branches in major cities until 1954 which was the year for promulgating the official establishment of the MOH (Niblock 2004).

The healthcare system in the country is called the national health system which refers to the eligibility of treatment for all citizens as well as residents that work for any governmental sector. Residents that work for the private sector are mandatory insured by third party companies through their employers to be eligible to benefit from health services in both governmental and private health facilities. Health services are provided by three categories of providers: the first category is MOH facilities which represents almost 60% of all curative and preventative services across the country through 274 hospitals with total bed capacity of 41,835 and more than 2,300 PHCCs at three different levels of care: primary level through PHCCs, secondary level through general hospitals, and tertiary level through central and specialised hospitals (Statistics Yearbook, MOH, KSA 2016). The second category is the government health facilities which are run by government authorities, for example, Armed Forces Hospitals, National Guards Hospitals, King Faisal Specialist Hospitals & Research Centres, Medical Cities, and Universities' Medical Services. They provide 17.3% of the total health services in the country through 43 specialised hospitals (General Authority for Statistics in KSA 2015). The third category is the private health sector which provides 23.4% of the services by 145 hospitals owned and managed privately by either investors or companies, however, supervised medically by the MOH (General Authority for Statistics in KSA 2015) (Figure 1.2).

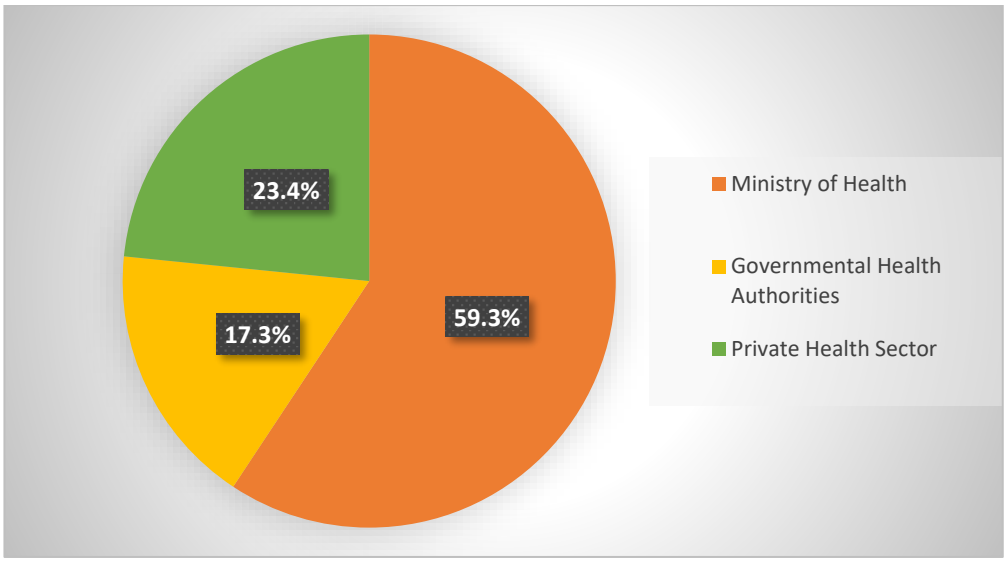


Figure 1.2: Healthcare providers in the Kingdom of Saudi Arabia. Source: Statistics Yearbook, Ministry of Health, KSA (2016)

The government has heavily invested in both health services facilities and health IT infrastructure and have been dedicated to allocating a budget of billions of Saudi Riyals annually. In 2016, the MOH budget was 58.9 billion Saudi Riyal amounting to 7.01% of the total government budget (Statistics Yearbook, MOH, KSA 2016). As a consequence of this investment and focus, the health system in Saudi Arabia was ranked 26th among 191 countries in the findings of the World Health Organization (WHO) report. This was notably ahead of several recognised health systems, such as Australia which was ranked the 32nd and USA 37th. This report was presented by the WHO based on five main indicators (WHO 2004):

1. Overall level of population health
2. Health inequalities (or disparities) within the population
3. Overall level of health system responsiveness (a combination of patient satisfaction and how well the system acts)
4. Distribution of responsiveness within the population (how well people of varying economic status find that they are served by the health system)
5. The distribution of the health system's financial burden within the population (who pays the costs)

1.3 Key terms in use

The key terms of this study are eHealth, health managers, and technology acceptance. Below is a detailed explanation of the meaning of every term identified and pooled from the literature review.

1.3.1 Electronic Health (eHealth)

The revolution of "e" has shaped the face of daily life. In this sense, it is normal in 2020 to say that eHealth is not a new term. It has been in practice for decades, however, it may sound like a new revolutionary term to some countries where technology has just started to take its' place in society. The most popular definition for eHealth is the one proposed by WHO in 2004 which refers to eHealth as the use of Information and Communication Technology for health (WHO 2004). In this context, many terms are used to refer to eHealth such as, telemedicine, telehealth, telecare, and remote health. The evolution of using eTerms started in the 90s, for instance, email made it possible for people to communicate rapidly, ecommerce invented ways for conducting business and finance, and eHealth for improving the outcomes of healthcare systems (Oh et al. 2005). Eysenbach (2001) defined eHealth as:

"an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology" (Eysenbach 2001).

Pagliari et al (2005) highlighted the important role of the Internet for eHealth offering an alternative definition as:

"*the use of emerging information and communication technology, especially the internet, to improve or enable health and health care" (Pagliari et al. 2005).*

A systematic review of published definitions of eHealth was conducted in 2005 by a group of researchers from the University of Toronto, Canada. Six databases were searched for the terms eHealth OR e-Health OR electronic health. Fifty-one published definitions were found with different degrees of emphasis given to concepts like health, technology, and commerce (Oh et al. 2005).

In KSA where Islamic religious beliefs play a role in spiritual health of patients, Househ (2013) brought another new definition of eHealth from a religious point of view based on the perspective of professionals that are more concerned about improving spiritual health. Househ defined Islamic eHealth as:

"the application and use of information and communication technologies to monitor and support Islamic spiritual health practices with the goal of improving Muslims' spiritual, mental and physical health status" (Househ 2013).

Jung (2008) provided an overall definition of eHealth services as every health service that utilised technology whether at basic or advance level and that could include most common systems and applications such as ePrescriptions and telemedicine (Jung 2008). This definition was based on a study conducted by Lofstedt (2007) that discussed eServices research including eGovernment, ePublic services, and eHealth (Lofstedt 2007).

The international literature was reviewed to give an overview of eHealth research in the past ten years. The focus was on studies that investigated or identified factors that influence eHealth adoption and acceptance. As per Table 1.1, a range of research methodologies from quantitative, qualitative, and mixed methods designs were evidenced. Each study had a different sample size, a specific group of professionals, and data collection methods. Table 1.1 summarises the range of potential influencing factors that may lead to the intention to accept utilising eHealth technology which include: perceived usefulness, perceived ease of use, social influence, facilitating conditions and technology readiness and infrastructure, education and literacy, security and confidentiality, organisational and management support, accessibility to internet and availability of other resources, stakeholder involvement in planning services and identification of needs, familiarity with technology and workload, and lastly, financial factors.

Chapter 3, which is based on a systematic review (Alshahrani et al. 2019), will focus on the Saudi Arabian context of investigating these factors.

With the growth of eHealth services utilisation, some benefits have been noticed. Some sought to be more patient-focused such as improving the quality of care by enabling access to advanced health services. The Internet specifically can play a key role in connecting patients with health providers through building a network platform where patients can receive care remotely without having to travel to see their physician or health professional (Baldwin et al. 2002). On the other hand, benefits that have an economic or institutional impact, such as reducing costs or enhanced information exchange among different health providers, were of interest. Al-Dossary et al (2017) introduced two potential reasons for using health technology in delivering healthcare services, "two key reasons for introducing telemedicine as a means of delivering healthcare services are cost reduction and improvement of delivery of services" (Al-Dossary et al. 2017).

Although many studies have seen eHealth in a positive light to influence the provision of healthcare services and make it more accessible to wider community, some disbenefits and challenges of using health technology-related interventions emerged. One of the considerable drawbacks highlighted in the literature was the ethical issue associated with security and privacy of health information (Kilkku 2018). Noar et al (2012) reviewed eHealth applications, strategies for behaviour change and described some advantages of moving toward a world that is technology-dependant. They did, however, emphasise that healthcare providers should address privacy and data safety issues when determining who can access personal and medical information (Noar et al. 2012). Chenthara et al (2019) stated that the nature and sensitivity of health information, including medical history and personal information, must be secured to avoid privacy breaches with only authorised professional given legal access (Chenthara et al. 2019). Privacy breaches can result from cyber attacks but may also focus on the role of human factors in violating set standards. In 2018, a study conducted by Simplican et al (2018) reported that some service users reveal too much information on social media platforms without realising the potential risks. This may lead to major privacy violation and identity theft (Simplican et al. 2018).

Lack of face to face interaction between the patient and the healthcare professional has also been highlighted as one of disadvantages of using eHealth. Deslich et al (2013) aimed to describe the benefits and constraints of telemedicine in the psychiatry field in the United States. Their study discussed the risks of receiving telepsychiatry therapy via videoconference if instructions provided by the healthcare professional are misunderstood. They confirmed that utilising technology channels can be useful but, for some, cameras and microphones might never be considered a substitute or even equivalent to face to face interaction (Deslich et al. 2013).

Organisational risks such as financial burdens and operational expenses of eHealth have been seen as a barrier to full utilisation of eHealth especially where healthcare facilities have limited resources. Infrastructure, systems implementation and maintenance, user training and technical support all require a budget (Ossebaard et al. 2013). Noar et al (2012) claimed that "the biggest disadvantage to technology is affordability" (Noar et al. 2012).

Lack of specialised training in dealing with minor technical problems and lack of qualified human resources that provide technical support were focused on as two key areas. It is understandable that end-users come from variety of professional backgrounds and not all of them have the technical ability and willingness to help provide technical solutions (Kilkku 2018).

Although eHealth has been found to be a solution to reach some people, the fact that not everyone has access to internet, has a smart phone, or PC is another challenge sometimes referred to as 'digital poverty'. Three groups of the population are noted as likely to be digitally disadvantaged: 1) people with limited financial support; 2) people who live in rural areas, and 3) people who find technology complex or are unable to access and communicate online due to a lack of digital literacy, find using eHealth challenging (Raman and Tewari 2012).

Table 1.1: Identified factors which influence eHealth adoption and acceptance in different countries

Author (Publishing year) Study title	Aim	Country	Methodology & Methods	Influencing factors
Moen et al (2013). eHealth in Europe–Status and challenges	To present European reflections on the concept of eHealth	Europe	Quantitative, cross-sectional survey	eHealth strategies, organizational change, and appropriate technological infrastructure were highlighted as important aspects
Li et al (2013). Health care provider adoption of eHealth: systematic literature review	To identify and synthesize influential factors to health care providers' acceptance of various eHealth systems	Systematic literature review (International)	Studies of qualitative, quantitative, and mixed methods designs were included	Seven clusters of influencing factors were identified: 1) health care provider characteristics, 2) medical practice characteristics, 3) voluntariness of use, 4) performance expectancy, 5) effort expectancy, 6) social influence, and 7) facilitating or inhibiting conditions
Cilliers and Stephen (2014). User acceptance of telemedicine by health care workers: a case of the Eastern Cape province, South Africa	To identify the factors that influence the user acceptance of telemedicine among health care workers	South Africa	Quantitative, cross-sectional survey	Perceived usefulness factors such as improving quality of healthcare services and increase productivity at work; perceived ease of use associated factors, and educational factors such as computer literacy skills

Sulaiman and Magaireah (2014). Factors affecting the adoption of integrated cloud-based e-health record in healthcare organizations: A case study of Jordan	To explore the factors that affect adoption of integrated cloud-based e-health record EHR system in healthcare organizations	Jordon	Qualitative, Phenomenological Approach using individual interviews	Three domains of factors were found of significance: 1) Technological factors including privacy, security, and reliability; 2) organisational factors such as top management support and technology readiness; and 3) environmental factors which involve government policies and competition
Ologeanu-Taddei (2015). Understanding the acceptance factors of an Hospital Information System: evidence from a French University Hospital	To examine the perceived usefulness, the perceived ease of use and the perceived behavioural control of a Hospital Information System (HIS) for the care staff	France	Quantitative, open and closed -end questions questionnaire	Perceived usefulness factors, perceived ease of use factors, and perceived behavioural control factors
Alloghani et al (2015). Technology Acceptance Model for the Use of M-Health Services among health related users in UAE	To identify the main factors that influence health related users' acceptance to mobile health services technology as a mean for receiving general health services	United Arab Emirates	Quantitative, cross-sectional survey	Perceived usefulness factors, perceived ease of use factors, security of health information, and trust in using mHealth services were found significant to influence the intention to utilise mHealth services

Gagnon et al (2016). M-Health adoption by healthcare professionals: a systematic review	To synthesise current knowledge of the factors influencing healthcare professional adoption of mobile health (m-health) applications	Systematic review (International)	Studies of qualitative, quantitative, and mixed methods designs were included	Perceived usefulness and ease of use, design and technical concerns, cost, time, privacy and security issues, familiarity with the technology, risk-benefit assessment, and interaction with others such as colleagues, patients, and management
Ariens et al (2017). Barriers and facilitators to eHealth use in daily practice: perspectives of patients and professionals in dermatology	To assess opinions of the most important stakeholders influencing the implementation and use of eHealth services in daily dermatology practice	Netherlands	Mixed methods study design using cross-sectional survey and focus group	Willingness to use eHealth services, availability of resources, financial factors, security, and confidentially of eHealth intervention, and Educational factors were identified significant in this study
Hennemann et al (2017). Ready for eHealth? Health professionals' acceptance and adoption of eHealth interventions in inpatient routine care	To investigate barriers and facilitators to acceptance of eHealth interventions and of online aftercare	Germany	Quantitative, web-based questionnaire	Social influence, performance expectancy, eHealth literacy, and mobile use

Zayyad and Toycan (2018). Factors affecting sustainable adoption of e-health technology in developing countries: an exploratory survey of Nigerian hospitals from the perspective of healthcare professionals	To investigate, identify and analyse the underlying factors that affect healthcare professionals decision to adopt and use e-health technology applications in developing countries	Nigeria	Quantitative, cross-sectional survey	Perceived usefulness, belief, willingness, as well as attitude were found of most significant factors that influence the intention to adopt eHealth. Low literacy level, experience level in using eHealth technology applications, lack of motivation, and poor organizational and management policies were also found significant
Schreiweis et al (2019). Barriers and facilitators to the implementation of eHealth services: systematic literature analysis	To provide a comprehensive list of relevant barriers to be considered and list facilitators or success factors to help in planning and implementing successful eHealth services	Systematic literature analysis (International)	Studies of qualitative, quantitative, and mixed methods designs were included	Top list of factors addressed in the literature include: Limited knowledge of eHealth or poor limited health literacy, availability of necessary devices and resources, problems with financing eHealth solutions, security, confidentiality, cognition, motivation, accessibility, added workload, unsuited services, design does not fit users' needs, organisational factors, involvement of all stakeholders, and ease of use

Alam et al (2019). Determinants of access to eHealth services in regional Australia	To investigate the current state and predictors of eHealth service access in regional Australia	Australia	Quantitative, cross-sectional survey	Access to the Internet, Educational level, socioeconomical factors, digital literacy, and geographical location were sought to be significant
Kesse-Tachi et al (2019). Factors influencing adoption of eHealth technologies in Ghana	To highlight factors influencing the adoption of eHealth technologies	Ghana	Quantitative, cross-sectional survey	Results reveal two significant factors influence the adoption of eHealth: 1) Institutional factors such as availability of resources in the workplace and 2) individual factors such as being female, young, and with high education
Hossain et al (2019). Factors influencing rural end-users' acceptance of e-health in developing countries: a study on portable health clinic in Bangladesh	To explore the factors that influence rural end users' acceptance of e-health in Bangladesh	Bangladesh	Quantitative, structured questionnaire	Social reference was found the most influential factor followed by advertisement, attitude toward the system, access to use cell phone, and perceived system effectiveness. Some demographic factors were also find significant such as age, gender, and level of education

1.3.2 Health Managers

Thompson et al (2012) stated that "Healthcare management is the profession that provides leadership and direction to organisations that deliver personal health services, and to divisions, departments, units, or services within these organisations" (Thompson et al. 2012). It has three different supervisory levels: top, middle and lower. Each level has its key responsibilities and roles that should be carried out by the position holder. The primary goal for health managers is improving the quality of services and outcomes (Neuhauser et al. 2011). However, this duty can be complicated in a dynamic and fast-growing industry such as healthcare. While Stefl (2008) believed that all practicing healthcare managers should have five competency domains: (1) communication and relationship management, (2) professionalism, (3) leadership, (4) knowledge of the healthcare system, and (5) business skills and knowledge (Stefl 2008), Thompson (2007) believed that managers must consider two major domains: (1) internal domain which focuses on staffing, budgeting, quality, patients satisfaction, technology acquisition and development, and (2) external domain which pays attention to the community demographics, regulations, stakeholders demand, competitors, and insurers (Thompson 2007). Health managers may come from different professional, social, health, technical, or management backgrounds. Egger et al. (2005) defined health managers as professionals with the primary responsibility for services, resources and partnership (Egger et al. 2005). Many of them are clinicians that are also working as managers even without a recognised management qualification.

1.3.3 Technology acceptance

After introducing the technology into practice, studying the user's acceptance became an issue of importance to investigate (Lee et al. 2003). Technology acceptance definition and technology acceptance models are two aspects that could give an overview of the technology acceptance concept in the literature. Questions such as: What does technology acceptance mean? When did it start? What are the most recognised technology acceptance models? – are now addressed.

Although there is no universally accepted definition of technology acceptance, Kollmann (2004) defined it as simply "the continuous use of technology" (Kollmann 2004). However, Biljon and Renaud (2008) thought about it from a deeper point of view and stated that technology acceptance is an attitude towards technology that can be influenced by many factors (Biljon and Renaud 2008). Faber (2014) gave it another definition with emphasis on commitment "The innovation is employed in organisational work; members are committed to using the innovation" (Faber 2014).

The literature around eHealth acceptance shows that embedding advanced technologies is never an easy process despite all the benefits that it has been shown to bring. One of the main global concerns raised while planning eHealth initiatives was the failure to understand why people resist technical interventions which demonstrated the importance of human-related factors in the process of planning and implementation of new technologies. This issue was introduced in a conference by the International Medical Informatics Association in 2003. It was pointed out that "people, not technology, will ultimately determine the success of Health Information Systems (HIS)" (Guise and Kuhn 2003). Watson (2010) stated that, in the European Union, the level of complexity and time-consuming nature of eHealth are two practical obstacles that could hinder the process of technology acceptance (Watson 2010).

To explain the rationale of the interaction between people and technology, many technology acceptance theories from different social and technical backgrounds have been developed to attain a better understanding of this relationship. Theory of Reasoned Action (TRA); Theory of Planned Behaviour (TPB); Motivational Model (MM); Model of Personnel Computer Utilisation (MPCU); Social Cognitive Theory (SCT); Innovation Diffusion Theory (IDT); Technology Acceptance Model (TAM); and, the Unified Theory of Acceptance and Use of Technology (UTAUT) were the most identified and distinguished theoretical technology acceptance frameworks presented in the literature. (More explanation about these theories in chapter 2).

1.4 eHealth in KSA

The healthcare industry in the KSA has made significant progress in the past few decades which result in ranking many healthcare institutions in the country as one of the best healthcare institutions in the Middle East region for the quality of health services provided (Altuwaijri 2008). King Faisal Specialist Hospital and Research Centre (KFSH&RC) was one of the leading healthcare organisations to introduce health technology in practice (Altuwaijri 2008). Since 1993, The KFSH&RC has been connected to many MOH hospitals in different provinces with an advanced telemedicine network (Altuwaijri 2008). Other healthcare organisations in the country took steps to benefit from the advantages of this health technology revolution. The rapid expansion of healthcare and the high expectations from stakeholders has been one of the major concerns for the healthcare providers and health decision makers. One of the ways suggested to boost healthcare services was utilising ICT technologies with eHealth considered as an innovative way of healthcare delivery (Altuwaijri 2008). A review of current eHealth literature studies conducted by Alsulame et al (2016) to investigate the status of eHealth in the country found that there were different forms of eHealth interventions in practice such as: Electronic Medical Records (EMRs), Electronic Health Records (EHRs), telemedicine, Computerised Physician Order Entry Systems (CPOE), and Clinical Decision Support Systems (CDSS). The study concluded that the eHealth field is promising with significant growth, however eHealth studies remain limited to only a few geographical provinces and healthcare organisations (Alsulame et al. 2016). That could affect the overall picture of eHealth status in the country as findings would not be generalised countrywide.

Despite the range of benefits that eHealth solutions are shown in the literature to have the potential to provide for the healthcare system in general, such as improving the quality of care, cost reduction, enhancing patient safety and avoiding medication errors, and finally saving effort and time, there remain many barriers hindering the successful transition (Khalifa 2013).

Altuwaijri (2008) and Khalifa (2013) stated that many barriers of a different nature can be a challenge to overcome. For example:

- The difficult geography of the KSA as a country of many terrains
- The expansion needs of healthcare services especially in remote areas
- E-Health establishment costs including electronic systems and applications upgrade and maintenance
- The difficulty of connecting eHealth systems and applications of healthcare providers due to the variety of quality, specifications and manufacturing companies
- Lack of standards that govern the implementation of health information systems within the health sector
- And lastly human related barriers such as resistance to accept proposed changes and potential willingness to utilise technology

Some eHealth initiatives in the KSA evidenced impact on the field. For example, in 2011, the MOH launched the eHealth Strategy that visualised providing **"**A Safe, Quality Health System based on Patient Centric Care guided by standards, enabled by eHealth**"** (Figure 1.3) (National eHealth Strategy, MOH 2011).

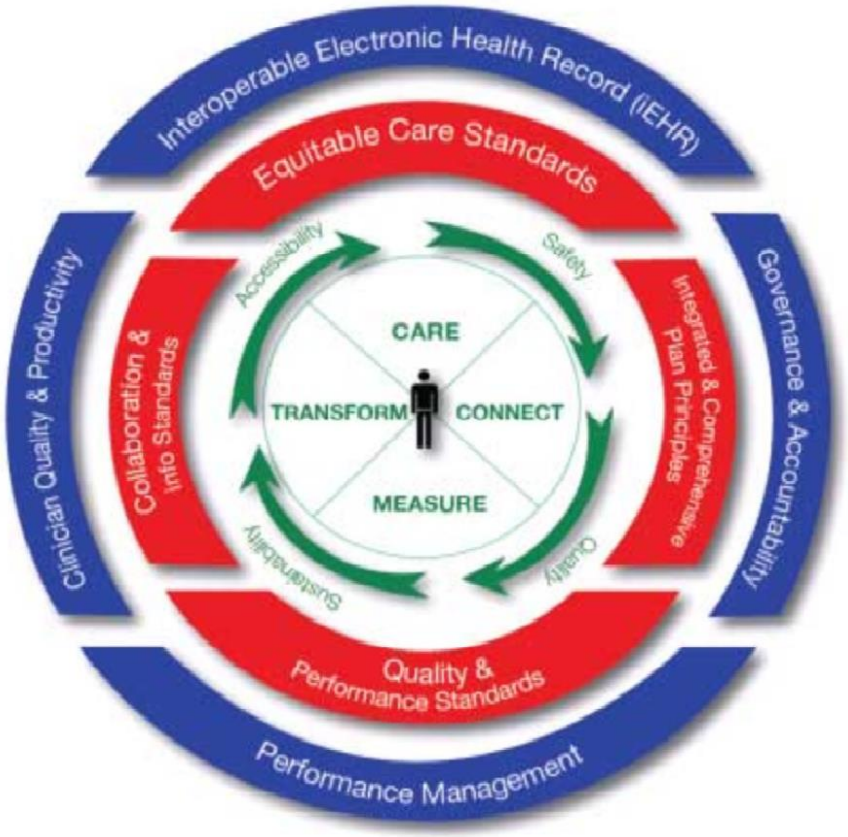


Figure 1.3: eHealth vision in KSA. Adopted from National eHealth strategy, MOH (2011)

To achieve this vision, four main objectives were set:

- To care for patients
- To connect providers at all levels of care
- To measure the performance of healthcare delivery
- To transform healthcare delivery to a consistent, world-class standard

This E-Health Strategy was seen to be of benefit to patients, health professionals, health managers and healthcare providers. It has been one of the MOH initiatives that are related to the National Transformation Programme (NTP) 2020 which is part of the Saudi Vision 2030.

The Saudi Vision 2030 plans to develop public sectors such as health and education, transform services into an electronic-based government, focus on qualifying and training people, open ambitious investment channels, and enhance the quality of life for all citizens and residents. These steps are part of a bigger plan that overall aims to build a strong economy based on the human workforce and natural resources rather than oil dependency (Saudi Vision 2030 2016).

Another initiative was the initial establishment of the Saudi Association of Health Informatics in 2006 in Riyadh. This association aimed to provide a solid background for exchanging experiences and ideas related to health information practice in Saudi Arabia among its members (Altuwaijri 2010). Furthermore, an educational initiative by the Ministry of Education which realised the importance of studying the field of health informatics. In 2005, the first Masters programme in Health Informatics in the Arabian gulf region was launched by the School of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, KSA. Today, many KSA universities provide undergraduate and postgraduate programmes in health informatics, health information management, and eHealth. This educational expansion has been seen to positively impact the field and future of health technology (Altuwaijri 2010).

1.5 Research problem

The use of ICT has impacted all domains of life. Healthcare is no exception. In the KSA healthcare context, the quality of health services delivery varies from one province to another based on the type of healthcare provider, the geography of the province, the availability of resources, and healthcare infrastructure. Despite the budget allocated by the Ministry of Health for the ICT, and the heavy investment in upgrading systems and technologies, the level of acceptance and the desired impact still falls below expectations. There are many possible causes for this problem. One of the major causes that was highlighted in the literature is the lack of resources (Alsulame et al. 2015). Another possible cause is the complexity of technology and lack of technical training on the eHealth interventions in practice (Hasanain and Cooper 2014). Additional causes may go beyond that and touch financial and organisational causes (Aldosari 2016). It was clear that known and unknown causes could negatively impact the eHealth acceptance level. Many studies have been conducted on eHealth services in the Saudi healthcare context but the lack of theoretical grounding to explain findings was observed. Health managers are key professionals in positions to influence acceptance of eHealth. They, as decision makers, have the authority and influence to help boost the acceptance level, however, there are scarce studies that investigated health managers views towards eHealth services in the KSA context. It was thought of importance to connect eHealth practice with health management to bring in the significance of eHealth research and increase the awareness of investment in health technologies and acceptance. Thus, this research will systematically present all available factors that influence eHealth acceptance, investigate which of them would be of significance to the health managers and, finally, explore factors that influence health managers acceptance with a focus on key health managers in Aseer Province, KSA.

1.6 Research aim and questions

The overall aim of this research was to explore factors that influence health managers acceptance of eHealth services in the KSA.

This research was conducted in three sequential phases as follows:

First phase was a systematic review which aimed to critically appraise, synthesise and present the available evidence on the status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia from the perspectives of multiple stakeholders.

This systematic review sought to answer three questions:

1. What are the views of health professionals, health IT professionals, and health managers towards eHealth status in Saudi Arabia?

2. What are the factors that influence eHealth adoption and acceptance in the KSA from the perspectives of health professionals, health IT professionals, and health managers?

3. What are the main facilitators and barriers to implementing eHealth in the KSA from the perspectives of health professionals, health IT professionals, and health managers?

Second phase was a quantitative survey which was informed by the findings from the first phase systematic review (Alshahrani et al. 2019). The overall aim of this phase was to investigate the factors that influence health managers' acceptance of eHealth services in KSA utilising the UTAUT as a theoretical framework.

Phase 2 sought to answer the following three questions:

1. What are the factors that influence health managers' acceptance of eHealth services in KSA?

2. What UTAUT constructs are of significance to the health managers' behavioural intention to utilise eHealth services in the KSA?

3. What UTAUT constructs are of significance to the health managers' actual use of eHealth services in the KSA?

Third phase was qualitative interviews which were informed by the findings from the survey in the second phase. The overall aim of the third phase was to explore the views of health managers in Aseer Province, KSA towards factors that influence health managers' acceptance of eHealth services in the KSA.

This phase was designed to answer the following three questions:

1. What do health managers in Aseer Province know about eHealth services in the KSA?

2. What advantages do health managers in Aseer Province think that eHealth services can bring to healthcare system in the KSA?

3. What factors do health managers in Aseer Province think are of significance to influence the acceptance of eHealth services in the KSA?

1.7 Chapter summary

This chapter has set the scene for this doctoral research. Key terms were defined. An overview of the study context of Saudi Arabian healthcare was given which included the country profile, healthcare system, and eHealth status in KSA. Finally, the research problem, overall aims, objectives, questions and linked phases were described.

CHAPTER 2: RESEARCH METHODOLOGY

2.1. Introduction

Oates (2005) questioned the meaning of "research" and defined it as "the creation of new knowledge, using an appropriate process, to the satisfaction of the users of the research" (Oates 2005). Bacon-Shone (2013) gave it another definition as "a systematic and unbiased way of solving a problem (by answering questions or supporting hypotheses) through generating verifiable data" (Bacon-Shone 2013). Research methodology on the other hand is defined by Walliman (2005) as the processes that explain how a specific research study is being handled: what instruments were used to collect data, how subjects were recruited and investigated, how collected data were analysed, and what theories have been utilised to explain results (Walliman 2005). Methodology is a broad term describing a philosophical approach which should not be confused with the term method. Method is a specific term that refers to the "procedure, technique or planned way of doing something" (Bowling 2014).

This chapter provides an overview of the general methodological approaches including, philosophical research paradigms, mapped paradigms of this study, differences between quantitative and qualitative methodologies, methods of data collection, and justification for the adopted research design for this study. Research ethics, sampling, and data analysis techniques will also be presented as part of this chapter.

2.2. Research paradigms

Oates (2005) defined research paradigm as "a pattern or model or shared way of thinking" of a research community about a certain aspect (Oates 2005). Guba (1990) described it as "a set of beliefs and feelings about the world and how it should be understood and studied" (Guba 1990). Research paradigms have four elements which were defined by Healy and Perry (2000) and Creswell (2009) as the following:

Ontology *which is the "reality" that researchers investigate*

Epistemology *which is the "relationship" between the reality and the researcher*

Methodology *which is the technique used by the researcher to investigate that reality*

Axiology *which is the role of value and its implication on the research being conducted*

These four elements of research paradigms are associated with four categories of research philosophy which are:

- *Positivism*
- *Constructivism*
- *Transformativism*
- *Pragmatism*

Table 2.1 illustrates the main features of the four categories of research philosophy.

Table 2.1: Research paradigm features based on Guba (1990), Bowling (2009), and Creswell (2017)

	Positivism	**Constructivism**	**Transformativism**	**Pragmatism**
Ontology	Reality is objective apart from the researcher	Reality is subjective to the views of the researcher	Reality is emerged objective-subjective	Reality is what is useful, is practical, and "works"
Epistemology	Researcher is independent from what is being researched	Researcher could interact with what is being researched	Co-created findings with multiple ways of knowing	Reality is known through using many tools of research that reflect both deductive (objective) evidence and inductive (subjective) evidence
Axiology	Researcher bias needs to be controlled	Values are negotiated among individuals	Values need further interrogation	Values are discussed because of the way that knowledge reflects both the researchers' and the participants' views
Methodology	Quantitative approaches such as experimental or surveys	Qualitative approaches such as case study and ethnography	Use of collaborative processes of research. Questioning of methods, highlighting issues and concerns	Mixed Methods quantitative and qualitative
Common Methods	Close-ended questionnaires and laboratory science	Open-ended structured and semi-structured interviews	Participatory methods	A combinations of qualitative and quantitative methods for data collection and analysis

For the purpose of identifying the most appropriate paradigm for each phase in this study, different research paradigms have been adopted for the three phases as the following:

Phase I:
The first phase of this study focussed on presenting all available evidence of eHealth adoption and acceptance in the KSA through a systematic review from the views of multiple stakeholders. Studies included in the review were quantitative, qualitative and mixed methods designs. More about this phase in Chapter 3.

Phase II
The second phase of the study was of quantitative design to investigate factors that influence health managers' acceptance of eHealth services in the KSA. Survey methodology with a close-ended questionnaire for data collection was applied. Positivism paradigm was mapped to this phase as to align the given aim and questions of the phase. More about this phase in Chapter 4.

Phase III
The third phase of the study was of qualitative design to explore more in-depth the views of health managers towards the factors influencing health managers acceptance of eHealth in the KSA. Phenomenological methodology with open-ended semi-structured interviews for data collection was applied. Constructivism paradigm describes the subjectivity and personal perspectives of health managers towards the topic under investigation. More about this phase in Chapter 5.

2.3. Quality of evidence

The quality of evidence is the reflection of confidence in evaluating the effect to support the recommendations (Guyatt et al 2008). It is used to rank the strength of the obtained relative results. A commonly cited hierarchy for research evidence was proposed to pool the best available evidence. The strength of results was measured with focus on two key concepts "quality" and "bias". Figure 2.1 shows that Systematic Reviews (SR) and meta-analysis are placed at the top of the pyramid followed by critically appraised topics. This hierarchy basically suggests

that the higher position the study design is, the more rigorous the methodology it shows and, hence, the more likely to reduce the level of bias (Hoffmann et al. 2013).

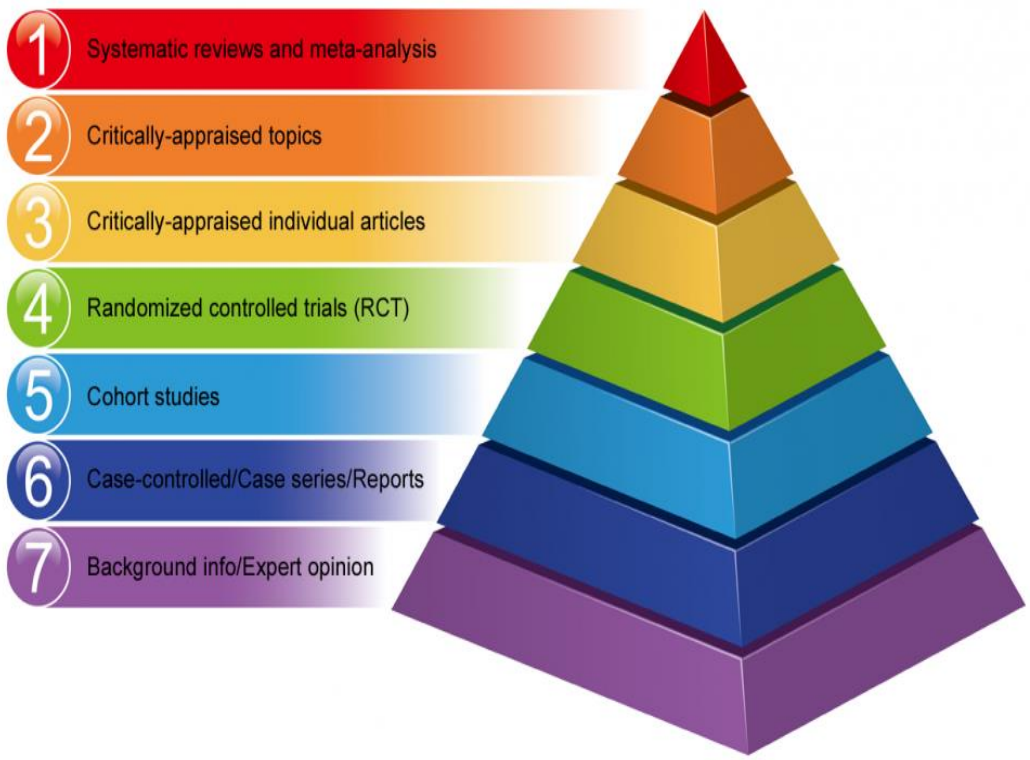


Figure 2.1: Hierarchy of evidence. Adopted from Markus MacGill (2019)

2.4. Systematic review (SR)

Literature review refers to a "comprehensive study and interpretation of literature that addresses a specific topic" (Aveyard 2010). Literature could be obtained from many sources such as but not limited to; books; peer reviewed articles; individuals' experiences; and reports. The hierarchy for research evidence can be used to evaluate the quality and strength of literature results.

Although literature review is a commonly used term, it is not the only available form of review. Grant and Booth (2009) compiled fourteen different types of reviews (Grant and Booth 2009). Table 2.2 provides a description of each type.

Table 2.2: Types of review. Adopted from Grant and Booth (2009)

Type of review	Description
Critical review	Aims to demonstrate writer has extensively researched literature and critically evaluated its quality. Goes beyond mere description to include degree of analysis and conceptual innovation. Typically results in hypothesis or model
Literature review	Generic term: published materials that provide examination of recent or current literature. Can cover wide range of subjects at various levels of completeness and comprehensiveness. May include research findings
Mapping review/ systematic map	Maps out and categorises existing literature from which to commission further reviews and/or primary research by identifying gaps in research literature
Meta-analysis	Technique that statistically combines the results of quantitative studies to provide a more precise effect of the results
Mixed studies review/ mixed methods review	Refers to any combination of methods where one significant component is a literature review (usually systematic). Within a review context it refers to a combination of review approaches for example combining quantitative with qualitative research or outcome with process studies
Overview	Generic term: summary of the [medical] literature that attempts to survey the literature and describe its characteristics
Qualitative systematic review/ qualitative evidence synthesis	Method for integrating or comparing the findings from qualitative studies. It looks for 'themes' or 'constructs' that lie in or across individual qualitative studies
Rapid review	Assessment of what is already known about a policy or practice issue, by using systematic review methods to search and critically appraise existing research
Scoping review	Preliminary assessment of potential size and scope of available research literature. Aims to identify nature and extent of research evidence (usually including ongoing research)

Table 2.2: Types of review. Adopted from Grant and Booth (2009)

Type of review	Description
State-of-the-art review	Tend to address more current matters in contrast to other combined retrospective and current approaches. May offer new perspectives on issue or point out area for further research
Systematic review	Seeks to systematically search for, appraise and synthesise research evidence, often adhering to guidelines on the conduct of a review
Systematic search and review	Combines strengths of critical review with a comprehensive search process. Typically addresses broad questions to produce 'best evidence synthesis'
Systematized review	Attempts to include elements of systematic review process while stopping short of systematic review. Typically conducted as postgraduate student assignment
Umbrella review	Specifically refers to review compiling evidence from multiple reviews into one accessible and usable document. Focuses on broad condition or problem for which there are competing interventions and highlights reviews that address these interventions and their results

Systematic review is defined as "A literature review that is designed to locate, appraise, and synthesise the best available evidence relating to a specific research question in order to provide informative and evidence-based answers" (Boland et al. 2017).

Given the aim and questions in the first phase of this study, a systematic review was carried out: first, to present a robust evidence of the status of eHealth adoption and acceptance in the KSA with specific and focussed questions that are PICO-based (Population, Intervention (or focus of Interest), Context, and Outcome); second, to identify the knowledge gap in the literature, and; finally to inform the later phases of the study. Table 2.3 shows differences between the more generic "literature review" and the type of review used in this study, a "systematic review".

Table 2.3: Comparison table between literature and systematic reviews. Adopted from Grant and Booth (2009)

Criteria	Literature review	Systematic review
Description	Generic term: published materials that provide examination of recent or current literature. Can cover a wide range of subjects at various levels of completeness and comprehensiveness	Seeks to systematically search for, appraise and synthesise research evidence, often adhering to guidelines on the conduct of a review
Search	May or may not include comprehensive searching	Aims for exhaustive, comprehensive searching
Question	Broad or general	Focussed, PICO-driven
Appraisal	May or may not include quality assessment	Quality assessment may determine inclusion/exclusion. Checklist-driven
Synthesis	Typically, narrative	Typically, meta-analysis, narrative with tabular accompaniment
Analysis	Analysis may be chronological or thematic	What is known; recommendations for practice. What remains unknown; uncertainty around findings, recommendations for future research

Using an explicit method, such as systematic review, has proven to bring some significant advantages (Gopalakrishnan and Ganeshkumar 2013) such as: minimising bias, producing accurate and reliable conclusions, making easier delivery of information to healthcare providers, researchers, and policy makers, developing new hypotheses about subgroups of study populations, and most of all increasing the rigour and quality of the results, were some of the noticeable advantages (Greenhalgh 1998).

2.4.1. Systematic Review protocol registration

There are two aims for registering SR protocol. First is to minimise bias which can occur at any stage of the research. Bias is defined as "any tendency which prevents unprejudiced consideration of a question" (Pannucci and Wilkins 2010). There are many types of biases, however, the most common ones are: design bias, participants selection bias, data collection bias, and analysis bias (Smith and Noble 2014). The second aim is to avoid duplication of reviews of the same topic and probably context. This is thought to be important in order to save time and cost for the new potential researchers which will give them the opportunity to dedicate their effort in investigating a new topic that has not been studied.

For the above aims, a systematic review protocol was suggested to be developed and published prior to commencing to guide the whole systematic review process (Stewart et al. 2012).

Systematic review protocols could be published in journals as peer reviewed articles, however, there are several systematic review databases that are considered formal bodies for registering systematic review protocols.

Cochrane Database of Systematic Reviews (CDSR) is a highly regarded database for registering review protocols for healthcare and health services scope topics. Publishing reviews in CDSR is guided by certain standards of which selecting studies, criteria for inclusion and exclusion, collecting data, applying quality assessment, interpreting results, and updating protocols should be adhered to (Cochrane Library 2020). RevMan is a software recommended by CDSR to write the review as well submit it for publication.

The work of CDSR is based on ten key principles:
1. Collaboration; 2. Building on the enthusiasm of individuals; 3. Avoiding duplication of effort; 4. Minimising bias; 5. Keeping up-to-date; 6. Striving for relevance; 7. Promoting access; 8. Ensuring quality; 9. Continuity; and 10. Enabling wide participation (Cochrane Library 2020).

CDSR started publishing protocols in 1995. Registered protocols from 1995 until 2009 were scheduled for publication every three months in a total of four times a year. Starting from 2010, CDSR changed to a twelve-issue schedule per year on a monthly basis. According to the Cochrane Handbook, authors are expected to maintain and update their published reviews at regular intervals (The Cochrane Handbook for Systematic Reviews of Interventions 2020).

Joanna Briggs Institute (JBI) is another index for systematic review protocol registration. It was founded in 1996 as an independent, international, not-for-profit research organisation mainly based and published from the University of Adelaide, Australia. The JBI Model of Evidence-based Healthcare was developed to serve the institute's mission of "supporting health professionals to improve health outcomes globally and create ripples of change by providing the best available evidence to inform clinical decision making" (Joanna Briggs Institute 2020). The JBI has online critical appraisal tools to assess the quality of different methodological approaches such as: cross-sectional studies, case reports, qualitative research, and systematic reviews (Joanna Briggs Institute 2020). The JBI has an active collaboration with many universities and healthcare facilities around the world to provide training courses on many areas such as: conducting systematic reviews, evidence implementation training to assist promoting healthcare practice globally, and clinical leadership workshop (Joanna Briggs Institute 2020).

The Centre for Reviews and Dissemination (CRD) at the University of York, UK and funded by the National Institute for Health Research (NIHR) maintains the international Prospective Register of Systematic Reviews (PROSPERO) database (Centre for Reviews and Dissemination 2020). The main purpose of this database that presents guidance of core methods and steps on conducting SRs is to "provide a comprehensive listing of systematic reviews registered at inception to help avoid duplication and reduce opportunity for reporting bias by enabling comparison of the completed review with what was planned in the protocol." It covers a wide range and scope of topics including but not limited to, social care, public health, education, and healthcare outcomes (Centre for Review and Dissemination 2020).

Upon writing the SR protocol, guidance checklists provided by the centre are available to help in addressing what the protocol should involve. Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) checklist is one recommended statement to guide the protocol writing (Moher et al. 2015). More about PRISMA-P in Chapter 3.

Reporting results should follow certain guidelines as shown in the PRISMA flow diagram (Figure 2.2).

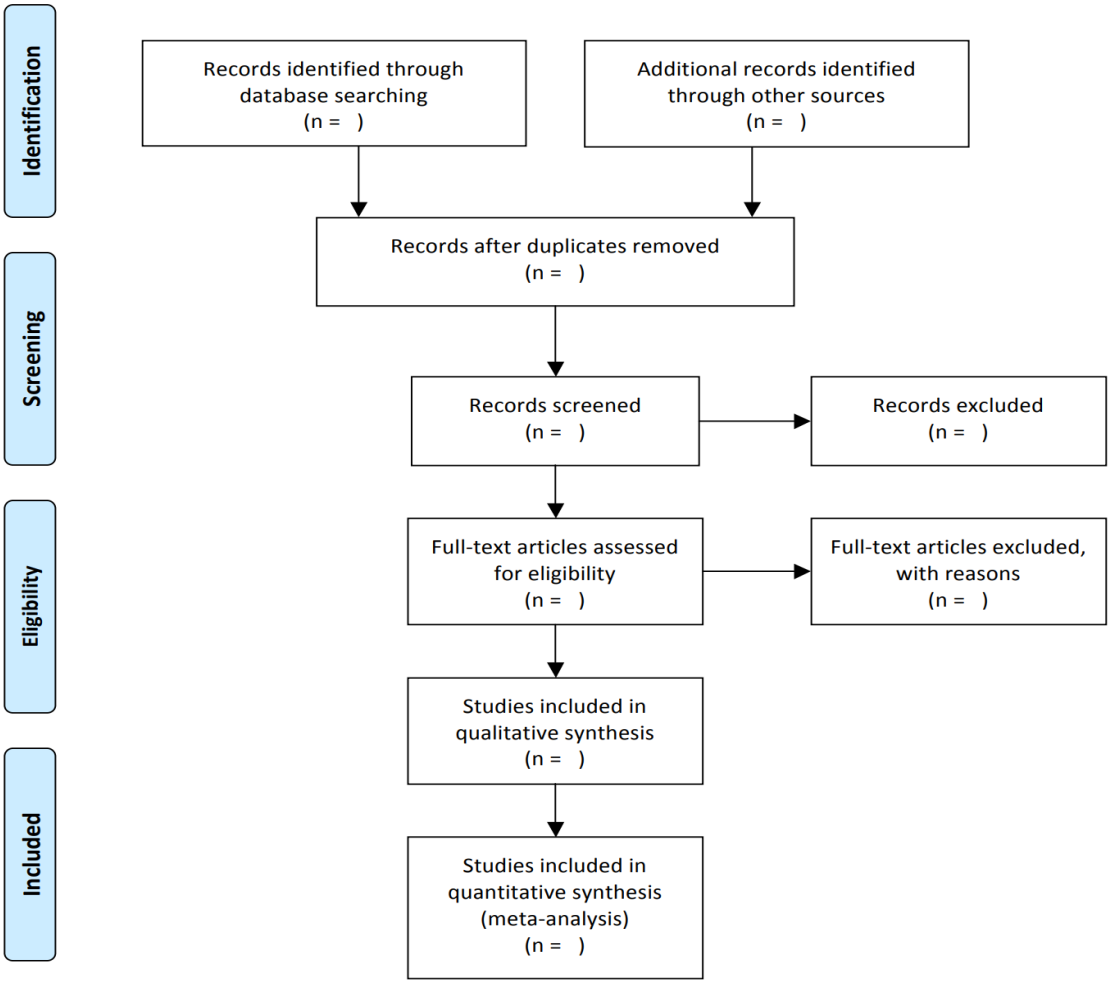


Figure 2.2: PRISMA reporting flow diagram. Adopted from Moher et al. (2009)

Due to the nature of the included studies in the SR which vary in design, a range of Critical Appraisal tools like CASP and CEBM are accessible. Quality Appraisal tools are of importance to be applied in order to assess the trustworthiness and relevance of the studies (Mhaskar et al 2009). Data extraction of the key information from the selected studies are to be done by at least two independent researchers of the team in order to minimise bias and increase transparency of how the process should be handled (MacLure et al 2016). More about the selected tools and data extraction process in Chapter 3.

2.5. Research approaches

In the general literature overview, two research approaches, quantitative and qualitative, are commonly applied in many academic fields including healthcare. A third approach that is a combination of both quantitative and qualitative approaches in what is called a "mixed methods" approach (Kumar 2019). However, the decision to carry out or adopt either research approach is mainly determined by the study aim and question(s) and not the researcher's preferences (Marshall 1996). Methodology, in general, is defined as "The strategy, plan of action, process or design lying behind the choice of particular methods and linking the choice and use of methods to the desired outcomes" (Crotty 1998). The following sections highlight the differences between research approaches, common methodologies of each approach, and associated methods for data collection and analysis.

2.5.1. Quantitative Methodologies

Quantitative Methodology is a broad term that covers many types of research (Bryman 2003). It is defined as "a systematic and empirical investigation of phenomena through statistics and mathematics and the processing of numerical data" (Basias and Nikolaos 2018). This approach tends to answer questions of quantity or nature such as how much, how many, to what extent (Rasinger 2013). Although this approach has been widely employed by researchers for decades in studies that aim to measure the quantity (Creswell 2017), caution should always be applied as this methodology can only be applied to phenomena that can be expressed in terms of numbers and statistics (Kothari 2004).

There are mainly two major categories of quantitative research methodologies: experimental designs and survey designs (Watson 2015).

Experimental designs: Experiment is a "study where the researcher can manipulate one variable, the independent variable, and study its effect on a dependent variable" (Watson 2015). Randomised Controlled Trial (RCT) is an example of this design and it is considered an ideal method for testing the correlation between cause and effect in clinical interventions (Watson 2015).

Survey design: "the collection of information from a sample of individuals through their responses to questions" (Check and Joseph 2011). Scheuren (2004) also defined it as a "method of gathering information from a sample of individuals" (Scheuren 2004). Creswell (2017) defined it from a population's perspective as: "A numeric description of trends, attitudes, or opinions of a population by studying a sample of that population" (Creswell 2017).

2.5.1.1. Advantages and disadvantages of quantitative methodologies

In the literature of research methodologies, a wide range of benefits and drawbacks of using quantitative methodologies were evidenced. Table 2.4 illustrates some of the potential advantages and disadvantages of using this approach in conducting a study.

Table 2.4: Advantages and disadvantages of quantitative methodologies based on Creswell (2014), Carr (1994), Connolly (2007), and Denzin and Lincoln (2008)

Advantages	**Disadvantages**
Efficient data analysis (Creswell 2014)	Dry and impersonal as no personal interaction between the investigator and participants (Creswell 2014)
Likely to be generalised to a population as it draws conclusion from a large sample that is randomly selected, given the sample is representative (Creswell 2014 and Carr 1994)	Provides only limited understanding of the phenomena under investigation (Creswell 2014 and Denzin and Lincoln 2008)
Time saving as it uses statistical software such as the Statistical Package for Social Sciences (SPSS), Microsoft Excel, and Stata to analyse data (Connolly 2007)	Participants' words, expressions, and actions are not recorded or observed (Creswell 2014)
Allows to investigate relationships among variables (Creswell 2014)	Potential bias as the study is likely to be an investigator driven (Creswell 2014)

Given the aim and questions of the second phase of this study, a quantitative survey-based methodology was thought to be appropriate.

2.5.1.2. Data collection tools in quantitative methodologies

There are different data collection tools in quantitative methodologies such as close-ended questions, experiments, and document review, however, questionnaire is the most popular and widely used quantitative method (Ponto 2015). There are two formats of questionnaires: paper-based questionnaires and online questionnaires. Each format has its own advantages and disadvantages.

Paper-based questionnaire was first in mind to be the method of data collection for the second phase of the study but due to the high potential financial cost and difficult logistical reasons of distribution, as well as the difficulty to identify health

managers, an online questionnaire format was selected to be the data collection instrument. In the KSA, social media were found to be in common use by health professionals who engage in many online activities such as education, seeking information, and performing research (Courtney 2013). Several advantages for using these channels were noticed, for example, active professional networking, low cost of access to the internet, and ability to advertise new services to a wider community (Courtney 2013). Three social media platforms, Facebook, Twitter, and WhatsApp, were adopted for distribution of the questionnaire as a rapid and wide-reaching solution with support from Saudi Arabian Health Informatics groups and some influential health professionals.

2.5.1.3 The quantitative study design

In this study, the online questionnaire of four parts was developed based on two sources. The first source was the thirty-nine factors identified in a systematic review as relevant to eHealth acceptance in KSA from the perspectives of multiple stakeholders (Alshahrani et al. 2019), and second was the validated questionnaire adopted from the UTAUT model (Venkatesh et al. 2003). Details can be found in Chapter 4.

The questionnaire had gone through several stages of development starting with identifying the data to be collected, followed by selecting the target population and the method of distribution, research team agreement on the questions, then validation and piloting. More about the questionnaire development in Chapter 4.

The questionnaire was designed in two languages Arabic and English. Sekaran and Bougie (2016) explained the importance to use a clear and understandable language at the level of all participants (Sekaran and Bougie 2016). The original language of questionnaire design was English which is the official language of teaching in the United Kingdom (UK). A decision to add Arabic language was made as Arabic is the official language of the KSA. Although English is widely used in the healthcare sector but it was of importance to add the daily spoken language for more participation preferences as recommended. The final questionnaire design was made to support two languages, English and Arabic.

The original version of the questionnaire was designed in English and translated into Arabic language by the principal researcher. Both English and Arabic versions were then sent to two Saudi PhD students, one of whom comes from a health background. Both were asked to provide comments and compare the two versions of the questionnaire with focus on accuracy of translation and clarity of the language. Feedback was received with minor changes applied before confirming the identical translated version for distribution.

2.5.1.4 Sampling techniques in quantitative research

For studying a phenomenon in a certain population, the best approach is to investigate the whole population, however, this is not always possible. Alternatively, a sample that is representative of the entire population can be considered (Acharya et al. 2013).

To understand the meaning of the three key terms in the sampling process, Levy and Lemeshow (2013) defined:

population as the "entire set of individuals to which findings of the survey are to be extrapolated" (Levy and Lemeshow 2013).

Landreneau (2009) described the difference between sample and sampling in quantitative research as the following:

sample: a subset of a population that are selected to participate in a certain study (Landreneau 2009).

sampling: The process of selecting a portion of a population that is a representation of the whole population (Landreneau 2009).

There are two main categories of sampling techniques, 1) probability sampling which means that every individual has an equal chance to be selected for participation in the study (Acharya et al. 2013); 2) Non-probability which is the opposite of probability and that may lead to bias in the selection process of the sample (Acharya et al. 2013).

Marshall (1996) stated that probability sampling is most appropriate in studies of quantitative nature as it gives the best chance to generalise the findings over the population. Having said that, it is not the best approach if the study is qualitative based and seeks to develop an in-depth understanding of a certain phenomenon (Marshall 1996).

There are four main probability sampling techniques (Landreneau 2009 and Sharma 2017). Table 2.5 shows a comparison between the different techniques.

Table 2.5: Comparison of most common probability sampling techniques based on Landreneau 2009 and Sharma (2017)

Sampling technique	Procedure of selection	Advantages	Disadvantages
Simple random	Every subject has an equal chance to be selected. Each subject is selected independently	• Assembling the sample is easy • High chance the sample will be representative • An unbiased random selection	Population list needs to be complete and up to date prior to sampling
Systematic	Subjects are chosen in a systematic way in which the selection of the first random unit determines the process of the entire sample	• Easy to conduct • Spread of sample selection is done systematically	There is a risk of data manipulation and bias
Stratified	Population is divided into smaller groups based on shared characteristics then a random sample from each group is selected	• Highly representative of the population • This sample allows generalisation to the whole population	Not useful if there is no knowledge of the characterised groups and size of each group
Cluster	First, population is divided into groups (clusters) then researcher selects the number of clusters to be the sample size	• Cost of conducting this technique is cheaper compared to other techniques	There are two major concerns, bias interference and sampling error which is high in this technique compared to others

2.5.1.6 Sample size representation

To calculate the sample size representation in this study, some health informational facts were considered. In 2015, the General Authority for Statistics in KSA determined the total number of healthcare workforce in KSA as 384,636 with high growth due to the expansion of health services and the continuous need for specialist professionals (General Authority for Statistics 2016). However, the number of professionals that self-identify as health managers cannot be estimated. To apply caution on calculating the representative sample size, the total number of all healthcare workforce was considered a target population in this study. Smith (2013) suggested the following sample size calculation formula to be used at confidence interval 95% (1.96) and margin of error 5% (0.05) (Smith 2013).

$$Sample\ size = \frac{(Z)^2 \times p(1-p)}{(\mathrm{e})^2}$$

Z = confidence level (1.96)
p = population proportion (0.5)
e = Margin of error (0.05)

Sample size= $(1.96)^2$ * 0.5(1-0.5) / $(0.05)^2$
Sample size= 3.8416 * 0.25 / 0.0025= 384.16

The sample size representation needed is determined at 384 respondents.

2.5.1.7 Analysis of quantitative data

In quantitative research, data collected can be analysed by using different techniques. Punch (2003) suggested three simple steps to start analysing quantitative data: create variables, distribute variables across the sample, and then test the relationship between the variables (Punch 2003). In this study, the Statistical Package for the Social Sciences (SPSS, v25) was the most commonly in use within the university and readily accessible for data analysis due to the nature of the collected data. Test of normality was planned to be conducted first to decide

the type of regression and whether to use parametric or non-parametric tests for analysis as differences described in Table 2.6 followed by internal consistency of variables, Principal Components Analysis (PCA) and finally Ordinal Regression Analysis. More details in Chapter 4.

Table 2.6: Differences between parametric and non-parametric tests based on Grech and Calleja (2018)

	Parametric test	**Non-parametric test**
Data distribution	Assumed to be normal	Non-normal distribution
Data type	Interval	Nominal or ordinal
Correlation test	Pearson	Spearman
Two groups, independent measures	t-test	Mann-Whitney U test
More than two groups, independent measures	One-way analysis of variance (ANOVA)	Kruskal-Wallis test

2.5.1.8 Robustness in quantitative research

The robustness of quantitative research can be reached by assessing the validity and reliability. Heale and Twycross (2015) defined validity as "the extent to which a concept is accurately measured in a quantitative study" (Heale and Twycross 2015). Content and face validity were applied in this study. Hardesty and Bearden (2004) described face validity as the relation of the test's items to the targeted aim(s) (Hardesty and Bearden 2004). Content validity, on the other hand, was referred to as the representation of the items to measure what they aim to measure (Hardesty and Bearden 2004). Reliability relates to the consistency of the measure. It is defined as "the extent to which a research instrument consistently has the same results if it is used in the same situation on repeated occasions" (Heale and Twycross 2015). In this study Cronbach alpha was applied

in reliability command in SPSS to test the internal consistency of the variables. More details in Chapter 4.

2.5.2. Qualitative Methodologies

Qualitative methodologies are defined as a "systematic inquiry into social phenomena in natural settings. These phenomena can include, but are not limited to, how people experience aspects of their lives, how individuals and/or groups behave, how organizations function, and how interactions shape relationships" (Teheran 2015). In other words, qualitative approaches mainly aim to look into life experiences in order to explain the phenomena under investigation.

Creswell (2016) stated that the most employed approaches in qualitative research are: narrative, phenomenology, grounded theory, ethnography, and case study (Creswell 2016). Table 2.7 gives a description of each approach.

Table 2.7: Description of qualitative approaches based on Creswell (2016)

Qualitative approach	Description
Narrative approach	The study of chronological experience of a single individual or event. Details could be provided from different sources such as literature or history
Phenomenological approach	The study of lived experiences of several individuals in order to provide an overall understanding of the phenomenon under investigation
Grounded theory approach	A theory is intended to be generated or developed from the data of participants that have experience of the phenomenon under investigation in order to give comprehensive explanation
Ethnographic approach	A study that focuses on describing and interpreting shared patterns of human culture such as values, behaviour, and beliefs through using certain methods such as observation
Case study approach	A single case or several cases are to be explored by using data collection methods such as participant observation or in-depth interviews

2.5.2.1 Data collection tools in qualitative methodologies

The most common data collection tools in qualitative methodologies are: interviews, focus groups, and participant's observation (Creswell 2017).

The third phase of the study was planned to be carried out in Aseer Province, KSA. This phase aims to explore views on the topic. Face-to-face and telephone interviews were thought to be an appropriate method for data collection due to the level of work engagement of the targeted population (Health managers) and the potential sensitivity of expressing open views in focus group discussion with presence of others health managers who might have higher authority (Bowling 2014).

Interviews are: A qualitative technique that aims to conduct interviews with a small number of individuals to explore their perspectives on a specific topic or area (Boyce and Neale 2006).

Interviews can also be defined as: a primary data collection method in qualitative research that consists of specific research questions *(*Stuckey 2013*)*

Wildemuth (2016) added to the above definitions that interviews are organised and planned in advance in which both parties, the interviewer and the interviewee, know the purpose of this communication and the role that both parties should stick to in order to achieve the desired goal (Wildemuth 2016).

There are three types of interviews: Structured, semi-structured, and unstructured (Bowling 2014). Table 2.8 demonstrates the differences between the three types.

Table 2.8: Differences between the three types of interviews based on Kajornboon (2005), Bowling (2014), and Creswell (2016)

	Structured interviews	Semi-structured interviews	Unstructured interviews
Description	• This type is sometimes called standardised interview • Set of questions are pre-determined prior to the interview and are asked in fixed order to all participants. As per interview guide, no change of questions or asking order are allowed	• This type is sometimes called non-standardised interview • Set of questions are pre-determined prior to the interview but there is flexibility to add more questions and change the order of asking the questions based on the direction of the interview	• This type is sometimes called non-directed interviews • No questions are prepared prior to the interview. Each interview can be different, however, there is a high risk of bias in this type
Reliability	• High reliability. Interview guide is followed	• Reliable. Interview guide is followed but not adhered to completely	• Low reliability. No interview guide to be followed
Analysis	• There is a common analysis format. It is a straightforward analysis process. Themes are pre-coded and researcher can easily compare data	• Coding and analysis can be done after the interview. Researcher is freer and does not have to adhere to pre-coded themes or format	• Difficult to code and analyse data due to the fact that unrelated questions might be asked and irrelevant answers could be received

2.5.2.2 Sampling techniques in qualitative research

In contrast to the probability sampling used in quantitative approaches, non-probability sampling is commonly used in qualitative methodologies. The problem with this non-probability technique is that findings cannot be generalised over the population (Higginbottom 2004).

There are different non-probability sampling techniques. Purposive technique is the most employed method (Oppong 2013). Table 2.9 illustrates differences between qualitative sampling techniques.

Table 2.9: Comparison of most common non-probability sampling techniques based on Marshall (1996) and Oppong (2013)

Sampling technique	Procedure of selection	Advantages	Disadvantages
Purposive sampling	Researcher identifies characteristics of the target population such as age, gender, and social class then select purposeful samples that match the characteristics	• Most common and efficient sampling technique in qualitative methodologies • Stratification strategy applied	• High risk of bias in selecting participants
Snowball sampling	New participants are recruited in the investigation as per recommendation by current participants	• Easy to recruit as new participants are recommended by current participants • Time saving	• High risk of participants' recommendation bias
Convenience Sampling	Researcher recruits most reachable or accessible participants	• Least costly with regards to money • Time saving as only available participants are selected	• Poor quality data could be generated

2.5.2.3 Sample size in qualitative research

According to Dworkin (2012), there is always a query about sample size needed for qualitative studies (Dworkin 2012). Although sample size in qualitative research is smaller than in quantitative, it should be large enough to provide rich description of the phenomena and address the research questions (Creswell 2016). Guest et al (2006) conducted a study to estimate how many interviews are enough and found few evidence-based suggestions. Creswell (1998) proposed a number between 5–25 samples to reach the richest description of the topic of interest, and Bertaux (1981) who recommended that 15 is the smallest acceptable sample number (Guest et al. 2006). Despite that, Boddy (2016) suggested that data saturation should be the key point that researchers must focus on to discuss the sample size in qualitative research (Boddy 2016).

The concept of data saturation was found in the qualitative literature to be of high importance to determine the sample size. Barbour (2008) defined it as the point when information started being repeated and collecting additional data becomes redundant (Barbour 2008). The decision to stop conducting more interviews should be taken if no new ideas are emerging, however, Francis et al (2010) proposed to conduct three more interviews as a stopping criterion if the research team think that saturation is reached (Francis et al. 2010).

In this study, 21 interviews were conducted. Data saturation as well as recommended sample size range were both met. More details in Chapter 5.

2.5.2.4 Data analysis of qualitative research

Data analysis of qualitative research is determined by the type of qualitative methods employed. Pope et al (2000) highlight that large and rich amount of data could be produced in qualitative research (Pope et al. 2000). Table 2.10 describes the five stages of qualitative data analysis as suggested by Pope et al (2000).

Table 2.10: Qualitative data analysis stages based on Pope et al. (2000)

Stage	Description
Familiarisation	This is the first stage in which researchers immerse in the process by listening to the audio-recorded interviews, making transcripts, reading through the transcripts, and list key ideas and themes
Identifying a Thematic Framework	Identify all themes and concepts that relate to the study aim and objectives as well as any issues that are raised by the respondents based on their experience
Indexing	Comment on the transcripts with appropriate indexing code. A short description can be added for elaboration especially if the passage of text would potentially encompass more than one theme
Charting	Data are to be rearranged according to the thematic framework. Every theme or key topic will be placed in a separate chart. Every chart will contain summaries of respondents' views and experiences of one area (theme)
Mapping and Interpretation	Finally, association between themes will be analysed and themes will be mapped against the phenomena to provide full explanation of all findings

This analysis stages showed consistency with other suggested qualitative analysis approaches explored by: Braun and Clarke (2006), Lacey and Luff (2009), and Ritchie et al (2013). More details on the qualitative analysis of this study in Chapter 5.

2.5.2.5 Trustworthiness in qualitative research

While in quantitative studies, robustness is determined by assessing the validity and reliability of the data collecting instruments, the trustworthiness in qualitative research is addressed differently. Four criteria of trustworthiness were proposed

by Guba (1981). Table 2.11 gives a description of these and their similar terms in quantitative studies (Guba 1981).

Table 2.11: Criteria of trustworthiness based on Guba (1981)

Criteria	Description
Credibility	• Similar to the internal validity in quantitative research • It means that the established findings are trustworthy and believable. That can be achieved by different ways such as: the richness of information collected which provides a detailed explanation of the phenomena of interest. Revising the work by other members of the research team is also another way of achieving credibility
Transferability	• Similar to external validity (generalisability) in quantitative research • It means that findings are applicable to other contexts or settings. That can be achieved by providing rich information about the phenomena under investigation, then a reader can compare what has been read with other situation or contexts
Dependency	• Similar to reliability in quantitative research • It means that findings will show consistency if being repeated by following the same process
Confirmability	• Similar to objectivity in quantitative research • It means to avoid any potential bias and that can be achieved as mentioned in credibility by triangulation, for example, by using different methods for collecting data

2.5.3 Differences between quantitative and qualitative approaches

Table 2.12 demonstrates the major differences between quantitative and qualitative approaches from different aspects.

Table 2.12: Quantitative approach verses Qualitative approach based on Bowling (2014), Creswell (2017), and Johnson and Christensen (2019)

Criteria	Quantitative approach	Qualitative approach
Purpose	To quantify data or test hypotheses in order to explain the phenomenon under investigation. Questions usually start with, how much, how many, or to what extent ...?	To explore and provide rich and in-depth details and complete insight into the phenomenon under investigation. Questions usually start with, how, why, and what ..?
Paradigm	Positivism	Constructivism
Data collection methods	Structured and validated instruments such as questionnaires and experiments	Open-ended response methods such as interviews and focus groups
Sample	Large and randomly selected	Small and purposively selected
Data generation	Data are generated in a form of numbers or statistics	Data are generated in a form of words or images
Data Analysis	Deductive by statistical methods	Inductive by the researcher (thematic and content analysis)
Generalisability of findings	Generalisable to the entire population	Less generalisable but may be transferable to similar populations and contexts

2.5.4. Mixed Methodologies

Mixed methodologies research is increasingly popular with high continuous growth (Johnson et al. 2007). Research methodologies can be pure mono/multi quantitative, pure mono/multi qualitative, or a combination of mixed quantitative/qualitative methods. The first two methodologies were viewed in the previous sections of this chapter. In this section, two key terms need to be clearly defined, **mixed methods research** as of to answer the question 'What

methodologies are appropriate to employ and in what order?' And **triangulation** to justify 'Why mixed methodologies were used?'.

Mixed methods research is defined by Creswell (2000) as: "the integration of both quantitative and qualitative approaches in one study or multiphase program. This definition includes utilisation of data collection and data analysis of both approaches" (Creswell 2000).

Triangulation is defined by Denzin (2017) as "the combination of methodologies in the study of the same phenomenon" This step is meant to strengthen the validity of findings (Denzin 2017).

Creswell (2017) introduced the main four mixed methods designs:

1- The convergent parallel design

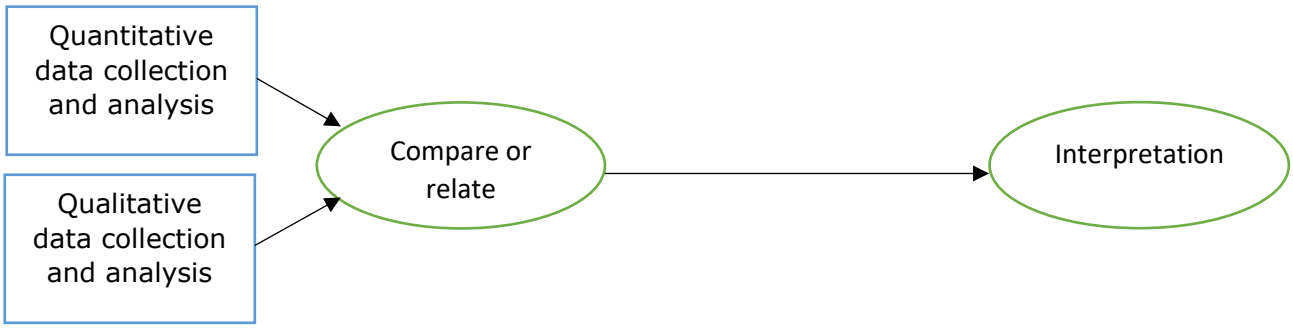
2- The explanatory sequential design

3- The exploratory sequential design

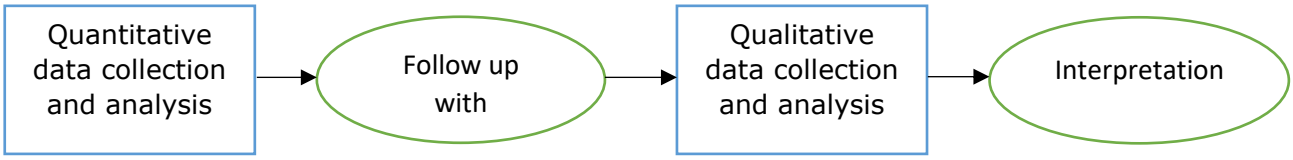
4- The embedded design

Figure 2.3 shows the differences between mixed methods designs.

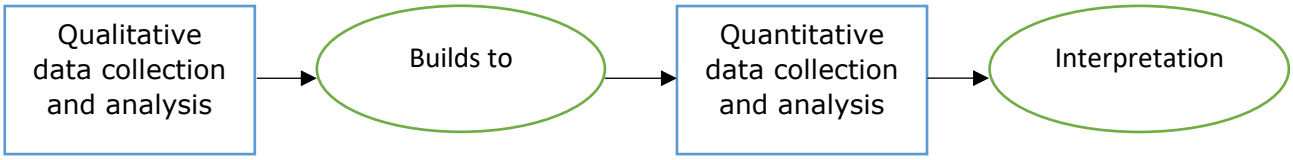
(1) Convergent Parallel Mixed Methods



(2) Explanatory Sequential Mixed Methods



(3) Exploratory Sequential Mixed Methods



(4) Embedded Mixed Methods

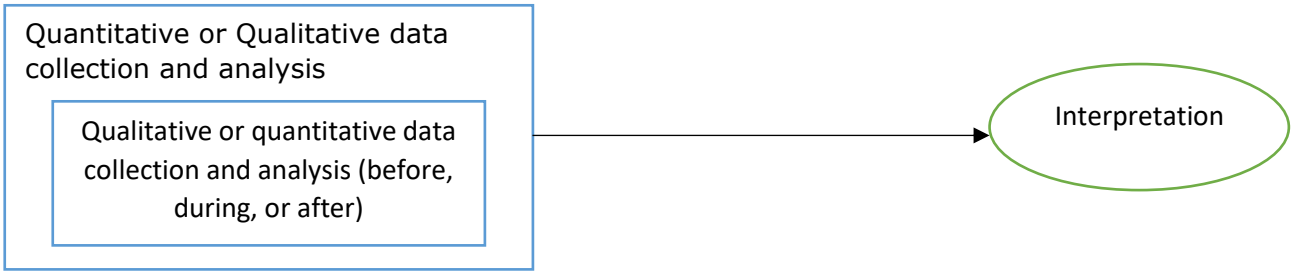


Figure 2.3: Different mixed methods designs based on Creswell (2017)

In this study, following on from phase 1 systematic review, Explanatory Sequential Mixed Methods has been employed. Quantitative cross-sectional survey methodology with close-ended questionnaire and representative simple random sample was applied in phase 2 to investigate the influential factors followed by

qualitative phenomenological approach with face-to-face and telephone interviews and purposively selected sample in phase 3 to provide further explanation and in-depth understanding.

2.6 Ethical considerations

Ethical considerations are one of the most important aspects in research. They are required to be reported in every study to protect the participants from any potential risks such as identity exposure (Connelly 2014).

Data protection and handling of all study materials had been planned to be stored, processed and destroyed in accordance with the School of Pharmacy and Life Sciences standard operating procedures which reference Robert Gordon University Research Governance policies. In addition, all participants were assured that their confidentiality, anonymity and any personal information that could identify them would be strictly confidential before, during and after the research life cycle and the access to this information would be restricted to the principal researcher and the research supervisory team (RGU Research Governance Policy 2014).

In this study, the following steps were implemented to gain the ethical approval prior to data collection:

- A proposal of the study's aim, objectives, background, setting, phases, data collection methods, data analysis, data handling and storage, was submitted to the Ethical Review Panel, School of Pharmacy and Life Sciences at Robert Gordon University. Decision to proceed with the study was approved with reference (S72, PALS, RGU).

- An online course on "Protecting Human Research Participants" provided by the National Institutes of Health (NIH) was attended. Certificate of course completion was issued based on the PASS result on the end of the course examination.

- Another proposal of the study was submitted to the Ethics Committee, Ministry of Health (MOH), Kingdom of Saudi Arabia (KSA). Approval to conduct the study in the KSA was given with approval code (IRB 18-259E).

- In phase 2 (cross-sectional survey), all participants were informed in the front sheet about the aim of the study, the anonymity of all participants, the research team details, general background and the target population of the study, and finally their right to withdraw before completing the questionnaire without providing any details or reasons.

- In phase 3 (semi-structured interviews), management approval to collect data from the Directorate of Health Affairs, Aseer province, KSA was gained. All participants were given an information sheet to gain an understanding of the study. They had the opportunity to ask questions and time to consider whether or not to participate. A participation consent form was signed by all participants prior to conducting the interviews.

- All participants in the two phases were assured that they may be informed about the research results, if they chose to receive a study report.

2.7 Theory use in research

Sun and Zhang (2006) stated that in the past few decades, several technology acceptance theories were proposed and tested. The contribution of these different theories was of importance to explain end-users technology acceptance factors (Sun and Zhang 2006). In the literature, theories and theoretical frameworks can inform data collection, data analysis and interpretation of the findings. In this study, a number of Technology Acceptance Models were of relevance to the topic. Below is an explanation of these models and justification of adopting the Unified Theory of Acceptance and Use of Technology (UTAUT).

2.7.1 Theory of Reasoned Action (TRA)

This theory was one of the primary models in this field. It came from a social psychology background and was developed by Fishbein & Ajzen in the 1970s for the purpose of understanding the voluntary intention of individuals to perform an action of using technology (Fishbein and Ajzen 1975). In this theory, the assumption that drives the behavioural intention is seen to be predicted by two determinants, Attitude and Subjective norms (Figure 2.4). Attitude is defined as "an individual's positive or negative feelings about performing the target behaviour" (Fishbein and Ajzen 1975) which means if the outcome of performing a specific behaviour is perceived to be positive, the attitude towards performing it is most likely going to be positive. The opposite side is also true if the perceived outcome is thought to be negative. Subjective norms were defined as "the person's perception that most people who are important to him think he should or should not perform the behaviour in question" which means that it is more likely to perform the behaviour if the person perceives that people that are important to him/her think that outcome of performing it is positive. The opposite is also true. It was noted that although the TRA has been applied in a wide range of settings (Yusuf et al. 2013) and gives a robust prediction of individuals' behaviour (Sheppard et al. 1988) but it has limitations. The greatest limitation of the TRA was discussed by Ajzen (1991) in which the incomplete volitional control over the behaviour was highlighted (Ajzen 1991). That means the TRA works well in predicting the volitional behaviour of individuals, however, that does not necessarily apply in predicting the behaviour for mandatory users in different

contexts (Hillmer 2009). In the context of KSA, Alsughayir and Albarq (2013) applied this model to explain the adoption of internet banking by Saudi consumers. The findings suggested that applying this model could generate an overall good understanding of consumers' behavioural intention towards using internet banking services (Alsughayir and Albarq 2013).

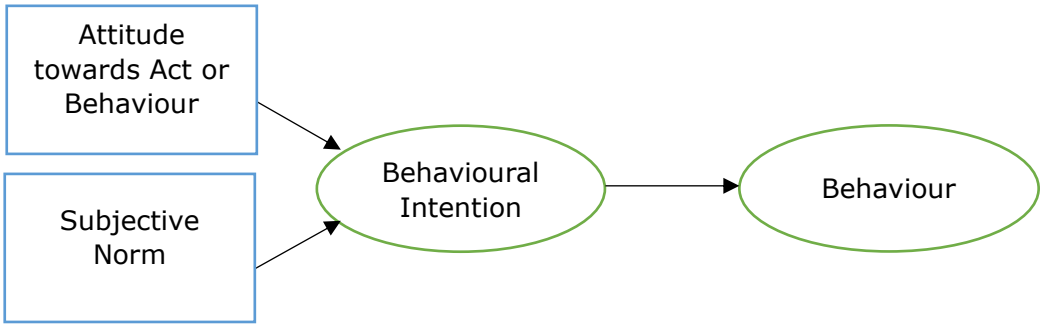


Figure 2.4: Theory of Reasoned Action by Fishbein and Ajzen (1975)

2.7.2 Social Cognitive Theory (SCT)

A theory that was developed by Bandura (1986) is one of the best known in the field of studying social and human behaviour (Bandura 1986). It assumed that the individual's behaviour was influenced by their beliefs and feelings. The three determinants in the theory: personal, behavioural, and environmental, interact to influence each other in a way that can provide a framework to explain the relationship among them (Figure 2.5). Alsaif (2014) stated that social network plays a role that impacts on the actions of individuals. He added, "self-efficiency or personal judgment of the ability to use the technology, as well as issues that evoke anxious feelings or emotions affect the adoption of technology" (Alsaif 2014). Alghamdi (2015), in a mixed methods study that aimed to examine the attitude to use of online classrooms, surveyed a population of 100 Saudis and used this model as a theoretical framework to help explain the results. Findings revealed that online classrooms were positively accepted with high significance association of both location and experience to the technology use (Alghamdi 2015).

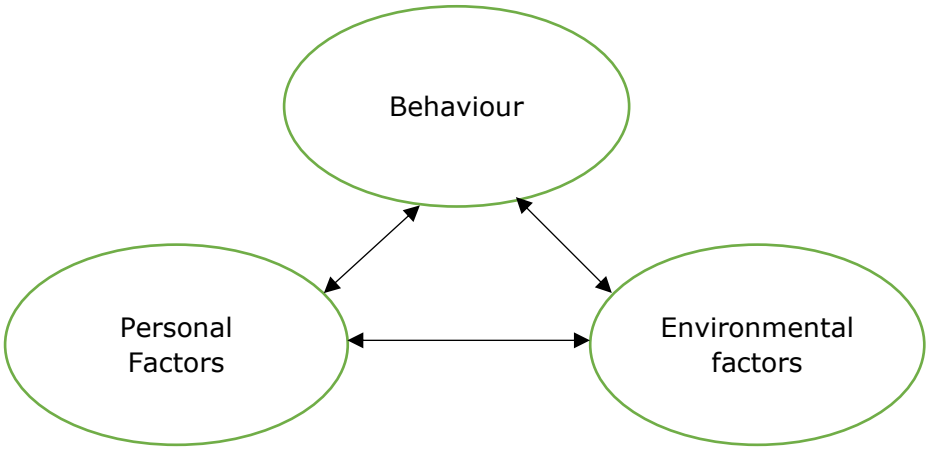


Figure 2.5: Social Cognitive Theory by Bandura (1986)

2.7.3 Technology Acceptance Model (TAM) and TAM2

Technology Acceptance Model (TAM) is considered one of the most influential and widely applied technology acceptance models (Benbasat and Barki 2007). This new model was developed by Davis et al (1989) (Figure 2.6). It was an extension that was proposed based on the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975), however, there were differences between the two models. The TRA was a theory to explain the behavioural intention and use of behaviour in a general concept while TAM was meant to be a specific model that aimed to explain the intention to use and actual use behaviour of IT systems (Jung, 2008). Another difference was that TRA had a construct that tested the social influence which was represented by the subjective norms while TAM had no social influence construct (Jung 2008). The two key components of the TAM were Perceived Usefulness (PU) and the Perceived Ease of Use (PEoU). PU is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989). PEoU was defined as "the degree to which a person believes that using a particular system is free of effort". Both constructs showed significance to the intention to use technology, however, PU was a stronger determinant than the PEoU (Venkatesh and Davis 2000). An extension to the TAM was proposed to overcome the limitations, such as ignoring the social norms and

the low explanatory power it showed, to increase the model's capability to explain the behaviour under investigation (Legris et al. 2003). More variables of social influence, such as subjective norms, image, and voluntariness, as well as cognitive instrumental variables like experience, output quality, result demonstrability were added to the TAM2 for testing. Findings proved that the new extended model TAM2 was stronger than TAM and could explain up to 52% of the intention to use technology (Venkatesh and Davis 2000). Experience was proposed to be moderating of the relationship between subjective norm and both Behavioural Intention and Perceived Usefulness while voluntariness was suggested to solely moderate the relationship between subjective norm and Perceived Usefulness (Figure 2.7). Almutairi (2015) applied TAM to study the adoption of privacy of health information in KSA with a focus on the diversity of professions. The findings reported that the medical professionals were more concerned about confidentiality issues compared to the other professions (Almutairi 2015). Aldosari (2012) also used this model to investigate the technology acceptance level of the radiology department staff at King Abdulaziz Medical City in Riyadh, KSA. The findings showed that perceived usefulness was the most significant predictor to accept technology (Aldosari 2012).

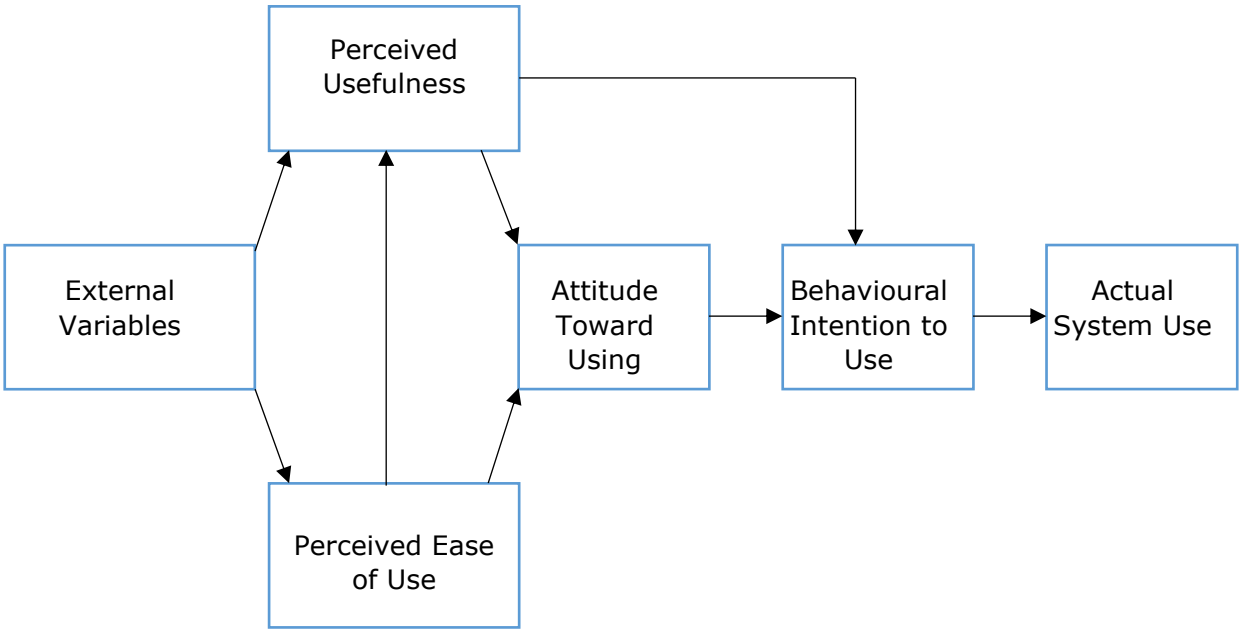


Figure 2.6: Technology Acceptance Model by Davis et al. (1989)

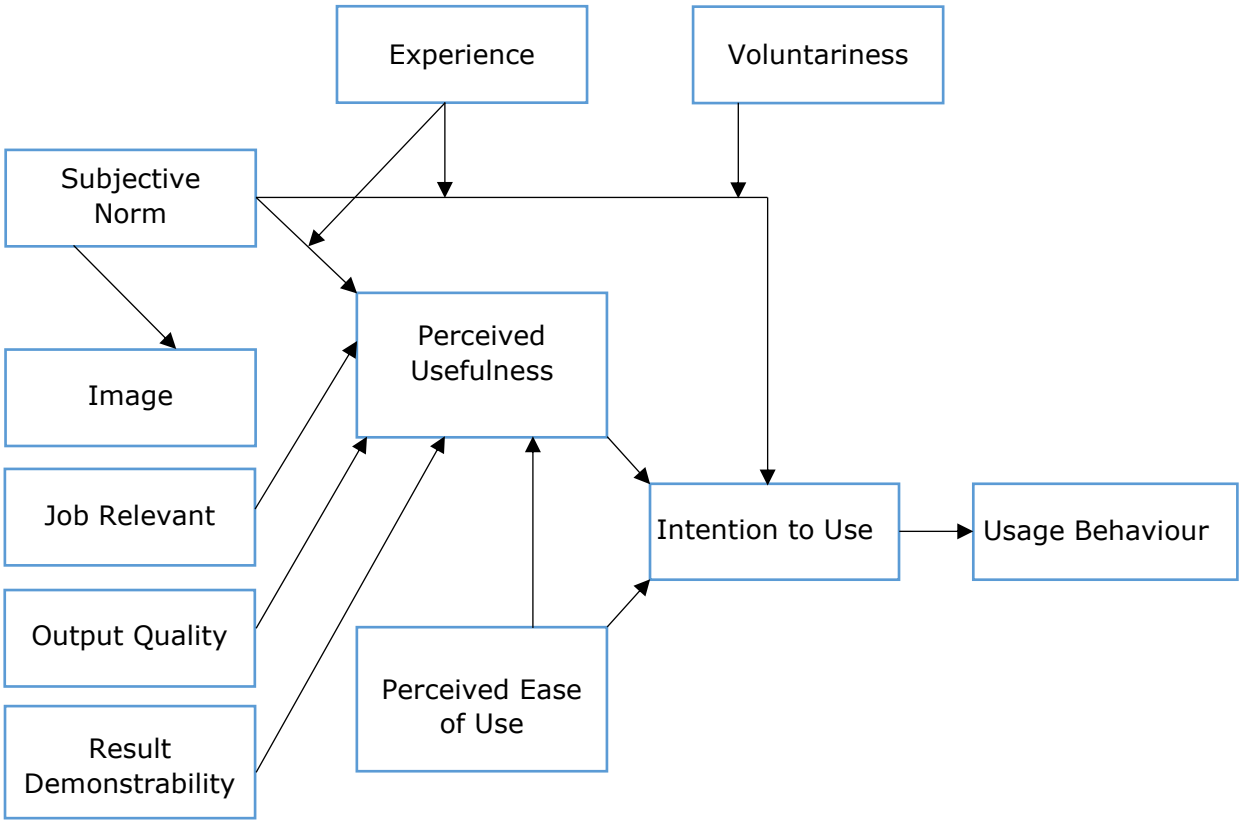


Figure 2.7: Extension to Technology Acceptance Model (TAM2)

2.7.4 Theory of Planned Behaviour (TPB)

This model is an extension of the TRA. It was developed by Ajzen (1991) to overcome the TRA limitations identified. Perceived Behaviour Control was a new construct added to the model (Figure 2.8). Ajzen (1991) defined the Perceived Behaviour Control as "perception of ease or difficulty of performing the behaviour of interest". This model is thought to work well in predicting individuals' behaviour in mandatory situations whereas TRA was thought to be more focused on voluntary situations (Sharma and Chandel 2013). In this model, the individuals' actual behaviour could be explained by understanding their behavioural intention. The behavioural intention could potentially be influenced by attitude, subjective norms and perceived behaviour control. Sheppard et al (1988) stated that TPB is one of the most influential technology acceptance theories in predicting behaviour (Sheppard et al. 1988) which has been utilised in different settings and research fields (Hung et al. 2006). Ali (2016) used this model to examine the intention of university students in the field of management in KSA universities to establish a new business and found out that perceived behavioural control and subjective norms were of significance to the students' intention (Ali 2016).

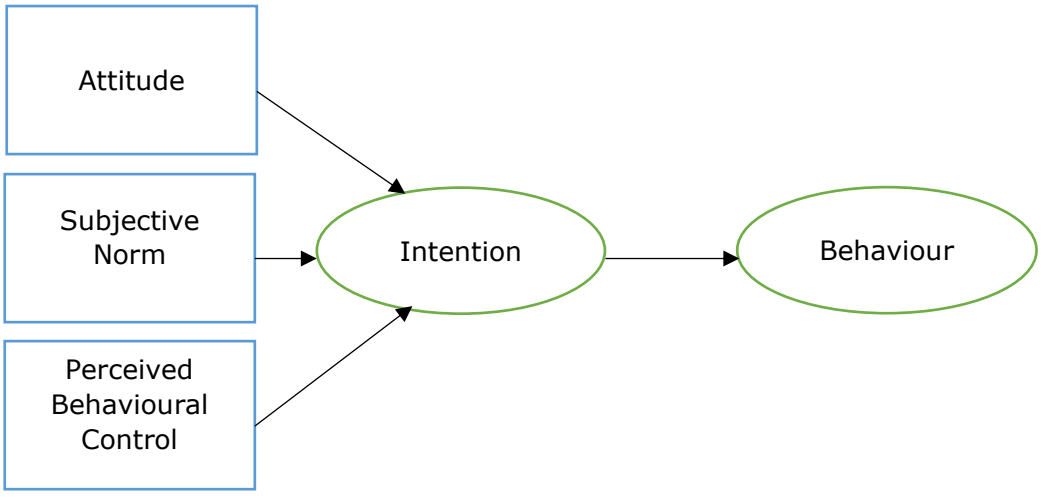


Figure 2.8: Theory of Planned Behaviour by Ajzen (1991)

2.7.5 Model of Personal Computer Utilisation (MPCU)

In 1991, a new model was proposed by Thompson et al (1991). It was based on the Theory of Human Behaviour developed by Traindis in 1977 (Thompson et al. 1991). This model focused on predicting the individual's acceptance of actual utilisation of computers rather than the intention to use. It was made up of six constructs: job fit; long-term consequences; complexity; affect toward use; social factors; and finally, facilitating conditions (Figure 2.9). Job fit was defined as "the extent to which an individual believes that using a technology can enhance the performance of his or her job" (Thompson et al. 1991). Long-term consequences was referred to as "the outcomes that have a pay-off in the future" (Thompson et al. 1991). These outcomes were intended to increase the flexibility at work and enhance opportunities in the future. Complexity was best described in the model as "the degree to which an innovation is perceived as relatively difficult to understand and use" (Thompson et al. 1991). Affect toward use is the "feeling of joy, elation, pleasure, depression, disgust, displeasure, or hate associated by an individual with a particular act" (Thompson et al. 1991). Social factors were defined as "the individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations" (Thompson et al. 1991). Facilitating conditions were described as all kinds of support that could be provided to users and could influence their system or technology utilisation (Thompson et al. 1991). Results from testing this model suggested that, out of the six components, only four: job-fit; long-term consequences; complexity; and social factors, showed significance to influence the PCs utilisation (Jung 2008). AlJarullah et al (2018) adopted constructs from different technology acceptance models including MPCU to investigate the factors that influence acceptance of electronic health records by primary health care centre physicians in KSA in order to develop a framework of most likely affecting factors. The study showed significance of several factors such as Perceived Usefulness, Perceived Ease of Use, and Social Factors (AlJarullah et al. 2018).

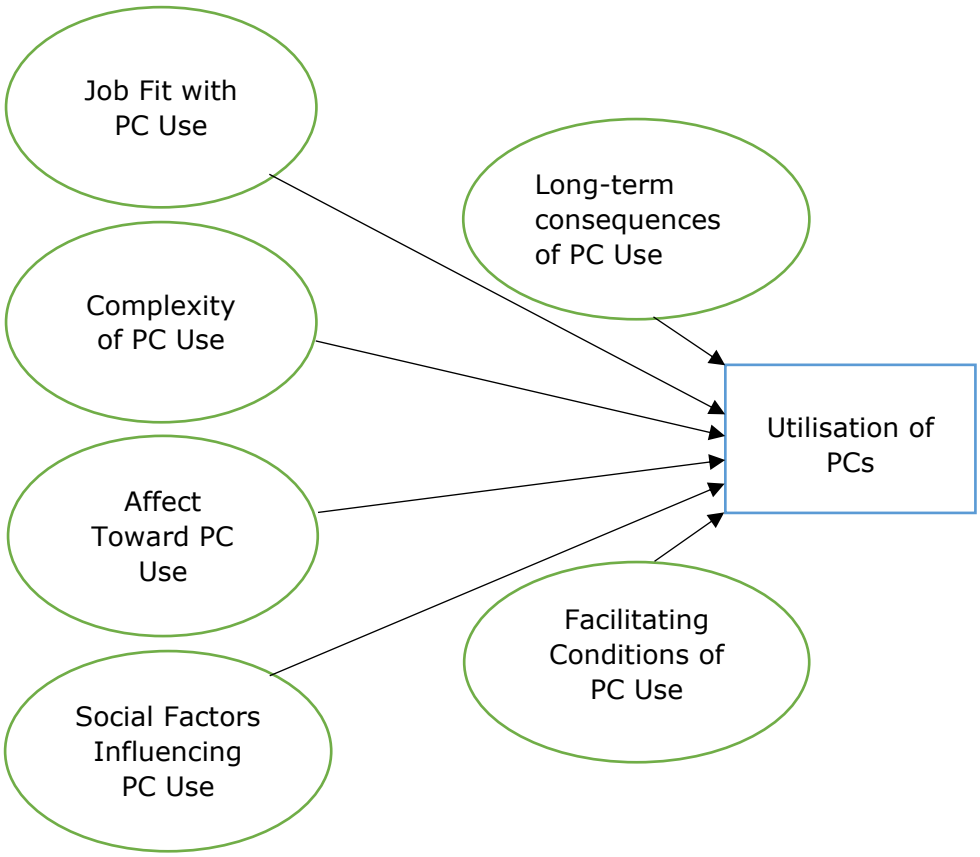


Figure 2.9: Model of Personal Computer Utilisation by Thompson et al. (1991)

2.7.6 Motivational Model (MM)

Davis et al (1992) developed the Motivational Model (MM) to explain what motivates individuals to use technology through studying the influence of two key constructs: (1) perceived usefulness which reflects as an extrinsic motivation, and (2) perceived enjoyment which is to act in the model as intrinsic motivation (Davis et al. 1992) (Figure 2.10). While extrinsic motivation was introduced by Venkatesh et al (2002) as the perceived gain that using technology can bring to the individual, two years earlier, Venkatesh (2000) referred to the intrinsic motivation as "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh 2000). The assumption of the model is that both extrinsic motivations, represented by the benefits that using technology can bring to the individual such as promotions and rewards, and intrinsic motivation, which is a reflection of the enjoyment, both make significant variance to the intention to use technology.

Nassuora (2012) employed this model, as well as other technology acceptance models, to investigate factors that affect mobile learning over a sample of 80 participants and concluded that the intention to adopt mobile learning was high over the sample surveyed (Nassuora 2012).

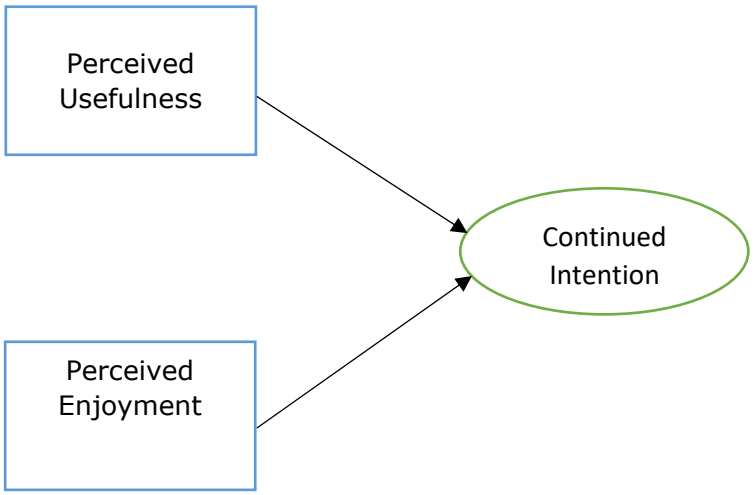


Figure 2.10: Motivational Model by Davis et al. (1992)

2.7.7 Innovation Diffusion Theory (IDT)

One of the most popular theories from sociology was developed by Everett Rogers (1995) based on early research conducted in the USA in 1950 (Rogers 1995) (Figure 2.11). Rogers gave a definition to the two key terms in the theory. Innovation was described as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers 2010). Diffusion was also described as "the process by which an innovation is communicated through certain channels over time among the members of a social society" (Rogers 2010)". The IDT consists of five constructs that contribute to and influence the adoption of innovation. These constructs are: relative advantage, complexity, compatibility, observability, and finally trialability. In addition to these five main constructs, Rogers argued that there are three key elements that are very important to the diffusion of innovation. These elements are: communication channels, time and

the social system (Rogers 2010). Although IDT was suggested by Helitzer et al (2003) as a suitable tool to explain technology adoption of eHealth (Helitzer et al. 2003), Alsaif (2014) claimed that there are researchers that argue the significance of all IDT constructs. They stated that not all constructs of the IDT are applicable. Only three of them - relative advantages, complexity, and compatibility - can contribute to the influence of diffusion innovation. It has been argued that observability and trialability are not measurable in terms of technology adoption (Alsaif 2014). Al-Gahtani (2003) studied computer technology adoption rate at workplace through applying IDT. A sample size of 1200 of public and private sector staff was recruited in this study that concluded with the significance of the five constructs of the theory to explain the adoption rate (Al-Gahtani 2003).

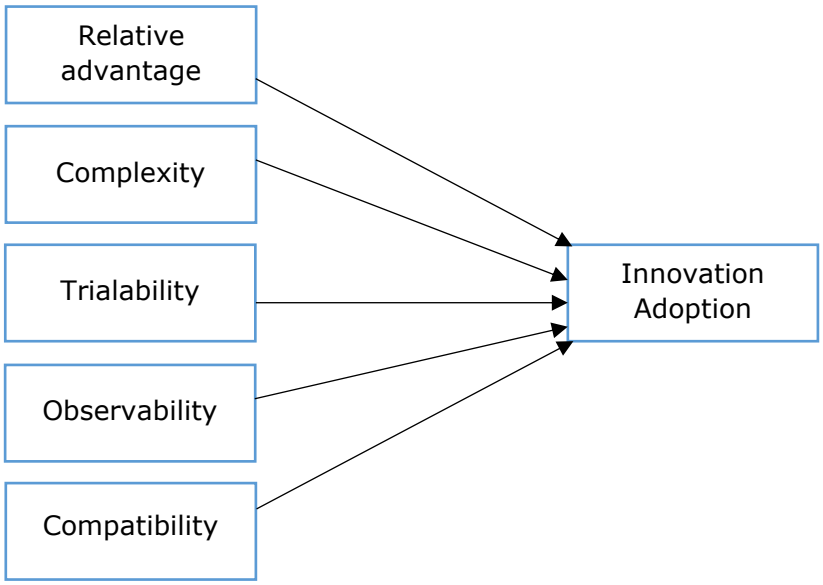


Figure 2.11: The Innovation Diffusion Theory by Rogers (1995)

2.7.8 Unified Theory of Acceptance and Use of Technology (UTAUT)

In 2003, Venkatesh developed a comprehensive model called the Unified Theory of Acceptance and Use of Technology (UTAUT) by integrating eight user acceptance theories in one unified model. These theories were: Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975); Theory of Planned Behaviour (TPB) (Ajzen 1991); Social Cognitive Theory (SCT) (Bandura 1986); Combined TAM-TPB (Taylor and Todd 1995); Motivational Model (MM) (Davis et al. 1992); Model of Personal

Computer Utilisation (MPCU) (Thompson et al. 1991); Innovation Diffusion Theory (IDT) (Rogers 1995); and, Technology Acceptance Model (TAM) (Davis 1989 and Davis et al. 1989). In the UTAUT, there are three direct constructs to behavioural intention; Performance Expectancy (PE); Effort Expectancy (EE); and Social Influence (SI). And two direct determinants to actual use which are Facilitating Conditions (FC) and Behavioural Intention (BI) (Figure 2.12).

Performance expectancy (PE) was defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al. 2003). Performance expectancy was derived from the following constructs in technology acceptance theories: perceived usefulness (TAM and TAM2), extrinsic motivation (MM), job-fit (MPCU), outcome expectations (SCT) and finally relative advantages (IDT) (Alsaif 2013).

Effort expectancy was defined as "the degree of ease associated with the use of the system" (Venkatesh et al. 2003). It was considered in the UTAUT based on the following variables in the theories: perceived ease of use (TAM and TAM2), complexity (MPCU), and ease of use from the (IDT).

The third construct was Social Influence which was defined as "the degree to which an individual perceives that others believe he or she should use the new system" (Venkatesh et al. 2003). The concept of SI was derived from the following constructs: subjective norm (TRA, TAM2, and TPB) social factors (MPCU), and image (TAM2).

Facilitating Conditions are "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh et al. 2003). It came from the following components: perceived behavioural control (TPB and combined TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT).

The final construct is the Behavioural Intention (BI) and it was defined in the literature as "the person's subjective probability that he/she will perform the behaviour in question" (Venkatesh et al. 2003).

The model also suggested four moderating variables which are: gender, age, experience, and voluntariness of use. Gender and age were proposed in this model while experience and voluntariness of use were derived from the TAM.

The UTAUT has been adopted as a theoretical framework in this study for many reasons. Firstly, from the literature, it has been clear that the model is widely used as a well-established and comprehensive framework. It was validated and tested

in different contexts such as E-Commerce, E-Services, E-Learning, and E-Health to predict the users' technology acceptance (Or and Karsh 2009). The utilisation of the model in technology adoption research in different contexts has increased (Olshansky et al. 2007). In addition, UTAUT has been referred to in the literature as the most predictive model of technology acceptance as it can explain up to 70% of the variance of technology acceptance (Weerakkody et al. 2013). Other models such as TRA, TPB and TAM have lower power to explain that with an average between 30 and 40 percent (Alshehri 2012). Furthermore, with regards to the technology acceptance literature in the Kingdom of Saudi Arabia (KSA), UTAUT was found to be previously applied in the geographical context of the country in many studies with different nature such as E-Government (Alshehri 2012), E-Learning (Badwelan et al. 2016), E-Commerce (Harby et al. 2012), and E-Banking (Al Somali and Ghinea 2012). However, there was scare literature applying this model to eHealth studies in Saudi healthcare context which could be considered as a research gap in this study.

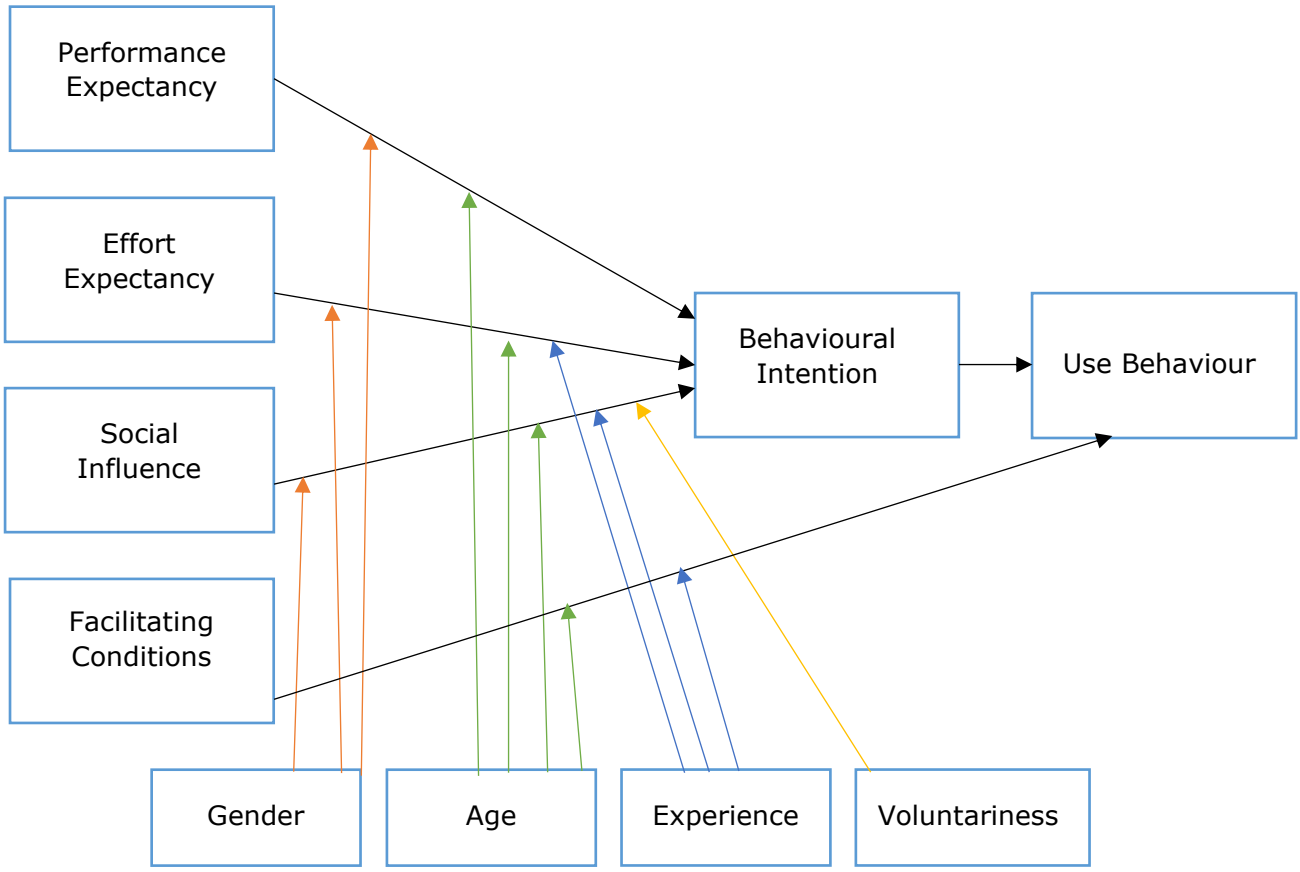


Figure 2.12: Unified Theory of Acceptance and Use of Technology by Venkatesh et al. (2003)

2.8 Chapter summary

This chapter presented the different methodological approaches as well as a number of Technology Acceptance Theories that are of relevance to the current research and the adopted model that has been utilised. Figure 2.13 shows the three phases of the study. The chapters which follow provide more detail of each of the 3 phases followed by a discussion and conclusion chapter.

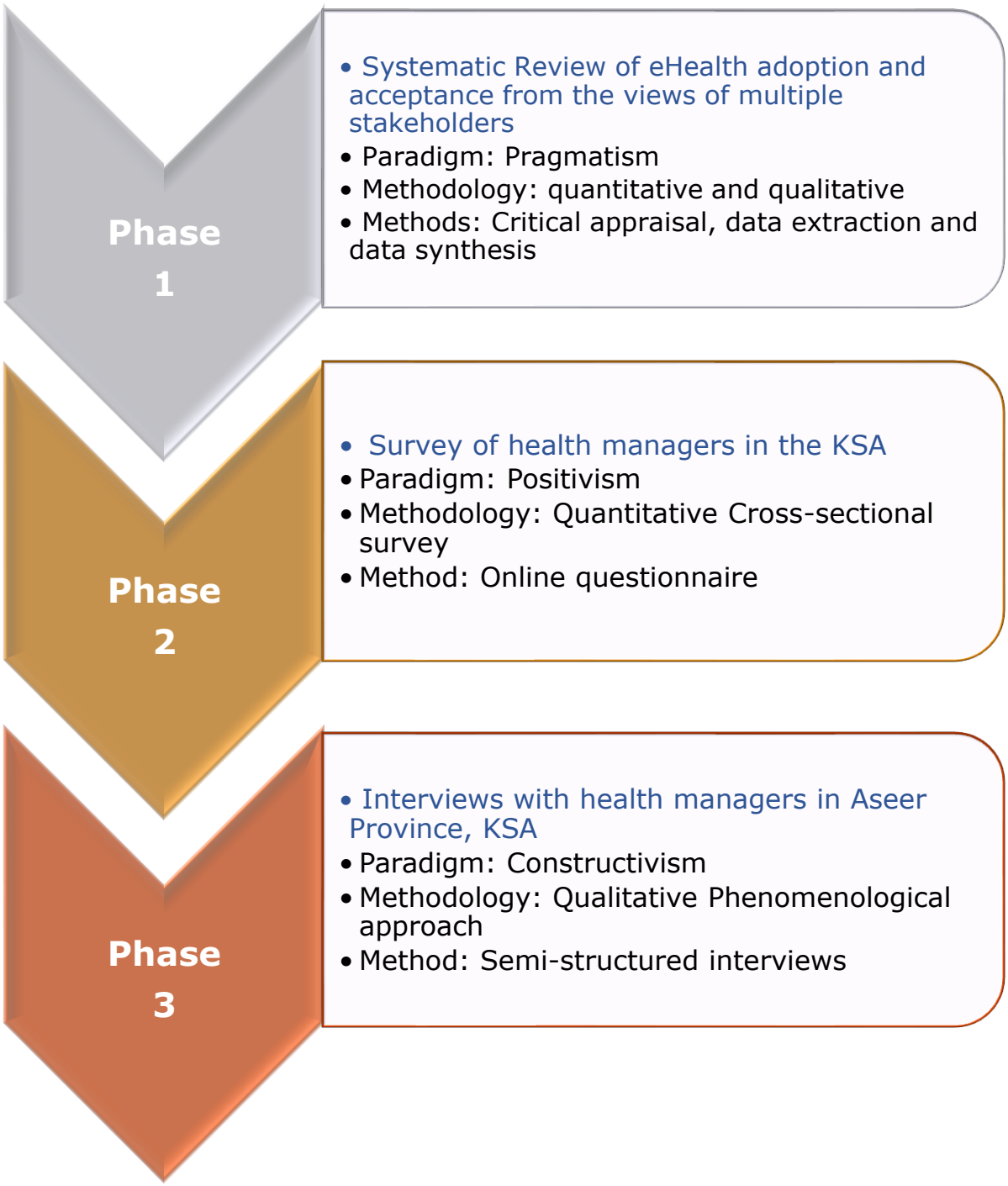


Figure 2.13: The three phases of the current study

CHAPTER 3: A SYSTEMATIC REVIEW OF THE ADOPTION AND ACCEPTANCE OF EHEALTH IN SAUDI ARABIA: VIEWS OF MULTIPLE STAKEHOLDERS

3.1 Introduction

In the published eHealth literature, two reviews on KSA eHealth status in general were found (Alsulame et al. 2016 and Weber et al. 2017). Both reviews were conducted in 2014 and published in 2016 and 2017 respectively. The first review was of current literature and had an overall aim of exploring the existing national eHealth programmes, initiatives, and growing efforts in Saudi Arabia (Alsulame et al. 2016). Three main areas focused on were: implementation of eHealth practices, eHealth challenges, and recommendations to enhance eHealth intiatives. The review concluded that the eHealth field is growing in Saudi Arabia even though the number of research publications remained low and limited to few organisations in few geographical areas. More in-depth studies were recommended, especially in the areas of investigating positive and negative aspects of implementing eHealth and understanding the views of different professionals towards eHealth challenges and needs.

The second review was a systematic thematic review conducted across all Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) (Weber et al. 2017). The main aim was to collate all research on eHealth in the GCC to reveal the current state of eHealth research and development in the region. The key themes under investigation were: national benefits from eHealth, implementation and satisfaction with electronic health records, online technologies in medical education, innovative systems, information security and personal health information. The review concluded that Saudi Arabia has a robust medical informatics culture that covers all aspects of eHealth. Two areas were recommended for future studies: the cost of eHealth initiatives and religious and gender-related issues in eHealth. However, there was a lack of focus on eHealth adoption and acceptance in both reviews.

A preliminary search of the international prospective register of systematic reviews (Prospero) database showed that there was neither published nor on-going systematic reviews on the topic of eHealth adoption and acceptance in the KSA which can be considered as an indication of a gap in the literature in

this area. Thus, this topic was of interest to focus on and synthesise all available literature in the context of KSA healthcare.

This chapter provides the aim, methods, synthesis, results, and discussion of a systematic review of the adoption and acceptance of eHealth in KSA from the perspectives of multiple stakeholders.

3.1.1 Review aim and questions

The overall aim of this systematic review was to critically appraise, synthesise and present the available evidence on the status of eHealth adoption and acceptance in Saudi Arabia from the perspectives of multiple stakeholders. In conducting this review, three questions were proposed:

1. What are the views of health professionals, health IT professionals, and health managers towards eHealth adoption and acceptance in Saudi Arabia?

2. What are the factors that influence eHealth adoption and acceptance in Saudi Arabia from the perspectives of health professionals, health IT professionals, and health managers?

3. What are the main facilitators and barriers to implementing eHealth in Saudi Arabia from the perspectives of health professionals, health IT professionals, and health managers?

3.2 Methods

3.2.1 Protocol and search strategy

The Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P) checklist of 17 items was followed in writing the protocol for this systematic review (Moher et al. 2015). The protocol was registered with the prospective register of systematic reviews (CRD Prospero) with registration reference (CRD42017065009) (Alshahrani et al. 2017).

3.2.2 Databases searched

The search of electronic databases was conducted in May 2017 with alerts set up to notify of future publications. Five electronic databases were included: Association for Computing Machinery (ACM), Google Scholar, Medline, ScienceDirect, and Web of Science. These sources were chosen for their reputation of covering the breadth of health, medical and technology articles from scientific and academic journals. The search was restricted to studies conducted in English language as this has been shown to be the primary language for eHealth articles in the GCC region (Weber et al. 2017). The search included peer reviewed articles published between January 1993 and May 2017. These dates were selected as 1993 is known to be the year that the first institution was connected to the internet in Saudi Arabia (Al-Tawil 1999).

3.2.3 Inclusions and exclusions

Table 3.1 illustrates the inclusion and exclusion criteria to address the review questions.

Table 3.1: Inclusion and exclusion criteria

Participants	**Inclusion**: • Health professionals (medical doctors, nurses, midwives, pharmacists, dentists, all other allied health professionals e.g. radiologists and laboratory technicians) • Health IT professionals • Health managers **Exclusion:** • IT professionals who do not have a role in any health facilities and organisations
Interventions	**Inclusion**: The intervention for this study is eHealth. This systematic review aims to include all published articles and literature around eHealth adoption, acceptance, facilitators and barriers in Saudi Arabia from the perspectives of multiple stakeholders. **Exclusion:** Studies that focused on pure technological infrastructure and products without the users views such as: health technology applications and Internet of Things (IoT) for health.
Studies	**Inclusion:** This systematic review focused on peer reviewed primary published articles and literature with all types of study design such as quantitative, qualitative and mixed methods. **Exclusion:** Reviews, conference proceedings, blogs, books chapters, and health website contents were excluded

The following search terms were applied: [eHealth OR e-health OR telemedicine OR telehealth OR telecare or "remote health"] AND ["health professionals" OR "health IT professionals" OR "health managers"] AND [adoption OR acceptance OR facilitators OR barriers] AND [Saudi Arabia] and result yielded number of hits as shown in (Table 3.2).

Table 3.2: Combined number of hits for all databases

No.	Key term	No. of hits
1	eHealth OR E-Health	1,254,871
2	Telemedicine	161,674
3	Telehealth	38,034
4	Telecare	26,180
5	Remote health	19,279
6	(1 OR 2 OR 3 OR 4 OR 5)	1,269,074
7	Health professionals	1,418,237
8	Health IT professionals	231
9	Health managers	9,973
10	(7 OR 8 OR 9)	123,414
11	Adoption	1,759,343
12	Acceptance	1,816,337
13	Facilitators	221,466
14	Barriers	2,673,602
15	(11 OR 12 OR 13 OR 14)	2,575,529
16	Saudi Arabia	616,969
17	**Review focus (6 AND 10 AND 15 AND 16)**	**176**

PRISMA checklist for reporting results of the scoping search was followed as shown in (Figure 3.1) (Moher et al. 2009). Titles and abstracts were screened independently by two reviewers and agreement was reached on papers to be excluded with reasons noted. Moreover, an alert was set in all databases for notification of any newly published papers that matched the search criteria.

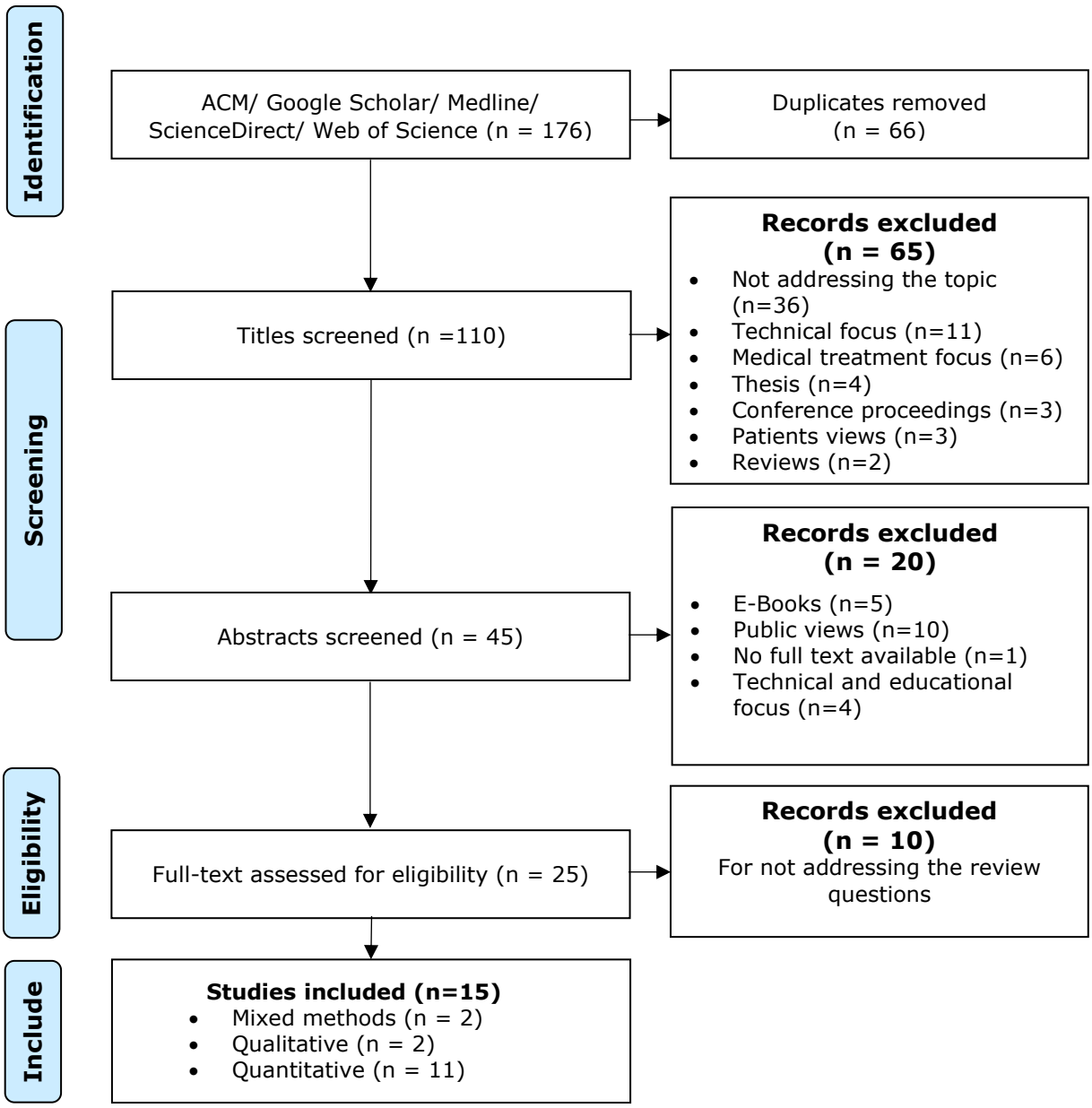


Figure 3.1: PRISMA flow diagram. Adopted from Moher et al. (2009)

3.2.4 Assessment of methodological quality

Three critical appraisal tools were utilised matching the study design of included articles to minimise the risk of bias by evaluating the methodological quality. Two independent reviewers conducted the quality assessment of the included studies by using the following tools:

1. A questionnaire checklist developed by Crombie and adopted by the Centre of Evidence Based Management (CEBMa) to assess the quality of quantitative studies (Crombie 1997) (Table 3.3).
2. Qualitative checklist provided by Critical Appraisal Skills Programme (CASP), Public Health Resource Unit was used to assess the qualitative studies (CASP 2013) (Table 3.4).
3. Critical appraisal checklist developed by a group of researchers led by Mays was used to assess the quality of mixed methods studies (Mays et al. 2001) (Table 3.5).

Table 3.3: Critical appraisal tool for 11 quantitative studies

Criteria	Bah et al (2011)	El Mahalli (2012)	Aldosari (2014)	Hasanain & Cooper (2014)	El Mahalli (2015a)	Hasanain et al (2015)	El Mahalli (2015b)	Almuayqil et al (2016)	Jamal et al (2016)	El Mahalli (2016)	Uluc & Ferman (2016)
Questions clear and Focused	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design is appropriate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear
Methods are clearly Described	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample introduced Bias	Yes	No	Unclear	Yes	No	Yes	No	Unclear	No	No	Unclear
Sample was Representative	Yes	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Unclear
Sample size was Considered	Unclear	Yes	Unclear	No	Yes	Yes	Yes	No	No	Yes	Unclear
Response rate was Achieved	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Questionnaire was Valid and reliable	Unclear	Unclear	Yes	Yes	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Yes
Statistical significance Assessed	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Confidence Intervals given for main results	No	No	No	No	No	No	No	No	No	No	Yes
Confounding factors Accounted	Yes	No	No	No	Yes	Yes	No	No	No	No	No
Results were Applicable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3.4: Critical appraisal tool for 2 qualitative studies

Criteria	Alsulame et al (2015)	Alfarra N. (2016)
Statement of aim was clear	Yes	Yes
Methodology appropriate	Yes	Yes
Design appropriate	Yes	unclear
Sampling appropriate	Yes	Yes
Data collection explained	Yes	Yes
Ethics statement	Yes	No
Data analysis	No	No
Findings discussed	Yes	Yes
Value to knowledge	Yes	Yes

Table 3.5: Critical appraisal tool for 2 mixed methods studies

Criteria	Alasmary et al (2014)	Alaboudi et al (2016)
Questions clear and terms defined	Yes	Yes
Design appropriate	Yes	Yes
Funding	Yes	Yes
Resource system	Yes	Yes
innovation	Yes	Yes
Context described	Yes	Yes
User system	Yes	Yes
Dissemination	Unclear	Unclear
Implementation	Unclear	Unclear
Sampling generalized	Yes	Unclear
Data collection systematic	Yes	Yes
Data Analysis systematic	Yes	Yes
Results	Yes	Yes
Conclusion	Yes	Yes
Ethics	Yes	Yes

3.2.5 Data extraction

Eleven key items were extracted from each study: 1) study title, 2) author(s) name, 3) publishing journal, 4) year of publication, 5) study aim, 6) setting(s), 7) methodology, 8) population, 9) intervention, 10) definitions, and 11) key findings. The data were extracted by one reviewer and checked for the accuracy by another (Tables 3.6 & 3.7).

Table 3.6: Data extraction

Author (Publishing year) Title/publishing Journal	Aim	Setting	Methodology	Population	Intervention
Bah et al (2011) Annual survey on the level and extent of usage of electronic health records in government-related hospitals in Eastern Province, Saudi Arabia/ Perspectives in Health Information Management	To determine the level and extent of usage of Electronic Health Records (EHRs) in government-related hospitals in Eastern Province, Saudi Arabia	Eastern Province, Saudi Arabia	Quantitative, cross-sectional questionnaire-based survey	Health IT Managers	EHRs
El Mahalli et al (2012) Successes and challenges in the implementation and application of telemedicine in the eastern province of Saudi Arabia/ Perspectives in health information management	To assess health professionals' perceptions regarding benefits and challenges of telemedicine also willingness to use telemedicine	Eastern Province, Saudi Arabia	Quantitative, cross-sectional, paper-based survey	Health professionals	Telemedicine
Alasmary et al (2014) The association between computer literacy and training on clinical productivity and user satisfaction in using the electronic medical record in Saudi Arabia/ Journal of medical systems	To investigate the association between computer literacy and training with the clinical productivity and satisfaction of Electronic Medical Records (EMRs)	Riyadh, Saudi Arabia	Mixed methods study design using survey and interviews	Nurses and physicians	EMRs
Hasanain & Cooper (2014) Solutions to Overcome Technical and Social Barriers to Electronic Health Records Implementation in Saudi Public and Private Hospitals / Journal of Health Informatics in Developing Countries	To investigate the extent of barriers to implementing Electronic Health Records (EHRs) in KSA, particularly social and technical barriers, in order to determine possible solutions to overcome them	Saudi Arabia	Quantitative, cross-sectional questionnaire	Hospital staff (physicians, nurses, laboratory technicians and scientists, administrative staff and pharmacist)	EHRs

Aldosari, B. (2014) Rates, levels, and determinants of electronic health record system adoption: A study of hospitals in Riyadh, Saudi Arabia/ International journal of medical informatics	To establish the rates, levels, and determinants of EHR system adoption in a sample of Saudi hospitals	Riyadh, Saudi Arabia	Quantitative, questionnaire-based survey	Project managers, medical directors, heads of IT departments, and senior members of the EHR development teams	EHRs
Alsulame et al (2015) eHealth in Saudi Arabia: Current Trends, Challenges and Recommendations/ Enabling Health Informatics Applications	To explore the current status of eHealth in Saudi Arabia from the perspective of health informatics professionals	Saudi Arabia	Qualitative, descriptive interview-based study	Senior health information professionals	eHealth
El Mahalli A. (2015a) Electronic health records: Use and barriers among physicians in eastern province of Saudi Arabia/ Saudi Journal of Health Sciences	To assess utilization and barriers of EHR system by physicians at three governmental hospitals adopting the same EHR software version in Eastern Province, Saudi Arabia	Eastern Province, Saudi Arabia	Quantitative, cross-sectional Paper-based questionnaire design	Physicians	EHRs
Hasanain et al (2015) Electronic Medical Record Systems in Saudi Arabia: Knowledge and Preferences of Healthcare Professionals/ Journal of Health Informatics in Developing Countries	To examine both the knowledge and preferences of current or potential EMR users, at seven hospitals in three cities, within the western region of Saudi Arabia	Jeddah, Makkah and Taif cities, Saudi Arabia	Quantitative, cross-sectional, online and paper-based survey	Health Professionals	EMRs
El Mahalli A. (2015b) Adoption and Barriers to Adoption of Electronic Health Records by Nurses in three Governmental hospitals in Eastern Province, Saudi Arabia/ Perspectives in health information management	To assess adoption and barriers of EHR system by nurses at three governmental hospitals implementing the same EHR software and functionalities in Eastern province, Saudi Arabia	Eastern province, Saudi Arabia	Quantitative, cross-sectional, paper-based survey	Nurses	EHRs

Jamal et al (2016) Mobile Phone Use Among Medical Residents: A Cross-Sectional Multi centre Survey in Saudi Arabia/ Journal of Medical Informatics Research	To evaluate the prevalence of mobile phone usage among medical residents and to explore their attitudes, perceptions, and the challenges they experience when using mobile phones in academic and clinical practice	Riyadh, Saudi Arabia	Quantitative, cross-sectional survey	Medical Residents	Mobile phone
Alaboudi et al (2016) Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia/ Journal of Infection and Public Health	To identify the principle predictive challenges and barriers in adopting and implementing telemedicine in the context of the KSA and investigating the degree of variation within all HCFs sectors, types, and locations	Saudi Arabia	Three mixed methods (literature review, interviews, questionnaires	Decision makers of healthcare facilities	Saudi Telemedicine Network (STN)
Almuayqil et al (2016) Ranking of E-Health Barriers Faced by Saudi Arabian Citizens, Healthcare Professionals and IT Specialists in Saudi Arabia/ Health	To rank the barriers of e-health in KSA from the perspectives of the Saudi Arabian citizens, healthcare professionals, and IT specialists	Saudi Arabia	Quantitative, survey based varied for each stakeholder group	Citizens, Healthcare Professionals, IT Specialists	eHealth
El Mahalli et al (2016) Assessment of Pharmacy Information System Performance in Three Hospitals in Eastern Province, Saudi Arabia/ Perspectives In Health Information Management	To assess the availability and usage of pharmacy information systems (PIS) in three hospitals in eastern province, Saudi Arabia	Eastern Province, Saudi Arabia	Quantitative, cross-sectional, paper-based survey	System Administrators	PIS
Uluc & Ferman (2016) A comparative analysis of user insights for e-health development challenges in Turkey, KSA, Egypt & UAE/ Journal of Management, Marketing & Logistics	To assess healthcare professionals' insights, for the major challenges of e-health development and a distinctive model and comparative analysis in four emerging countries Turkey, KSA, Egypt and UAE	Turkey, KSA, Egypt & UAE	Quantitative, explanatory field study with user questionnaires to identify variables for a model with follow on face-to-face interviews to confirm variables	Clinicians, healthcare IT professionals, Ministry of Health executives	eHealth

Alfarra N. (2016) *A* qualitative study of an electronic health record: perspective on planning objectives and implementation at King Faisal Specialist Hospital & Research Centre (KFSH & RC), Saudi Arabia/ IOSR Journal of Business and Management	To obtain insight into the issues surrounding the implementation and impact of Electronic Health Records (EHRs) at King Faisal Specialist Hospital and Research Centre (KFSH&RC) in Saudi Arabia	Riyadh, Saudi Arabia	Qualitative, Interpretive Phenomenological Approach using individual interviews and focus groups	Current patients, middle/ senior management, the chief information officer, the chief operations officer, the chief financial officer, and the chief medical information officer	EHRs

Table 3.7: Data extraction with definitions and findings

Author/Publishing year/Title/publishing Journal	Definitions	Key Findings
Bah et al. (2011) Annual survey on the level and extent of usage of electronic health records in government-related hospitals in Eastern Province, Saudi Arabia/ Perspectives in Health Information Management	EHRs is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting	Of 19 hospitals, only three use EHRs all implementing the same systems with core features of laboratory, radiology and pharmacy electronic modules. Main challenges faced by the IT managers in implementing EHRs in their hospitals were related to the uncooperative attitudes of some physicians and nurses toward EHRs
El Mahalli et al. (2012) Successes and challenges in the implementation and application of telemedicine in the eastern province of Saudi Arabia/ Perspectives in health information management	Telemedicine is: 'the use of medical information exchanged from one site to another via electronic communications to improve patients' health status'	Most frequently cited benefits from adopters were improved quality of care, enhancing access to healthcare and providing patients care and management. Adopters' perceptions were low for other benefits such as easy use of the network, the use of store-and-forward telemedicine and the ability to follow up after face-to-face contacts. The greatest barrier as perceived by health providers was the lack of knowledge about telemedicine
Alasmary et al. (2014) The association between computer literacy and training on clinical productivity and user satisfaction in using the electronic medical record in Saudi Arabia/ Journal of medical systems	EMR defined as an application environment that captures clinical data of patients individually composed with clinical decision support system, computerized order entry and clinical documentation applications	The majority of the participants were generally satisfied with the system. Satisfaction scores was higher among physicians. The majority of participants showed that they were satisfied by the system training they received, again higher amongst physicians. Most agreed that the system have increased perceived clinical productivity
Hasanain & Cooper (2014) Solutions to Overcome Technical and Social Barriers to Electronic Health Records Implementation in Saudi Public and Private Hospitals / Journal of Health Informatics in Developing Countries	None	Lack of knowledge and experience of using computers was the main barrier. Lack of adopting standardized and uniform system was also a barrier. Technical and social barriers were more evident in public hospitals. Inferiority and complexity of EHRs software was raised across both private and public hospitals. Also, lack of resources such as print paper and ink, lack of HR, training sessions, password access and required skills, lack of sufficient number of computers to be used by the staff and time limits for doctors with numerous patients

Aldosari (2014) Rates, levels, and determinants of electronic health record system adoption: A study of hospitals in Riyadh, Saudi Arabia/ International journal of medical informatics	The term "EHR system" describes the electronic organizational framework and infrastructure that allows EHRs to be stored, accessed, altered, and analysed.	1. Variations exist in the rate and level of EHR system adoption in Saudi Arabia between hospitals (and between regions). There is a need to measure adoption rates and levels in a geographically wider sample. 2. Further research is needed on the determinants of adoption. The research should include the determinants studied here, and detailed investigations should also be made of physician involvement in the implementation of EHR systems and of user acceptance of the systems. 3. Regarding the implementation phase, an area of weakness across the hospitals involves the legacy of paper data systems, including document scanning, record management, and data conversion. These deficiencies need to be addressed so that the efficiency and usefulness of EHR systems can be maximized in adopting hospitals, and to ease implementation by current non adopters. 4. In the maintenance phase, there is a weakness with respect to software updating and maintenance. The reasons for this weakness need to be identified. 5. For the improvement phase, there is a deficiency in health information communication and sharing, including deficiencies in the development of data repositories, in the establishment of information networks, and in information exchange. The barriers to information sharing need to be better defined, including the problem of interoperability between the many different hospital EHR systems in use
Alsulame et al. (2015) eHealth in Saudi Arabia: Current Trends, Challenges and Recommendations/ Enabling Health Informatics Applications	None	Challenges were grouped as: 1) Organizational and Behavioural 2) Technological and Professional; and, 3) Privacy and Confidentiality
El Mahalli (2015a) Electronic health records: Use and barriers among physicians in eastern province of Saudi Arabia/ Saudi Journal of Health Sciences	None	There was low adoption of chart review functionality with users reporting 'system hanging up problem' and additional time for data entry affecting utilization in all 3 hospitals. Problems were reported with drug alert systems. Lab, radiology and pharmacy order entry rates were high. Communication tools were not in use for patient contact and in limited use in hospital due to lack of internet access in hospitals. Loss of access to medical records was cited as an issue caused by power failure/computer crashes. Training and support were lacking. Confidentiality, security and privacy were noted barriers to EHR adoption

Hasanain et al. (2015) Electronic Medical Record Systems in Saudi Arabia: Knowledge and Preferences of Healthcare Professionals/ Journal of Health Informatics in Developing Countries	None	As computer literacy levels increase so too do staff preferences for EMR systems. Hospitals need to offer English language and computer literacy training to increase staff acceptance of the EMR system
El Mahalli (2015b) Adoption and Barriers to Adoption of Electronic Health Records by Nurses in three Governmental hospitals in Eastern Province, Saudi Arabia. Perspectives in health information management	Health Information Technology (HIS) is: 'the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making'	Under-utilization of most EHRs functionalities. No utilization of any communication tools with patients. Most frequently cited barrier among all hospitals was 'loss of access to medical records transiently if computer crashes or power fails'. Also lack of training and support, additional time for data entry and 'system hanging up problems', complexity and lack of customisability of systems
Jamal et al. (2016) Mobile Phone Use Among Medical Residents: A Cross-Sectional Multicenter Survey in Saudi Arabia/ Journal of Medical Informatics Research	None	Adoption of mobile phone usage was found to be 99.0%. Negative correlation between age of participants and duration of mobile phone use. Apple iPhone iOS was predominant in medical population. English most commonly used on mobile phones despite native language being Arabic. WhatsApp and phone calls were the most commonly used tools. Medical communication, drug and medical references and medical calculation applications were the most commonly used. Technically, short battery life was the main issue, and distraction at least once per week. All participants agreed with integrating medical staff mobile phones with hospital information systems. Most participants described themselves as self-learners, half learned from peers and a quarter from the internet. Only 6.9% (n=7/101) had received any formal training on the medical use of mobile phones. Over half of participating residents thought it was safe to discuss patients over their personal, non-encrypted email

Alaboudi et al. (2016) Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia/ Journal of Infection and Public Health	UTAUT: Unified Theory of Acceptance and Use of Technology TOE: Technology-Organisation-Environment ETSSM: Evaluating Telemedicine Systems Success Model HCF: Health Care Facilities	The top three barriers to adopt and implement telemedicine by the HCF decision makers are: (i) the availability of adequate sustainable financial support to implement, operate, and maintain the telemedicine system, (ii) ensuring conformity of telemedicine services with core mission, vision, needs and constraints of the HCF, and (iii) the reimbursement for telemedicine services
Almuayqil et al. (2016) Ranking of E-Health Barriers Faced by Saudi Arabian Citizens, Healthcare Professionals and IT Specialists in Saudi Arabia/ Health	None	Citizens ranked the connectivity of information system as the top barrier with cultural barriers least barrier. Healthcare professionals ranked connectivity as the top barrier and technical expertise/computer skills as least. The top ranked barrier from the perspective of IT Specialists was medication safety with security and privacy least
El Mahalli et al. (2016) Assessment of Pharmacy Information System Performance in Three Hospitals in Eastern Province, Saudi Arabia/ Perspectives In Health Information Management	PIS is a system that can help pharmacists 'reduce clinical errors with intelligent warnings, messages, and rejection notices; gain immediate access to clinical information from throughout the enterprise; access all relevant data from a single centralized processing screen; and minimise lots revenue with the option to charge on administration'	PIS include computerized provider order entry and clinical decision support, integrated with EHR, prescribing and transcription functionality. Dispensing remains a manual process. Barcode-assisted medication administration systems are not in use to verify patient identify nor to electronically check dose administration. Computerized adverse drug event monitoring was not linked to EHR
Uluc & Ferman (2016) A comparative analysis of user insights for e-health development challenges in Turkey, KSA, Egypt & UAE/ Journal of Management, Marketing & Logistics	E-Health 'refers to the use of information technologies in healthcare services. It has a wide scope covering many concepts such as tele-health, mobile health, use of EHR, consumer health IT data and big data in digital health systems'	ICT infrastructure, regulations, cultural and clinical adaptation of users, financing, supply chain management are some major challenges. Specially trust to e-business in healthcare, compliant use of big data in digital health and patient privacy play a key role for faster development of e-health. An original framework of a model for assessing the major challenges of e-health development in emerging countries was produced

Alfarra (2016) *A* qualitative study of an electronic health record: perspective on planning objectives and implementation at King Faisal Specialist Hospital & Research Centre (KFSH & RC), Saudi Arabia/ IOSR Journal of Business and Management	None	Three categories of impacts were identified according to who was affected. These related to the healthcare providers, the patients and the KFSH & RC respectively. The impact on the healthcare providers included increased convenience and efficiency in data entry, retrieval, storage and distribution; access to the EHR system; information and knowledge growth; empowering the staff; and impacts on healthcare providers attitude toward using the EHR system. The impact on patients was mainly felt in terms of the quality of care and the communication flow between the patients and healthcare providers. The KFSH & RC was affected by providing a better work environment to its employees by reducing the number of paper files stored; the educational benefits and learning experiences gained; and improved communication between staff members and patients while increasing their ability to control the quality of care. The positive impacts of the EHR implementation far outweigh the negative impacts. Therefore, it is logical to conclude that the benefits of the EHR systems are outweighed their negative impacts. In descending order, the most frequently mentioned benefits are: quick data retrieval, easy and quick data input, easy access to KFSH & RC EHRs, facilitating smooth communication with external healthcare providers, enhancing the flow of information about patients, facilitating communication among staff members, improving the format of records, and increasing patient safety

3.2.6 Data synthesis

Data pooled from the studies were presented narratively in tables. Findings were then considered with a focus on factors that may influence adoption and acceptance of eHealth from multiple stakeholder perspectives.

3.3 Results

3.3.1 Study characteristics

Fifteen papers were included for meeting all criteria of inclusion and exclusion (Bah et al. 2011, El Mahalli et al. 2012, Alasmary et al. 2014, Aldosari 2014, Hasanain and Cooper 2014, Alsulame et al. 2015, El Mahalli 2015a, El Mahalli 2015b, El Mahalli et al. 2016, Hasanain et al. 2015, Alaboudi et al. 2016, Alfarra 2016, Almuayqil et al. 2016, Jamal et al. 2016, and Uluc and Ferman 2016). All included studies were published between 2011 and 2016. One study was published in 2011 (Bah et al. 2011), one study in 2012 (El Mahalli et al. 2012), three studies in 2014 (Alasmary et al. 2014, Aldosari 2014, and Hasanain and Cooper 2014), four studies in 2015 (Alsulame et al. 2015, El Mahalli 2015a, El Mahalli 2015b, and Hasanain et al. 2015), and six studies in 2016 (Alaboudi et al. 2016, Alfarra 2016, Almuayqil et al. 2016, El Mahalli et al. 2016, Jamal et al. 2016, and Uluc and Ferman 2016). In regards to the geographical setting, one study was comparative of eHealth in four countries (Turkey, Saudi Arabia, Egypt and UAE) (Uluc and Ferman 2016). The remaining 14 studies were conducted in Saudi Arabia with 1 study in Makkah region (Hasanain et al. 2015), 4 studies in Riyadh city which is the capital of Saudi Arabia (Alasmary et al. 2014, Aldosari 2014, Alfarra 2016, and Jamal et al. 2016), 5 studies were conducted in the Eastern province of Saudi Arabia (Bah et al. 2011, El Mahalli et al. 2012, El Mahalli 2015a, El Mahalli 2015b, El Mahalli et al. 2016), and finally 4 studies did not specify any specific geographical location within Saudi Arabia (Hasanain and Cooper 2014, Alsulame et al. 2015, Alaboudi et al. 2016, and Almuayqil et al. 2016). See Figure 3.2 to overview the location of provinces identified in the review.

In regards to the methodology and methods, 11 studies were quantitative in design (Bah et al. 2011, El Mahalli et al. 2012, Aldosari 2014, Hasanain and Cooper 2014,

El Mahalli 2015a, El Mahalli 2015b, Hasanain et al. 2015, Almuayqil et al. 2016, El Mahalli et al. 2016, Jamal et al. 2016, and Uluc and Ferman 2016). Four of these studies used paper-based cross-sectional questionnaires (El Mahalli et al. 2012, El Mahalli 2015a, El Mahalli 2015b, and El Mahalli et al. 2016), two studies used online survey (Bah et al. 2011 and Jamal et al. 2016), one study used mixed online and paper-based surveys (Hasanain et al. 2015), while four studies did not supply information on the type of questionnaire in use in their studies (Aldosari 2014, Hasanain and Cooper 2014, Almuayqil et al. 2016, and Uluc and Ferman 2016). Two studies were qualitative and used interview and focus group approaches (Alsulame et al. 2015 and Alfarra 2016) and the remaining two studies were mixed methods using a combination of questionnaires and interviews for collecting data (Alasmary et al. 2014 and Alaboudi et al. 2016).

In terms of intervention, six studies discussed Electronic Health Records (EHRs) (Bah et al. 2011, Aldosari 2014, Hasanain and Cooper 2014, El Mahalli 2015a, El Mahalli 2015b, and Alfarra 2016), three studies were about eHealth in general (Alsulame et al. 2015, Almuayqil et al. 2016, and Uluc and Ferman 2016) while two studies specifically investigated Electronic Medical Records (EMRs) in hospitals (Alasmary et al. 2014 and Hasanain et al. 2015). Other studies examined different interventions, such as, Pharmacy Information System (El Mahalli et al. 2016), use of mobile phones in health (Jamal et al. 2016), telemedicine (El Mahalli et al. 2012), and the Saudi Telemedicine Network (STN) (Alaboudi et al. 2016).

With regards to population, participants were described differently in each study. Health professionals were the target participants of six studies (El Mahalli et al. 2012, Alasmary et al. 2014, El Mahalli 2015a, El Mahalli 2015b, Hasanain et al. 2015 and Jamal et al. 2016). Health IT managers were the focus in two studies (Bah et al. 2011 and Alsulame et al. 2015) while senior and middle level health managers participated in one study (Alfarra 2016). The remaining studies targeted mixed and random participants of the three groups of professionals matching the inclusion criteria (Aldosari 2014, Hasanain and Cooper 2014, Alaboudi et al. 2016, Almuayqil et al. 2016, El Mahalli et al. 2016, and Uluc and Ferman 2016).

With reference to the study aims, five studies identified barriers of intervention implementation with the focus on challenges and adoption level (Hasanain and Cooper 2014, El Mahalli 2015a, El Mahalli 2015b, Almuayqil et al. 2016, and Uluc

and Ferman 2016), two studies assessed the perceptions of health professionals (El Mahalli et al. 2012 and Alaboudi et al. 2016), two studies evaluated the availability and prevalence of the interventions under study (El Mahalli et al. 2016 and Jamal et al. 2016), the remaining six studies had a variety of aims within the main scope of the review (Bah et al. 2011, Alasmary et al. 2014, Aldosari 2014, Alsulame et al. 2015, Hasanain et al. 2015, and Alfarra 2016). With regards to the intervention definitions, only eight studies provided definitions for the focus of the study (Bah et al. 2011, El Mahalli et al. 2012, Alasmary et al. 2014, Aldosari 2014, El Mahalli 2015b, El Mahalli et al. 2016, and Uluc and Ferman 2016).

In terms of the quality, all studies included were of good quality in regard to the clarity of aims and questions. All studies appropriately described their methods in use, however, in some studies there was a need for better identification of whether the undertaken design was appropriate for conducting the study. Different sample sizes were identified in each study, however, two-third of the studies (10 out of 15) did not clarify whether the sample selected was considered to be representative or not (El Mahalli et al. 2012, Aldosari 2014, Hasanain and Cooper 2014, El Mahalli 2015a, Hasanain et al. 2015, El Mahalli 2015b, Alaboudi et al. 2016, Almuayqil et al. 2016, El Mahalli et al. 2016, and Uluc and Ferman 2016). The same lack of clarity applied to bias introduction in quantitative design studies as 8 studies out of 11 did not propose how bias would be dealt with (El Mahalli et al. 2012, Aldosari 2014, El Mahalli 2015a, El Mahalli 2015b, Almuayqil et al. 2016, El Mahalli et al. 2016, Jamal et al. 2016, and Uluc and Ferman 2016). Only one study considered technology acceptance theories to underpin their research which was about barriers and challenges in adopting Saudi Telemedicine Network (Alaboudi et al. 2016). In this sole study, three models were used: The Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology Organisation Environment (TOE) theoretical framework, and the Evaluating Telemedicine Systems Success Model (ETSSM). The study concluded that the top three barriers to adoption and implementation of telemedicine by the healthcare facilities (HCF) decision makers are: (i) the availability of adequate sustainable financial support to implement, operate, and maintain the telemedicine system, (ii) ensuring conformity of telemedicine services with core mission, vision, needs and constraints of the HCF, and (iii) the reimbursement for telemedicine services. These findings were based on the response of a representative sample of 905 participants and the barriers were highlighted as most significant to Saudi Arabian

context. However, that contradicts the findings from other studies of the same context that presented lack of technical and professional training sessions and confidentiality, security and data privacy issues at higher significance than financial barriers (Hasanain and Cooper 2014, El Mahalli 2015a, and El Mahalli 2015b).

Figure 3.2: Makkah, Riyadh, and Eastern provinces of KSA

3.3.2 eHealth influencing factors

From the 15 studies included, 39 factors were identified as influences affecting the adoption and acceptance of eHealth in Saudi Arabia from the perspectives of multiple stakeholders. For the purpose of clarity in this systematic review, all factors were grouped into six clusters based on their nature. See Figure 3.3.

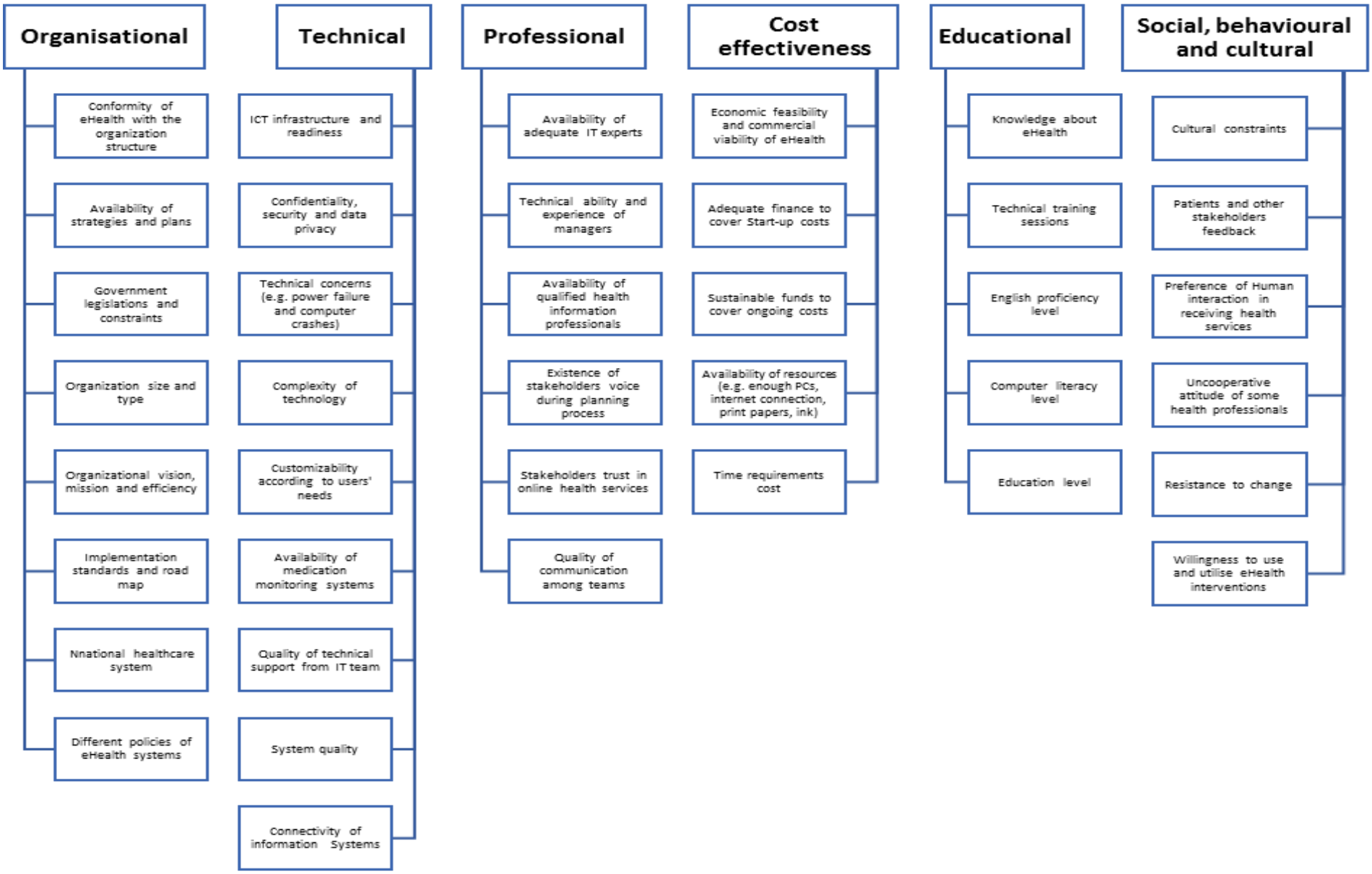


Figure 3.3: Clusters of factors that influence eHealth adoption and acceptance in Saudi Arabia

Further, the factors are described based on the 15 studies included.

Organisational factors which are related to the healthcare organisations and facilities. These factors vary from one organisation to another based on the level of bureaucracy and the clarity of policies and procedures within the work place. Literature from the studies has shown evidence on how these factors play a role in affecting the acceptance of technology by the health professionals and managers.

Technical factors which refer to the usage, processes and operations that are involved with technical aspects such as IT infrastructure, eHealth applications, and information security. These factors were reported to be major challenges requiring large budget allocation to cover operations and maintenance.

Professional factors these emphasised the importance of having adequate numbers of qualified professionals in the organisation with both the technical background to support systems and health background to run health technology systems with efficiency.

Cost effectiveness factors showed how financial support may affect both the adoption level of health organisations and the acceptance level by the professionals. Adequate finance to cover start-up costs, ongoing costs, and secure the sustainability fund to work on providing enough resources were all considered success signs of eHealth adoption and acceptance. Time can also be considered as a cost effectiveness factor required to front load implementation, adoption and acceptance of new innovations and ways of working.

Educational factors may influence an individual's attitude towards technology adoption and acceptance through their personal experience. These factors were mentioned in the studies in different ways such as: level of education, lack of training, English language proficiency level and computer or digital literacy.

Social, behavioural and cultural factors in which the level of the adoption can be challenged by the social and cultural beliefs of the stakeholders. Resistance to change, willingness to utilise technology and preference for human or computer interaction in receiving healthcare services may influence adoption and acceptance levels.

3.4 Discussion

3.4.1 Key findings

This review sets out the available evidence of the adoption and acceptance of eHealth in Saudi Arabia from the perspectives of multiple stakeholders. Despite the issues raised, the field of eHealth showed evidence of continual growth in the country in terms of both publications and awareness of significance (Figure 3.4). However, there has been a lack of studies that focus on the perspective of health management professionals. In general, the findings showed consistency with previous studies such as the study conducted by Altuwajiri (2008) which emphasised four major groups of barriers to eHealth in Saudi Arabia: economic, technological, organisational, and behavioural barriers (Altuwajiri 2008).

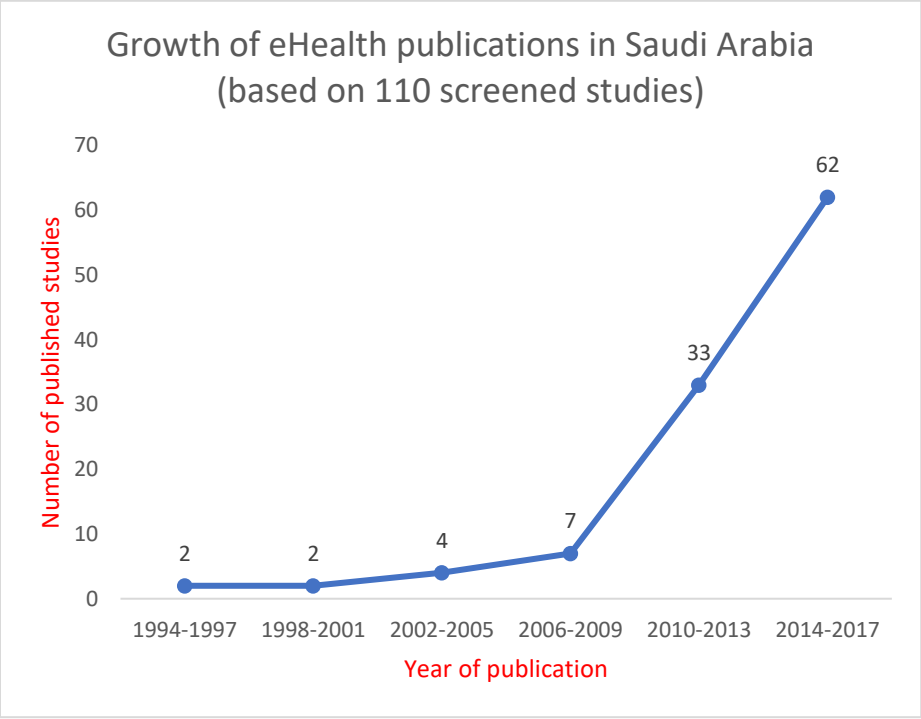


Figure 3.4: Growth of eHealth publications in Saudi Arabia

A new study was later added to the list of papers (Zaman et al. 2018). It was published in 2018 and picked out by notification alert that was set on searched databases. It was carried out in three MOH hospitals in Makkah city, KSA and aimed to: 1) Assess the utilization status of eHealth in Makkah city hospitals, 2) Measure the usefulness of eHealth in delivering good healthcare in Saudi Arabia, and 3) Find out the challenges / barriers in implementing eHealth services in Saudi Arabia. In this study, a questionnaire was used to collect data from a sample size of 51 administrative and medical staff. The study found out that apart from the shortage of operational resources such as computers and the staff technical ability, cost and expertise in innovative systems in IT were the main challenges. These findings showed similarity with the results that were pooled from the studies included in this review.

In 2011, the MOH in Saudi Arabia launched a national eHealth strategy in order to achieve its innovative vision for eHealth "safe, efficient health system, based on the care cantered on a patient, standard-oriented, and supported by the eHealth" (National eHealth Strategy, MOH 2011). This ambitious strategy anticipated that eHealth would bring huge benefits for patients, providers, and health system managers. A roadmap of implementation was established to track progress within the process which was planned to be carried out in two phases (5 years each). Furthermore, it has been found that the governance model for the Saudi National Transformation Programme (NTP) 2020 has set five phases to achieve the objectives for all government bodies concerned including the MOH. These phases progress gradually from first (i) identifying the challenges, moving to the second, (ii) developing initiatives and plans, followed by third, (iii) implementing plans, then fourth, (iv) publishing outcomes, to finally the fifth phase which concentrates on (v) auditing, improving and adding new initiatives (NTP, SaudiVision2030 2016).

The MOH has to achieve 15 objectives as part of meeting the Saudi NTP 2020. The third objective of the MOH plan is to improve the efficiency and effectiveness of the healthcare sector through the use of IT and digital transformation (NTP, SaudiVision2030 2016).

Findings from this review may help key professionals assigned to work on achieving the third objective to determine the 1st phase of operation which focuses

on identifying current challenges. This study, in addition, complements the previously identified factors thought to influence the adoption and acceptance of eHealth in Saudi Arabia and shall address the current challenges and barriers to help with prioritising the main areas for improvement. However, the similarities and differences between the findings of this systematic review and the extent to which they apply to all or parts of Saudi Arabia have yet to be established.

3.4.2 Strengths and limitations

Strengths of this review include following best practice such as the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) for writing the protocol (Moher et al. 2015) and PRISMA checklist for reporting the results (Moher et al. 2009). Another strength is that the review was conducted by a multidisciplinary team acting as independent reviewers at each stage to minimise the risk of bias (MacLure et al. 2016). However, there were weaknesses that could limit the transferability of the findings and recommendations such as: the limited number of studies and geographical scale which makes it difficult for findings and recommendations to be generalised. In addition, the findings relied on eligible studies that were found in only five databases. There might be other studies but not found in these particular databases. Finally, although all included studies were assessed by the review team members against quality criteria, and agreed to be good for inclusion, many included studies failed to meet some of the criteria. For example, not providing enough details on whether the sample size recruited in the study was representative of the targeted population. Based on these limitations, it is suggested to apply caution upon interpretation of the general findings.

3.5 Summary of the chapter

This review has highlighted the status of eHealth research in the KSA from the perspectives of multiple stakeholders and identified some of the main barriers and challenges that influence the adoption and acceptance of eHealth. Thirty-nine factors in six clusters were identified that influence eHealth adoption and acceptance in the country. Although the number of eHealth publications is increasing, there remains the need to investigate the views of specific stakeholder groups towards eHealth, taking into account their voices during the planning process of any future projects. Finally, due to the limitation of eHealth studies to

certain regions, it is recommended to extend research into the experience and extent of eHealth adoption and acceptance levels in different geographical settings across the country to draw a clearer picture of the current practice and future plans for eHealth.

Before conducting this review, few facts were known about eHealth status in KSA:

- Literature on eHealth status in Saudi Arabia has documented a wide range of benefits, such as improving the quality and efficiency of healthcare services, cost reduction, and inter- and intra-organisational communications.
- The eHealth field is growing in Saudi Arabia even though the number of research publications is limited to few organisations in few geographical areas.
- In 2011, the Ministry of Health (MOH) launched a national eHealth strategy.
- Little was known about the adoption and acceptance of eHealth in Saudi Arabia from multiple stakeholders perspectives.

This systematic review has added the following to the knowledge of eHealth in KSA:

- Thirty-nine factors were identified as influences affecting the adoption and acceptance of eHealth in Saudi Arabia from the perspectives of multiple stakeholders.
- There remains a need to investigate the views of specific stakeholder groups towards eHealth.
- Findings from this review may help key professionals to address the current challenges and barriers and so prioritise the main areas for improvement.
- This review recommends further research into the experience and extent of eHealth adoption and acceptance levels in different geographical settings across the country to draw a clearer picture of the current practice and future plans for eHealth in Saudi Arabia.

3.6 Implications on the next phase of the research

This systematic review was the first phase of this programme of research. All available influencing factors of the eHealth adoption and acceptance in KSA were identified from the perspectives of different stakeholders. Given the gaps identified

in this review, an explanatory sequential mixed methods approach will be adopted. The second phase will be a quantitative approach that focuses on bridging the gap of lack studies of health managers perspectives by investigating factors that influence health managers' acceptance of eHealth services in KSA. A qualitative approach phase will follow to explore more in-depth the views of health managers in Aseer Province, KSA to fill in the gap of extending the research into the experiences of different geographical settings.

CHAPTER 4: A UTAUT BASED CROSS-SECTIONAL SURVEY TO INVESTIGATE HEALTH MANAGERS' ACCEPTANCE OF EHEALTH SERVICES IN THE KINGDOM OF SAUDI ARABIA

4.1 Introduction

The first phase of this research was a systematic review (SR). All available factors in the literature that may influence eHealth adoption and acceptance based on the views of multiple stakeholders in KSA were identified (chapter 3). Two main knowledge gaps were highlighted: (1) the lack of studies of health managers perspectives, and (2) the need to extend the eHealth research into the experiences in different geographical settings in the KSA.

The second phase of this doctoral research, which is the focus of this chapter, was informed by the findings from the SR. A theoretically informed quantitative cross-sectional survey was conducted based on the UTAUT model (see chapter 2) to investigate the factors which influence health managers' acceptance of eHealth services in KSA. The aim of this phase of research, research questions, methods, results, and discussion will be presented.

4.1.1 Study aim and research questions

The overall aim of this phase of the research was to investigate the factors that influence health managers' acceptance of eHealth services in KSA.

In this phase, three research questions were posed:

1. What are the factors that influence health managers' acceptance of eHealth services in KSA?

2. What UTAUT constructs are of significance to the health manager's behavioural intention to utilise eHealth services in the KSA?

3. What UTAUT constructs are of significance to the health manager's actual use of eHealth services in the KSA?

4.2 Methods

4.2.1 Study Design

Given the study aim, a quantitative cross-sectional survey methodology was adopted. The findings generated from this quantitative data were used to develop a better understanding of eHealth acceptance across the KSA from the perspectives of health managers.

Firstly, to determine which of the 39 factors identified in the SR were of significance to health managers, a technique of grouping all factors into 17 themes was applied. Factors of the same nature were placed together under a main theme to shorten the list of factors without losing the clarity of meaning. For example, lack of technical training, computer literacy, and English language proficiency were grouped under an Educational Factors theme. The aim for this grouping was to save participant's time by posing fewer questions to encourage participation. This procedure showed consistency with studies previously conducted, such as: Khalifa (2013), Alsulame et al (2015), Alaboudi et al (2016), and Almuayqil et al (2016).

Seventeen themes were finalised with a study code and literature-based definition (Table 4.1).

Table 4.1: Factors identified in the SR

Theme	Theme code	Meaning in the literature
Availability of operational resources	AvOR	Operational resources are the tools that are used to handle daily work such as computers, laptops, printers, print papers, and ink
Availability of adequate qualified human resources	AvHR	Human resources are skilled professionals that manage systems and provide technical support
Educational factors	EduF	Educational factors are those related to the level of education, training and proficiency required to feel confidence in performing the job
Organisational factors	OrgF	Organisational factors are those factors that influence behaviour of work such as the mission, vision, size and type of the healthcare facility
Financial factors	FinF	Financial resources are the funds secured to establish, operate, and maintain infrastructure, systems and applications

Government legislation and constraints	GoLC	Government legislation and constraints are the plans, laws, rules, and regulations imposed by governmental bodies such as the national eHealth strategy
ICT infrastructure and readiness	InfR	Infrastructure is the physical structure of the healthcare facility including buildings, internet connection, network points, and power supplies
Privacy, confidentiality, and security of health information	PCSH	Privacy, confidentiality, security are major concepts of protection in which access to personal information are controlled
Stakeholders' voice upon planning and feedback on preferences	SVPF	Stakeholders' voice refers to the active participation and involvement of stakeholders in planning the necessary services
Quality of eHealth systems and applications	QuSA	Quality of eHealth systems and applications means smooth and efficient performance with no technical crashes, failures or hanging up difficulties
Customisability of systems functions according to users' needs	CuSU	Customisability of systems functions means adjusting them to give the best available experience to meet the needs of end-users
Connectivity of information systems	CoIS	Connectivity of information systems usually describes the communication between devices, systems, and applications either within the healthcare facility or with outside entities and facilities
Availability of information and knowledge about eHealth services	AvIK	Availability of information and knowledge refers to the awareness of eHealth services information which include plans of implementations, strategy, and policies and procedures of the practice
Uncooperative behaviour and resistance to change	UBRC	Uncooperative behaviour and resistance to change is the actions taken by some employees when they perceive that technology can be a threat to them
Willingness to utilise technology	WiUT	Willingness to utilise technology is the positive engagement of individuals in using technology once they perceive its advantages
Technical ability and work experience	TAWE	Technical ability and work experience refer to the competency in carrying out the technical tasks without help from others such as using eHealth systems and applications
Complexity of technology	ComT	Complexity of technology is the degree in which systems and applications are difficult and complicated to operate without prior experience or training

4.2.2 Study setting

The sampling frame of the second phase of this research targeted all health managers across KSA:

1. Due to the difficulty of identifying health managers as they come from different professions and variety of backgrounds, invitation to take part in this study targeted all potential population and participation links were distributed across social media platforms.

2. To draw a holistic and representative clear picture of influential factors from the perspectives of health managers who work under the umbrella of different healthcare providers across the KSA including MOH, governmental authorities, and private sector.

4.2.3 Inclusion and exclusion criteria

Inclusion: All professionals from multiple disciplines such as health professions, management, and health IT across the KSA were eligible to participate if currently or previously involved in a managerial role at any healthcare facility in the country.
Exclusion: Professionals who participated in the pilot study.

4.2.4 Sample size representation

As has been justified in chapter 2 section 2.5.1.6, a sample size calculation formula was used at confidence interval 95% and margin of error 5%, giving a representative sample size should be 384.

4.2.5 Questionnaire development

An online questionnaire of four parts was developed based on two sources. The first source was the thirty-nine factors found in the systematic review (chapter 3) to be relevant to eHealth acceptance in KSA from the perspectives of multiple stakeholders (Alshahrani et al. 2019), and second was the validated questionnaire adopted from the UTAUT model (chapter 2) (Venkatesh et al. 2003).

As suggested by the School of Pharmacy and Life Sciences, RGU, the questionnaire was hosted by Online Surveys platform and accessed through the following link: https://www.onlinesurveys.ac.uk

English was the primary language for the questionnaire with a translated version in Arabic language to allow optional preferences to all participants. To ensure accuracy of translation, the questionnaire was back-translated by an independent health professional. The questionnaire consisted of four parts: demographics (gender, age, managerial level, years of managerial experience, and geographical location); attitudinal scales to establish the level of importance of each of the seventeen themes (scale from 5=most important to 1=least important); modification version from the Unified Theory of Acceptance and Use of Technology (UTAUT) validated items in which five-point Likert scales were used where 1=strongly disagree and 5=strongly agree; an open space at the end of the questionnaire that gives all participants a chance to add any additional factors that may influence eHealth acceptance and any general comments or suggestions for consideration by the research team. Finally, participants who worked for the MOH in Aseer Province, KSA were invited to submit their contact details to take part in follow up face-to-face or telephone interviews.

To review the face and content validity of the data collection instrument, a panel of experts in eHealth from KSA were invited to assess the questionnaire items for clarity and whether or not they covered the concepts being studied. Three responses were received from:

1. A senior Information Technology professional who works for Information Technology Department, King Faisal Specialist Hospital and Research Centre, Riyadh, KSA.
2. A PhD holder in Computer Sciences with focus on E-health who works as an Assistant Professor in Shaqra University, KSA.
3. A Senior health manager who works for the Ministry of Health, KSA.

This resulted in minor changes such as clarity of some statements prior to inviting eleven health managers from different healthcare settings in KSA to pilot the questionnaire.

Hassan et al (2006) described the importance of conducting a pilot study as "to identify potential problem areas and deficiencies in the research instruments" (Hassan et al. 2006). In the current study, piloting was carried out to obtain feedback with regards to:

- The ability to understand the questionnaire items and sequences
- The estimated time to complete the questionnaire
- Any issues with language clarity and questionnaire lay out

Eight of the eleven invited provided comments mainly related to being more concise with the introduction as well as the clarity of some language. Estimated time to complete the questionnaire ranged between 8 and 12 minutes. Comments were taken into consideration and required changes made.

This study employed some valuable evidence-based strategies explored by Nair et al (2008) to encourage more participation:

- Provide clear information about the study and benefits of conducting it
- Demonstrate the importance of participation and the value of contribution from all participants
- Consider the length of questionnaire and time needed to complete it
- Assure the confidentiality of participants' personal information
- Send participation reminder messages to target population

4.2.6 Recruitment of participants

Due to the lack of access to the email database in healthcare authorities in the KSA, as well as the difficulty in identifying health managers, social media platforms were adopted as a rapid and wide-reaching solution. The Ministry of Communication and Information Technology (MCIT) reported that the number of social media platforms users in KSA has doubled in the past few years from 8.5 million to 18.3 million (MCIT 2020). Figure 4.1 Shows the average of population using social media platforms in some Middle Eastern countries. KSA ranked at high level (Second for using Facebook platforms including WhatsApp and first in using Twitter). The questionnaire was launched online in June 2018. Links to both English and Arabic versions were distributed across Twitter, Facebook, and WhatsApp with

support from Saudi Arabian Health Informatics groups and some influential health professionals. Links were re-posted online twice, after 15 days and after 30 days, to encourage those who did not participate to take part in the study. The study closed to participation on 1st August 2018.

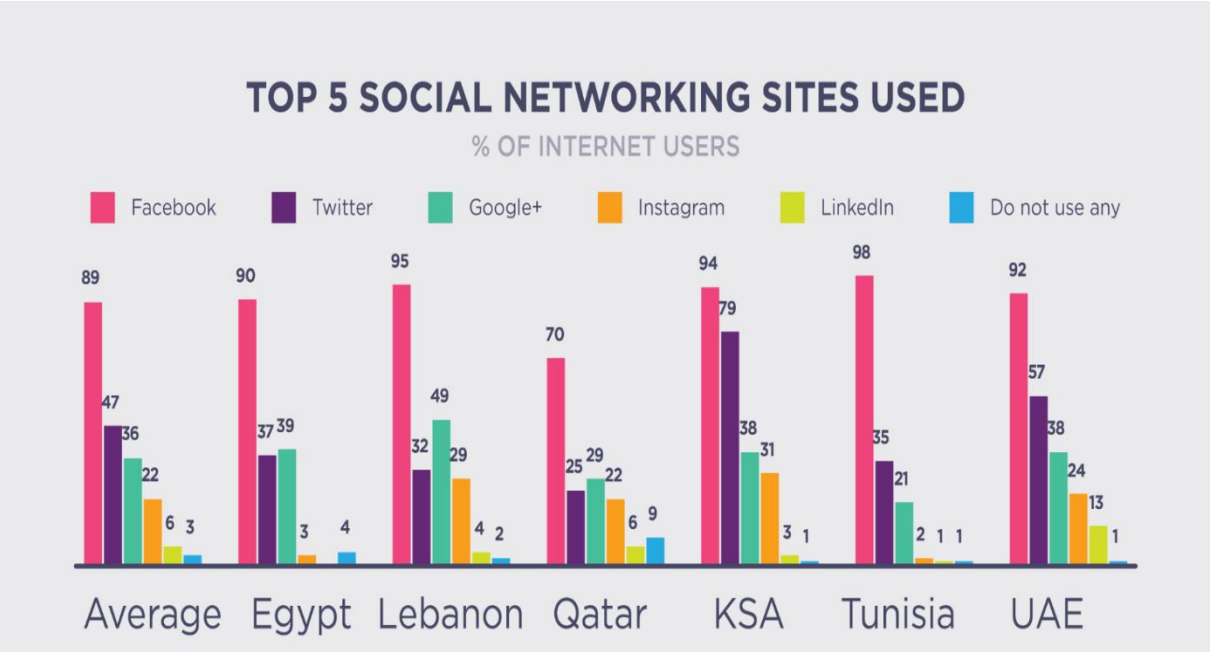


Figure 4.1: Comparison of using social media platform in some Middle Eastern countries adopted from http://www.mideastmedia.org

4.2.7 Data analysis

The data generated from the questionnaire were exported from online surveys platform to the SPSS and cleaned by checking spelling and removing any extra spaces prior to analysis. Analysis was conducted in three steps as shown in Table 4.2.

Table 4.2: Quantitative analysis steps

Step	Analysis conducted	Analysis tool/formula
1	Determine significant factors influencing health managers' acceptance of eHealth services in KSA	The Relative Importance Index (RII), IBM SPSS, v25
2	Map the RII identified significant factors against UTAUT constructs	Mapping was done by the Principal Investigator based on the definition of themes (Table 4.1). Procedure was re-checked and confirmed by another team member
3	Descriptive statistics, Principal Component Analysis (PCA), and Ordinal regression analysis	IBM SPSS, v25

First step: Aimed to determine the factors influencing health managers' acceptance of eHealth services in KSA. The Relative Importance Index (RII) tool was used in SPSS. Tam et al (2006) introduced the RII method as the mean score given to each factor which ranges between 0 and 1. This method is used to identify the importance of factors under investigation (Tam et al. 2006). The result suggests that the closer the value to 1, the higher the importance of the factor from the perspective of respondents. This method has been employed by many researchers to quantitatively estimate relative importance in different contexts such as: construction and infrastructure (Aziz 2013), education (Aziz et al. 2016), and healthcare clients' context (Borishade et al. 2018). The formula of the RII is as follows:

$$RII = \frac{\sum W}{A * N}$$

$$RII = \frac{W5 * (n5) + W4 * (n4) + W3 * (n3) + W2 * (n2) + W1 * (n1)}{A * N}$$

W = weights given to each factor by the respondents, ranging from 5 to 1 where '5' is most important and '1' least important.

A = highest weight (i.e. 5)

N = total number of respondents

n= number of respondents who selected an answer ranging from 5 to 1.

Second step: was informed by the findings from the first step. UTAUT was adopted with modification as shown in Figure 4.2. Four main independent constructs that would influence Behavioural Intention and Use Behaviour: Performance Expectancy; Effort Expectancy; Social Influence, and Facilitating Conditions moderated by five moderators: gender; age; managerial level; managerial experience; and geographical location.

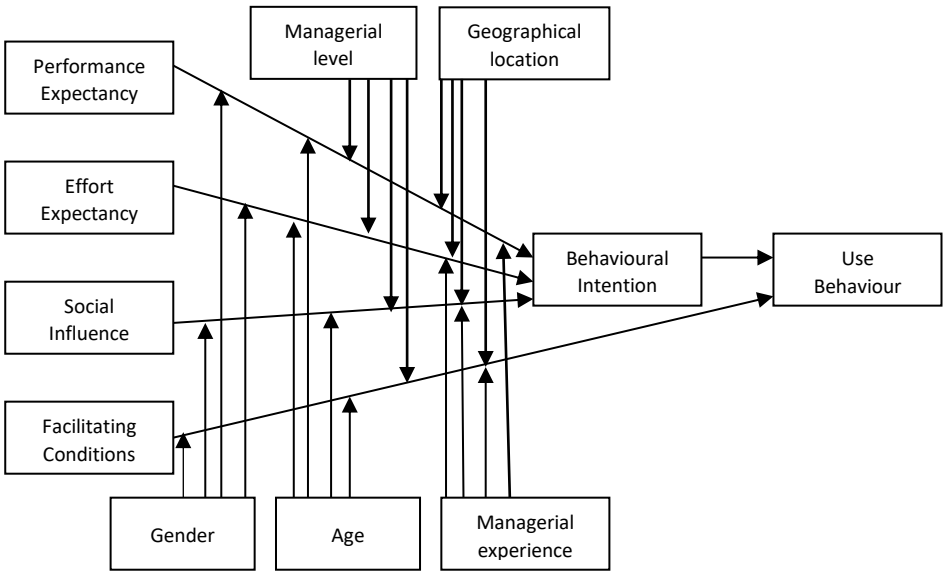


Figure 4.2: Adopted Unified Theory of Acceptance and Use of Technology with modifications. Adopted from Venkatesh et al. (2003)

This step aimed to map the significant identified themes from the RII technique against UTAUT constructs for further analysis. The seventeen themes with proven significance were clustered against the four main UTAUT model constructs that may potentially influence both the Behavioural Intention and Use Behaviour of health managers towards eHealth.

Third step: The statistical analysis in the final step involved using the Statistical Package for Social Sciences (SPSS, v25) to conduct the following procedures:

I. Descriptive statistics

Statistical procedures to describe respondents' demographics such as gender, age, experience, managerial level, qualifications, and geographical location. Basic features of the respondents' responses can be illustrated and compared. In this study, means, standard deviations, frequencies, and percentages were presented.

II. Principal Component Analysis (PCA)

PCA was applied to reduce the initial number of UTAUT variables to a smaller number that captures the same information in the large data set. One of the most common criterion for factor retention was proposed by Kaiser (1960). It was stated that only factors with the eigenvalues greater than 1 are to be retained (Kaiser 1960). The reason for that was explained by Cliff (1988) that the eigenvalue less than 1 would negatively impact the component's reliability (Cliff 1988). Cronbach's alpha, which is a test of reliability (more details in the results section), was then followed to calculate the internal consistency of the PCA extracted items.

III. Ordinal regression analysis

Test of normality was conducted first to check the normality of data distribution and then decide which type of regression analysis would statistically be the most appropriate to develop a predictive model for Behavioural Intention (BI) and Use Behaviour (UB). The aim of applying regression analysis was to discover possible determinants of Behavioural Intention and Use Behaviour. The original intention was to utilise multiple

regression which is used to predict the influential value of two or more variables on a dependent variable. This intention was revised in favour of ordinal regression due to the data distribution results which revealed significant departures from normality (more details in the results section).

4.3 Results

4.3.1 Respondents' profile

The total number of responses received was 385 which confirmed the representation of the targeted population (health managers).

Table 4.3 summarises the demographics of respondents. The percentage of male participants was 84.4% (n=325). Of the total sample, 42% (n=162) were aged between 35-44 years old. Nearly 60% (n=229) of all health managers were at the middle management level. Nearly half, 46% (n=178), had managerial experience of between 10-14 years. Three-quarters, (75.1%, n=289), of all participants across the KSA worked in city-located healthcare facilities.

Table 4.3: Demographics of participants

Profile	n (%)
Gender	
Male	325 (84.5)
Female	56 (14.6)
Prefer not to say	4 (1.0)
Age (years)	
Under 25	2 (0.5)
25-34	145 (37.7)
35-44	162 (42.1)
45-54	65 (16.9)
55 and over	11 (2.9)
Managerial level	
Lower Level	116 (30.1)
Middle Level	229 (59.5)
Top Level	40 (10.4)
Managerial experience (years)	
Less than 5	65 (16.9)
5-9	54 (14.0)
10-14	178 (46.2)
15-19	66 (17.1)
20 and above	22 (5.7)
Geographical location	
City	289 (75.1)
Urban Governorate	67 (17.4)
Rural Governorate	17 (4.4)
Village	12 (3.1)

4.3.2 RII analysis results

The overall RII analysis showed that all factors identified by multiple stakeholders were of significance at different levels to the group of health managers. Alkadiri (2011) reported that if the RII value is ≥0.60, it is considered significant (Alkadiri 2011). The RII values ranged between the most important theme which was the Availability of Operational Resources (AvOR; 0.889) and, the least important theme, which was the Complexity of Technology (ComT; 0.725) (Table 4.4).

Table 4.4: Overall rank and significance of factors

Themes	Number of responses (N=385) on the scale of importance where 5=most important and 1= least important					Overall RII	Rank
	5	4	3	2	1		
	n (%)	n (%)	n (%)	n (%)	n (%)		
Availability of operational resources (AvOR)	292 (75.8)	33 (8.6)	23 (6.0)	15 (3.9)	22 (5.7)	.889	1
Privacy, confidentiality, and security of health info (PCSH)	270 (70.1)	45 (11.7)	28 (7.3)	25 (6.5)	17 (4.4)	.873	2
ICT infrastructure and readiness (InfR)	260 (67.5)	59 (15.3)	27 (7.0)	17 (4.4)	22 (5.7)	.869	3
Availability of adequate qualified human resources (AvHR)	265 (68.8)	42 (10.9)	38 (9.9)	21 (5.5)	19 (4.9)	.866	4
Quality of eHealth systems and applications (QuSA)	254 (66.0)	57 (14.8)	32 (8.3)	21 (5.5)	21 (5.5)	.860	5
Availability of information and knowledge about eHealth services (AvIK)	230 (59.7)	77 (20.0)	37 (9.6)	23 (6.0)	18 (4.7)	.848	6
Educational factors (EduF)	237 (61.6)	68 (17.7)	35 (9.1)	23 (6.0)	22 (5.7)	.846	7
Government legislation and constraints (GoLC)	231 (60.0)	68 (17.7)	44 (11.4)	23 (6.0)	19 (4.9)	.8436*	8
Connectivity of information systems (CoIS)	239 (62.1)	60 (15.6)	36 (9.4)	30 (7.8)	20 (5.2)	.8431*	9
Customisability of systems functions according to users' needs (CuSU)	226 (58.7)	74 (19.2)	44 (11.4)	21 (5.5)	20 (5.2)	.8415*	10

Financial factors (FinF)	243 (63.1)	59 (15.3)	32 (8.3)	21 (5.5)	30 (7.8)	.8410*	11
Willingness to utilise technology (WiUT)	225 (58.4)	77 (20.0)	40 (10.4)	20 (5.2)	23 (6.0)	.839	12
Technical ability and work experience (TAWE)	213 (55.3)	84 (21.8)	45 (11.7)	21 (5.5)	22 (5.7)	.831	13
Organisational factors (OrgF)	213 (55.3)	77 (20.0)	48 (12.5)	23 (6.0)	24 (6.2)	.824	14
Stakeholders' voice and feedback on preferences (SVPF)	193 (50.1)	87 (22.6)	61 (15.8)	25 (6.5)	19 (4.9)	.812	15
Uncooperative behaviour and resistance to change (UBRC)	171 (44.4)	92 (23.9)	65 (16.9)	25 (6.5)	32 (8.3)	.779	16
Complexity of technology (ComT)	141 (36.6)	87 (22.6)	73 (19.0)	41 (10.6)	43 (11.2)	.725	17

*Some results are expressed as 4 decimal to differentiate if two results have same value

4.3.3 Mapping factors against UTAUT constructs

Based on the definition of themes (Table 4.1), mapping of factors against UTAUT constructs was conducted. All proven significant themes (from Table 4.4) were considered for mapping as shown in Figure 4.3. This procedure was done by the principle investigator and checked by a research team member showed consistency with a study conducted by Li et al (2013) on healthcare providers' adoption of eHealth.

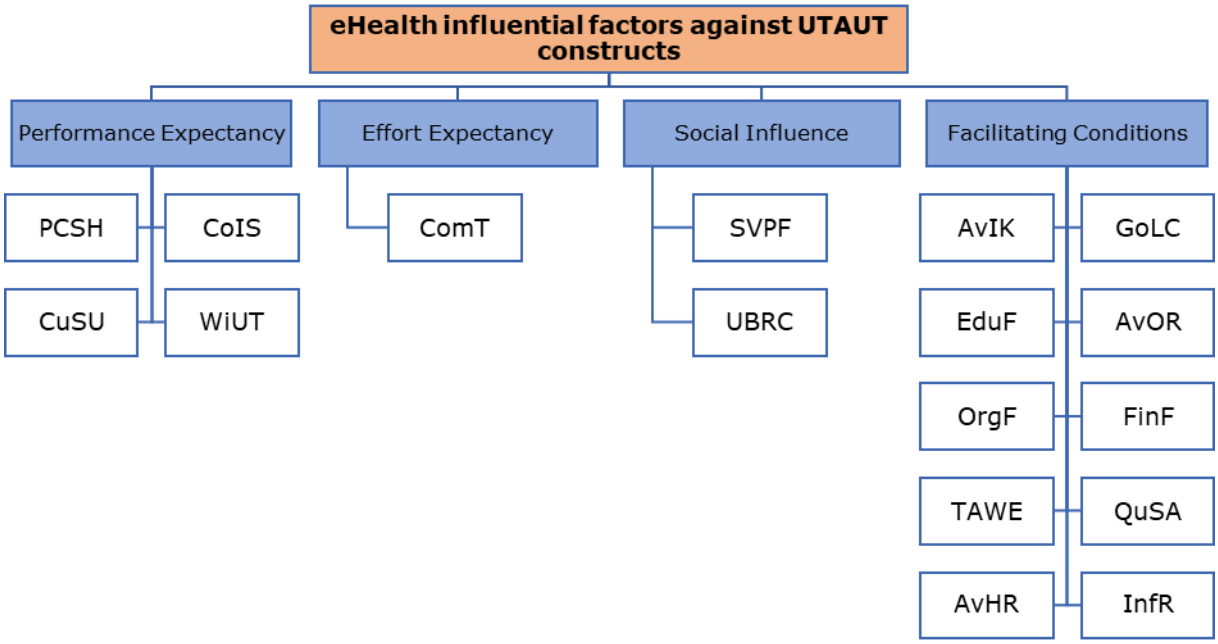


Figure 4.3: Seventeen themes of factors presented under UTAUT main constructs

4.3.4 UTAUT analysis results

As mentioned in chapter 2, there are three constructs for the UTAUT that could potentially influence Behavioural Intention as well as two constructs to the actual Use Behaviour. Tables 4.5 to 4.9 show the responses to the statements of each construct.

1. Performance Expectancy

"The degree to which an individual believes that using the system will help him or her attain gains in job performance" (Venkatesh et al. 2003).

Although positive, with 'strongly agree' and 'agree' to the first three statements combining at around 90%, the last statement with regards to the role of using eHealth services in increasing the chances of promotion, had less agreement. Over a quarter (n=98, 25.5%) of all participants gave a neutral response to this statement (Table 4.5).

Table 4.5: Responses to Performance Expectancy statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
eHealth services are useful for my work	9 (2.3)	5 (1.3)	18 (4.7)	121 (31.4)	232 (60.3)
eHealth services enable me to accomplish my work more quickly	8 (2.1)	4 (1.0)	23 (6.0)	111 (28.8)	239 (62.1)
eHealth services save my time	8 (2.1)	7 (1.8)	26 (6.8)	111 (28.8)	233 (60.5)
By using eHealth services, I will increase my chances of job promotion	21 (5.5)	25 (6.5)	98 (25.5)	109 (28.3)	132 (34.3)

2. Effort Expectancy

"The degree of ease associated with the use of the system" (Venkatesh et al. 2003).

Almost three quarters of all participants, and more for some statements, showed agreement to the statements of this constructs. More than four-fifths, (81.8%, n=315), of all participants agreed that learning how to use eHealth services was an easy process (Table 4.6).

Table 4.6: Responses to Effort Expectancy statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	n (%)	N (%)	n (%)	n (%)
My interaction with eHealth services are clear and understandable	9 (2.3)	20 (5.2)	70 (18.2)	157 (40.8)	129 (33.5)
It is easy to be skilful at using eHealth services	11 (2.9)	12 (3.1)	52 (13.5)	158 (41.0)	152 (39.5)
eHealth services are easy to use	10 (2.6)	21 (5.5)	70 (18.2)	153 (39.7)	131 (34.0)
Learning how to use eHealth services is easy	9 (2.3)	14 (3.6)	47 (12.2)	172 (44.7)	143 (37.1)

3. Social Influence

The degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al. 2003).

The highest agreement responses to the statements of Social Influence were given for the senior management encouragement (72.2%) and people who are important to individual (73.5%) (Table 4.7).

Table 4.7: Responses to Social Influence statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
People who influence my behaviour think that I should use eHealth services	12 (3.1)	30 (7.8)	88 (22.9)	140 (36.4)	115 (29.9)
People who are important to me think that I should use eHealth services	14 (3.6)	19 (4.9)	69 (17.9)	160 (41.6)	123 (31.9)
The senior management at my work place encourage using eHealth services	21 (5.5)	25 (6.5)	61 (15.8)	130 (33.8)	148 (38.4)
In general, my work place gives importance and supports the use of eHealth services	20 (5.2)	39 (10.1)	62 (16.1)	125 (32.5)	139 (36.1)

4. Facilitating Conditions

"The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al. 2003).

The agreement to the Facilitating Conditions statements were low compared to other constructs. Only 55% of overall responses agreed that they have resources to use eHealth services, however, three quarters, (75.4%, n=290), of all participants agreed that they are knowledgeable on using eHealth services.

Table 4.8: Responses to Facilitating Conditions statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
I have the resources necessary to use eHealth services	27 (7.0)	47 (12.2)	98 (25.5)	122 (31.7)	91 (23.6)
I have the knowledge necessary to use eHealth services	13 (3.4)	22 (5.7)	60 (15.6)	155 (40.3)	135 (35.1)
The eHealth services are not compatible with other electronic services I use	39 (10.1)	56 (14.5)	136 (35.3)	96 (24.7)	59 (15.3)
A specific person (or group) is available for assistance with technical problems of eHealth services	36 (9.4)	57 (14.8)	59 (15.3)	147 (38.2)	86 (22.3)

5. Behavioural Intention

"The person's subjective probability that he/she will perform the behaviour in question" (Venkatesh et al. 2003).

The results of responses showed close percentage of agreement to the first two statements about intending and predicting to use eHealth services (73.2% and 73.5% respectively). The third statement, which demonstrated the future plans to continue using eHealth services, showed slightly more agreement (75.1%) and less disagreement (only 8.6%) compared to other statements in the same construct.

Table 4.9: Responses to Behavioural Intention statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	n (%)	n (%)	n (%)	n (%)	n (%)
I intend to use eHealth services in the next 6 months	18 (4.7)	17 (4.4)	68 (17.7)	123 (31.9)	159 (41.3)
I predict I would use eHealth services in the next 6 months	20 (5.2)	15 (3.9)	67 (17.4)	123 (31.9)	160 (41.6)
I plan to use eHealth services in the next 6 months	18 (4.7)	15 (3.9)	63 (16.4)	132 (34.3)	157 (40.8)

4.3.5 Principal Component Analysis (PCA)

All UTAUT constructs were subjected to PCA to reduce the large number of interrelated variables. Hair et al (1998) stated that "in the social sciences, where information is often less precise, it is not uncommon to consider a solution that accounts for 60 percent of the total variance (and in some instances even less) as satisfactory" (Hair et al. 1998). This procedure can be statistically considered:

1) If there is a strong correlation between variables (Kim 1996).
2) When factorability of variables is confirmed by the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy. Kaiser (1974) recommended that KMO accepted values should be greater than 0.5 (Field 2013).

For all UTAUT constructs, strong correlation was observed and KMO ranged between 0.665 (SI) and 0.827 (EE) with high significance level of Bartlett's Test of Sphericity (sig.≤0.05).

Table 4.10: KMO and Bartlett's Test for all UTAUT constructs

Construct	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity significance
Performance Expectancy	.771	.000*
Effort Expectancy	.827	.000*
Social Influence	.665	.000*
Facilitating Conditions	.740	.000*
Behavioural Intention	.747	.000*

*P value is highly significant

1. Performance Expectancy

Tables 4.11 and 4.12, and Figure 4.4 show the results of PCA for the Performance Expectancy (PE). Only one factor with eigenvalues greater than 1 was extracted as proposed by Kaiser (1960).

Table 4.11: Mean and Standard Deviation of Performance Expectancy (N=385)

Item	Mean	Std. Deviation
eHealth services are useful for my work	4.4597	.83794
eHealth services enable me to accomplish my work more quickly	4.4779	.82611
eHealth services save my time	4.4390	.86122
By using eHealth services, I will increase my chances of job promotion	3.7948	1.14427

Table 4.12: Correlation matrix of Performance Expectancy items

ITEMS	eHealth services are useful for my work	eHealth services enable me to accomplish my work more quickly	eHealth services save my time	By using eHealth services, I will increase my chances of job promotion
eHealth services are useful for my work	1.000	.788**	.737**	.441**
eHealth services enable me to accomplish my work more quickly	.788**	1.000	.861**	.432**
eHealth services save my time	.737**	.861**	1.000	.501**
By using eHealth services, I will increase my chances of job promotion	.441**	.432**	.501**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Number of extracted items for PE:

Construct	No. of initial items	No. of extracted items	% of variance explained
Performance Expectancy	**4**	**1**	**72.991**

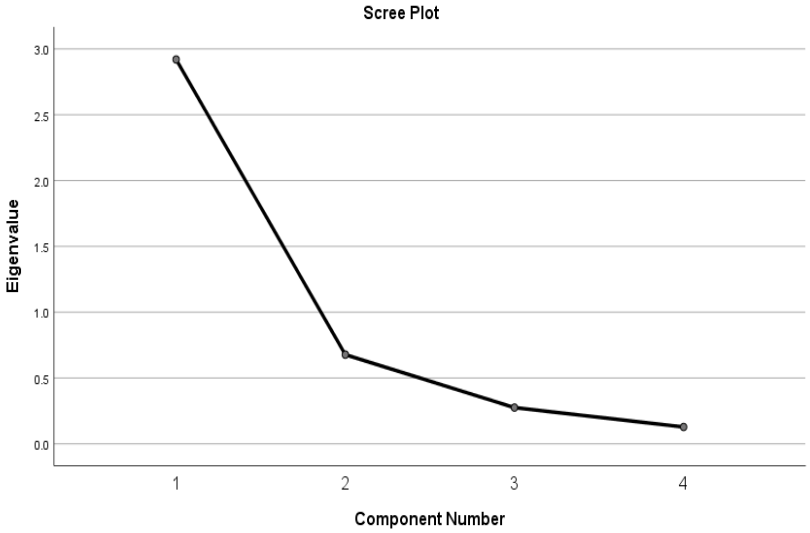


Figure 4.4: Extracted items from PCA of Performance Expectancy

2. Effort Expectancy

Tables 4.13 and 4.14, and Figure 4.5 show the results of PCA for the Effort Expectancy (EE). Only one factor with eigenvalues greater than 1 was extracted as proposed by Kaiser (1960).

Table 4.13: Mean and Standard Deviation of Effort Expectancy (N=385)

Item	Mean	Std. Deviation
My interaction with eHealth services are clear and understandable	3.9792	.96802
It is easy to be skilful at using eHealth services	4.1117	.94950
eHealth services are easy to use	3.9714	.98780
Learning how to use eHealth services is easy	4.1065	.91662

Table 4.14: Correlation matrix of Effort Expectancy items

ITEMS	My interaction with eHealth services are clear and understandable	It is easy to be skilful at using eHealth services	eHealth services are easy to use	Learning how to use eHealth services is easy
My interaction with eHealth services are clear and understandable	1.000	.640**	.656**	.639**
It is easy to be skilful at using eHealth services	.640**	1.000	.706**	.737**
eHealth services are easy to use	.656**	.706**	1.000	.817**
Learning how to use eHealth services is easy	.639**	.737**	.817**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Number of extracted Items for EE:

Construct	No. of initial items	No. of extracted items	% of variance explained
Effort Expectancy	**4**	**1**	**77.544**

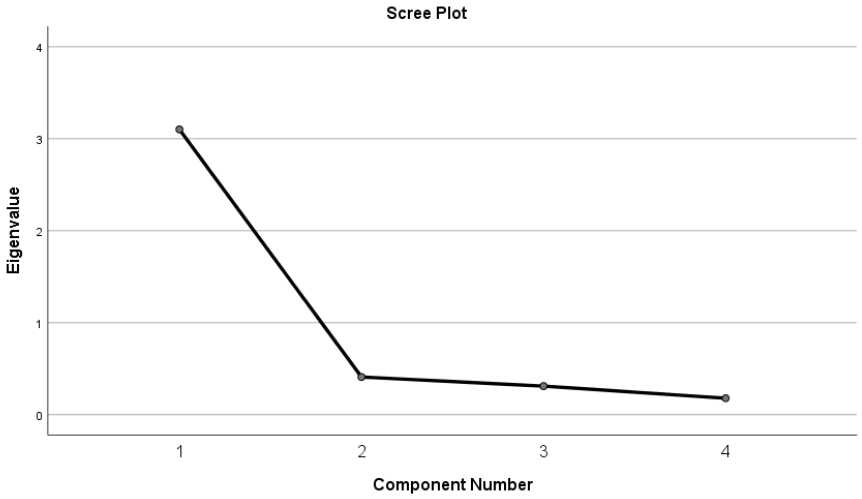


Figure 4.5: Extracted items from PCA of Effort Expectancy

3. Social Influence

Tables 4.15 and 4.16, and Figure 4.6 show the results of PCA for the Social Influence (SI). Only one factor with eigenvalues greater than 1 was extracted as proposed by Kaiser (1960).

Table 4.15: Mean and Standard Deviation of Social Influence (N=385)

Item	Mean	Std. Deviation
People who influence my behaviour think that I should use eHealth services	3.8208	1.04412
People who are important to me think that I should use eHealth services	3.9325	1.01068
The senior management at my work place encourage using eHealth services	3.9325	1.13679
In general, my work place gives importance and supports the use of eHealth services	3.8416	1.17187

Table 4.16: Correlation matrix of Social Influence items

ITEMS	People who influence my behaviour think that I should use eHealth services	People who are important to me think that I should use eHealth services	The senior management at my work place encourage using eHealth services	In general, my work place gives importance and supports the use of eHealth services
People who influence my behaviour think that I should use eHealth services	1.000	.825**	.525**	.492**
People who are important to me think that I should use eHealth services	.825**	1.000	.461**	.442**
The senior management at my work place encourage using eHealth services	.525**	.461**	1.000	.780**
In general, my work place gives importance and supports the use of eHealth services	.492**	.442**	.780**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Number of extracted Items for SI:

Construct	No. of initial items	No. of extracted items	% of variance explained
Social Influence	**4**	**1**	**69.077**

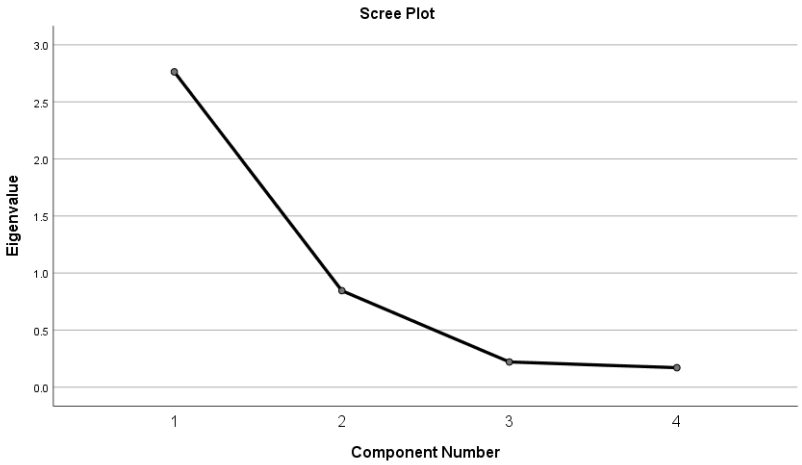


Figure 4.6: Extracted items from PCA of Social Influence

4. Facilitating Conditions

Tables 4.17 and 4.18, and Figure 4.7 show the results of PCA for the Facilitating Conditions (FC). Only one factor with eigenvalues greater than 1 was extracted as proposed by Kaiser (1960).

Table 4.17: Mean and Standard Deviation of Facilitating Conditions (N=385)

Item	Mean	Std. Deviation
I have the resources necessary to use eHealth services	3.5273	1.17921
I have the knowledge necessary to use eHealth services	3.9792	1.02041
The eHealth services are not compatible with other electronic services I use	3.2052	1.17126
A specific person (or group) is available for assistance with technical problems of eHealth services	3.4935	1.24816

Table 4.18: Correlation matrix of Facilitating Conditions items

ITEMS	I have the resources necessary to use eHealth services	I have the knowledge necessary to use eHealth services	The eHealth services are not compatible with other electronic services I use	A specific person (or group) is available for assistance with technical problems of eHealth services
I have the resources necessary to use eHealth services	1.000	.446**	.293**	.557**
I have the knowledge necessary to use eHealth services	.446**	1.000	.361**	.468**
The eHealth services are not compatible with other electronic services I use	.293**	.361**	1.000	.337**
A specific person (or group) is available for assistance with technical problems of eHealth services	.557**	.468**	.337**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Number of extracted items for FC:

Construct	No. of initial items	No. of extracted items	% of variance explained
Facilitating Conditions	**4**	**1**	**56.077**

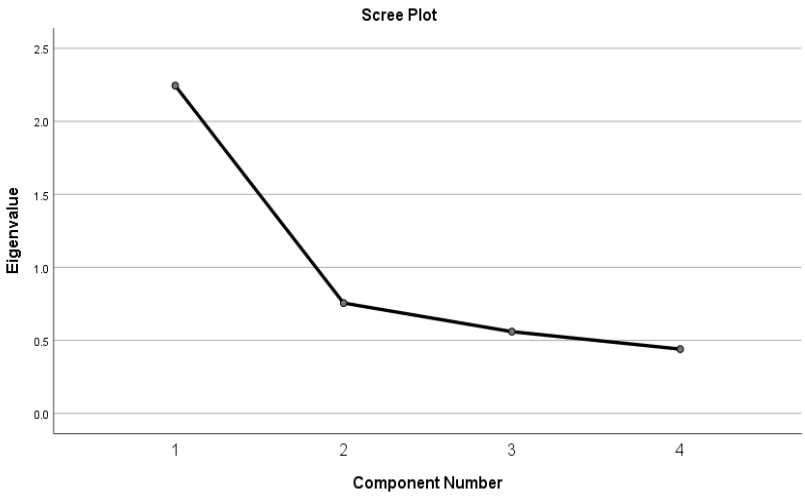


Figure 4.7: Extracted items from PCA of Facilitating Conditions

5. Behavioural Intention

Tables 4.19 and 4.20, and Figure 4.8 show the results of PCA for the Behavioural Intention (BI). Only one factor with eigenvalues greater than 1 was extracted as proposed by Kaiser (1960).

Table 4.19: Mean and Standard Deviation of Behavioural Intention (N=385)

Item	Mean	Std. Deviation
I intend to use eHealth services in the next 6 months	4.0078	1.09089
I predict I would use eHealth services in the next 6 months	4.0078	1.10276
I plan to use eHealth services in the next 6 months	4.0260	1.07255

Table 4.20: Correlation matrix of Behavioural Intention items

ITEMS	I intend to use eHealth services in the next 6 months	I predict I would use eHealth services in the next 6 months	I plan to use eHealth services in the next 6 months
I intend to use eHealth services in the next 6 months	1.000	.818**	.855**
I predict I would use eHealth services in the next 6 months	.818**	1.000	.914**
I plan to use eHealth services in the next 6 months	.855**	.914**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

Number of extracted items for BI

Construct	No. of initial items	No. of extracted items	% of variance explained
Behavioural Intention	**3**	**1**	**90.826**

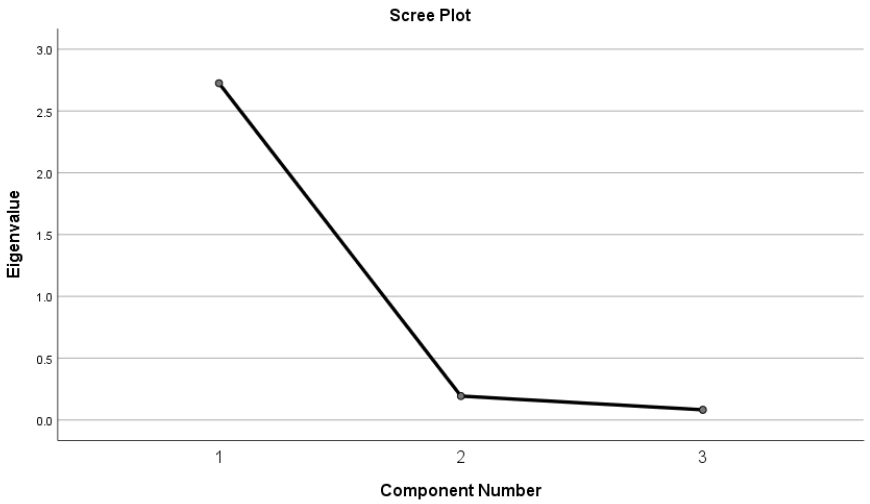


Figure 4.8: Extracted items from PCA of Behavioural Intention

Cronbach's alpha, which is a test of reliability that ranges between 0 and 1, was used to calculate the internal consistency of the UTAUT constructs. Mallery and George (2003) explained that the closer the value is to 1 the greater the internal consistency of the item, therefore, 0.9 and above is excellent and 0.7 and above is acceptable (George and Mallery 2003). Table 4.21 illustrates the level of internal consistency of all constructs ranging between 0.949 (excellent) and 0.734 (acceptable).

Table 4.21: Internal Consistency of UTAUT constructs

Constructs	Cronbach's alpha	Internal consistency
Performance Expectancy (PE)	.849	Good
Effort Expectancy (EE)	.902	Excellent
Social Influence (SI)	.849	Good
Facilitating Conditions (FC)	.734	Acceptable
Behavioural Intention (BI)	.949	Excellent

The correlation among UTAUT constructs was examined (Table 4.22) with a positive correlation established based on $p<0.01$ significance level. The strongest correlation was between FC and SI at ($r=.507$, $p<0.01$)

Table 4.22: UTAUT constructs correlation

	Mean	SD	PE	EE	SI	FC	BI
PE	2.8545	.42651	1.000				
EE	2.7013	.55116	.464**	1.000			
SI	2.6052	.60808	.380**	.401**	1.000		
FC	2.4182	.63671	.368**	.452**	.507**	1.000	
BI	2.6545	.62719	.391**	.334**	.360**	.311**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

4.3.6 Ordinal regression analysis

Tests of Normality of the extracted Principal Components (PC) revealed significant departures from Normality. Ordinal regression was chosen to be statistically appropriate to give a meaningful interpretation of the final PC scores. Ordinal regression coefficients provide a probabilistic interpretation of the likelihood of movement between the three ordinal scale values. A three-fold ordinal scaling (Low, Medium and High) of the PC scores was used. Each PC score range (i.e. maximum – minimum) was simply divided into three equal intervals to provide ordinal equivalents of the scores. Ordinal regression was then deployed in order to model Behavioural Intention and Use Behaviour. Table 4.23 shows the distributional spread of the ordinal groups for each of the constructs.

Table 4.23: Ordinal groups for UTAUT constructs (N=385)

Constructs	Ordinal groups	Number of participants	Marginal Percentage
Performance Expectancy (PE)	1.00 Low	11	2.6%
	2.00 Medium	34	8.9%
	3.00 High	340	88.5%
Effort Expectancy (EE)	1.00 Low	18	4.5%
	2.00 Medium	79	20.2%
	3.00 High	288	75.3%
Social Influence (SI)	1.00 Low	25	6.3%
	2.00 Medium	102	26.5%
	3.00 High	258	67.2%
Facilitating Conditions (FC)	1.00 Low	31	7.9%
	2.00 Medium	162	42.3%
	3.00 High	192	49.9%
Behavioural Intention (BI)	1.00 Low	32	7.9%
	2.00 Medium	69	17.8%
	3.00 High	284	74.3%

Ordinal regression of UTAUT constructs has been conducted in three rounds:

1) Separate constructs with socio-demographics on Behavioural Intention (BI) and Use Behaviour (UB)

2) All constructs with socio-demographics on Behavioural Intention (BI) and Use Behaviour (UB)

3) Only constructs confirmed significant on Behavioural Intention (BI) and Use Behaviour (UB)

First Round (A): **separate Constructs to Behavioural Intention:** Ordinal regression analysis was conducted separately on constructs with socio-demographics variables to check if any of them would have influence on the Behavioural Intention (BI).

1. Performance Expectancy (PE)

Ordinal regression results showed that PE, moderated by Age was of significance to the Behavioural Intention (BI) [p<=0.05 (low group) and p<=0.05 (medium group)] as shown in Table 4.24.

Table 4.24: Ordinal regression for PE to BI

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-.784	1.096	.474	-2.931	1.363
Behavioural Intention=[Medium]	1.022	1.088	.347	-1.110	3.154
[Gender=Male]	-.053	.374	.888	-.785	.679
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-.165	1.585	.917	-3.271	2.941
[Age=25-34 years]	1.443	.670	**.031**	.130	2.756
[Age=35–44 years]	.867	.645	.179	-.398	2.132
[Age=45–55 years]	.821	.683	.229	-.518	2.161
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	.440	.449	.327	-.439	1.320
[Managerial level=Middle]	.500	.405	.217	-.294	1.293
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	.537	.606	.375	-.650	1.724
[Managerial experience=5–9 years]	.741	.648	.252	-.528	2.011
[Managerial experience=10–14 years]	.305	.547	.577	-.767	1.377
[Managerial experience=15-19 years]	.153	.569	.788	-.962	1.269
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	.847	.658	.198	-.442	2.137
[Geographical location=Urban Governorate]	.340	.692	.623	-1.017	1.697
[Geographical location=Rural Governorate]	.148	.840	.860	-1.499	1.795
[Geographical location=Village]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-5.642	1.104	**.000**	-7.806	-3.478
Performance Expectancy=[Medium]	-1.810	.373	**.000**	-2.541	-1.078
Performance Expectancy=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

2. Effort Expectancy (EE)

Ordinal regression results showed that EE, moderated by age was of significance to the Behavioural Intention (BI) [p<=0.05 (low group) and p<=0.05 (medium group)] as shown in Table 4.25.

Table 4.25: Ordinal regression for EE to BI

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-1.221	1.107	.270	-3.392	.949
Behavioural Intention=[Medium]	.490	1.098	.656	-1.663	2.642
[Gender=Male]	.003	.372	.994	-.726	.732
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	.201	1.613	.901	-2.961	3.362
[Age=25-34 years]	1.310	.670	**.050**	-.002	2.623
[Age=35–44 years]	.749	.647	.247	-.520	2.017
[Age=45–55 years]	.683	.684	.318	-.658	2.023
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	.587	.435	.177	-.266	1.439
[Managerial level=Middle]	.591	.392	.132	-.177	1.359
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	.054	.580	.926	-1.084	1.191
[Managerial experience=5–9 years]	.519	.638	.417	-.733	1.770
[Managerial experience=10–14 years]	.194	.541	.720	-.867	1.255
[Managerial experience=15-19 years]	.148	.569	.795	-.967	1.263
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	.466	.676	.491	-.859	1.790
[Geographical location=Urban Governorate]	.114	.708	.872	-1.273	1.501
[Geographical location=Rural Governorate]	.584	.872	.503	-1.125	2.293
[Geographical location=Village]	0[a]	.	.	.	.
Effort Expectancy=[Low]	-3.681	.544	**.000**	-4.746	-2.615
Effort Expectancy=[Medium]	-1.046	.285	**.000**	-1.606	-.487
Effort Expectancy=[High]	0[a]	.	.	.	.

Link function: Logit. a. This parameter is set to zero because it is redundant.

3. Social Influence (SI)

Ordinal regression results showed that SI, moderated by age was of significance to the Behavioural Intention (BI) [p<=0.05 (low group) and p<=0.05 (medium group)] as shown in Table 4.26.

Table 4.26: Ordinal regression for SI to BI

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-2.227	1.164	.056	-4.509	.055
Behavioural Intention=[Medium]	-.441	1.150	.701	-2.694	1.812
[Gender=Male]	-.136	.387	.726	-.895	.624
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	2.548	1.988	.200	-1.348	6.443
[Age=25-34 years]	1.585	.678	**.019**	.257	2.914
[Age=35–44 years]	1.058	.655	.106	-.227	2.342
[Age=45–55 years]	.709	.688	.302	-.639	2.057
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	.686	.444	.122	-.184	1.556
[Managerial level=Middle]	.751	.400	.061	-.033	1.535
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.049	.602	.935	-1.228	1.130
[Managerial experience=5–9 years]	.318	.647	.623	-.951	1.587
[Managerial experience=10–14 years]	-.109	.555	.844	-1.198	.979
[Managerial experience=15-19 years]	.406	.599	.497	-.767	1.580
[Managerial experience=20 years and above]	0[a]	.	.	.	.

[Geographical location=City]	-.393	.753	.602	-1.869	1.083
[Geographical location=Urban Governorate]	-.735	.788	.351	-2.279	.809
[Geographical location=Rural Governorate]	-.617	.929	.507	-2.437	1.203
[Geographical location=Village]	0[a]	.	.	.	.
Social Influence=[Low]	-3.862	.496	**.000**	-4.834	-2.889
Social Influence=[Medium]	-1.119	.281	**.000**	-1.670	-.568
Social Influence=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

4. Facilitating Conditions (FC)

Ordinal regression results showed that FC was of significance to the Behavioural Intention (BI) [p<=0.05 (low group) and p<=0.05 (medium group)], however, no socio-demographic moderator showed significance as shown in Table 4.27.

Table 4.27: Ordinal regression for FC to BI

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-2.052	1.115	.066	-4.238	.134
Behavioural Intention=[Medium]	-.476	1.107	.667	-2.646	1.694
[Gender=Male]	-.084	.374	.823	-.817	.649
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	.146	1.641	.929	-3.070	3.363
[Age=25-34 years]	1.200	.681	.078	-.136	2.535
[Age=35–44 years]	.698	.663	.293	-.602	1.998
[Age=45–55 years]	.653	.696	.349	-.712	2.018
[Age=55 years and over]	0[a]	.	.	.	.

[Managerial level=Lower]	.592	.443	.182	-.277	1.461
[Managerial level=Middle]	.470	.397	.237	-.309	1.249
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.370	.598	.536	-1.542	.801
[Managerial experience=5–9 years]	.630	.662	.341	-.667	1.927
[Managerial experience=10–14 years]	-.169	.558	.762	-1.263	.924
[Managerial experience=15-19 years]	.044	.594	.942	-1.121	1.208
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	.307	.666	.645	-.998	1.612
[Geographical location=Urban Governorate]	.036	.699	.959	-1.335	1.407
[Geographical location=Rural Governorate]	.252	.843	.765	-1.400	1.905
[Geographical location=Village]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	-2.673	.427	**.000**	-3.509	-1.837
Facilitating Conditions=[Medium]	-1.156	.277	**.000**	-1.700	-.613
Facilitating Conditions=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

First round (B): Separate constructs to Use Behaviour (UB): A new round of ordinal regression analysis was conducted on constructs with socio-demographics variables to check if any of them would have influence on the Use Behaviour (UB) and results show as follows:

1. Performance Expectancy (PE)

Ordinal regression results showed that PE has no significance to the Use Behaviour. No observed significance of any moderators as was shown in Table 4.28.

Table 4.28: Ordinal regression for PE to UB

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-3.720	1.258	.003	-6.185	-1.255
Use Behaviour=[Medium]	-2.165	1.244	.082	-4.602	.272
[Gender=Male]	.018	.338	.958	-.645	.680
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-1.808	1.535	.239	-4.816	1.200
[Age=25-34 years]	-.173	.729	.812	-1.602	1.255
[Age=35–44 years]	.311	.729	.670	-1.118	1.740
[Age=45–55 years]	.087	.767	.910	-1.417	1.591
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	-.249	.476	.600	-1.182	.683
[Managerial level=Middle]	.114	.451	.801	-.770	.997
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.698	.714	.328	-2.098	.701
[Managerial experience=5–9 years]	-.409	.735	.578	-1.851	1.032
[Managerial experience=10–14 years]	-.806	.674	.232	-2.127	.515
[Managerial experience=15-19 years]	-.366	.717	.610	-1.770	1.039
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	-.392	.718	.585	-1.800	1.015
[Geographical location=Urban Governorate]	-.427	.751	.569	-1.900	1.045
[Geographical location=Rural Governorate]	-.362	.903	.689	-2.132	1.409
[Geographical location=Village]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-.022	.762	.977	-1.515	1.472
Performance Expectancy=[Medium]	-.683	.378	.071	-1.423	.057
Performance Expectancy=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

2. Effort Expectancy (EE)

Ordinal regression results showed that EE has no significance to the Use Behaviour. No observed significance of any moderators as was shown in Table 4.29.

Table 4.29: Ordinal regression for EE to UB

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-3.772	1.262	.003	-6.246	-1.299
Use Behaviour=[Medium]	-2.216	1.248	.076	-4.662	.230
[Gender=Male]	.033	.336	.921	-.624	.691
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-1.566	1.537	.308	-4.578	1.445
[Age=25-34 years]	-.233	.731	.750	-1.665	1.199
[Age=35–44 years]	.273	.732	.709	-1.162	1.708
[Age=45–55 years]	.035	.769	.963	-1.472	1.543
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	-.281	.475	.555	-1.212	.650
[Managerial level=Middle]	.078	.451	.863	-.806	.962
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.813	.710	.252	-2.205	.579
[Managerial experience=5–9 years]	-.487	.735	.508	-1.927	.954
[Managerial experience=10–14 years]	-.861	.673	.200	-2.179	.457
[Managerial experience=15-19 years]	-.402	.717	.575	-1.807	1.002
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	-.309	.713	.665	-1.706	1.088
[Geographical location=Urban Governorate]	-.336	.746	.652	-1.798	1.126

[Geographical location=Rural Governorate]	-.284	.896	.752	-2.040	1.473
[Geographical location=Village]	0[a]	.	.	.	.
Effort Expectancy=[Low]	.813	.743	.274	-.644	2.270
Effort Expectancy=[Medium]	-.467	.284	.100	-1.024	.089
Effort Expectancy=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

3. Social Influence (SI)

Ordinal regression results showed that SI has no significance to the Use Behaviour. No observed significance of any moderators as was shown in Table 4.30.

Table 4.30: Ordinal regression for SI to UB

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-3.563	1.254	.004	-6.021	-1.105
Use Behaviour=[Medium]	-2.015	1.241	.104	-4.446	.417
[Gender=Male]	.031	.337	.926	-.629	.691
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-1.974	1.563	.206	-5.036	1.089
[Age=25-34 years]	-.203	.732	.781	-1.637	1.231
[Age=35–44 years]	.305	.733	.678	-1.131	1.741
[Age=45–55 years]	.079	.770	.918	-1.430	1.588
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	-.270	.473	.569	-1.197	.658
[Managerial level=Middle]	.094	.448	.834	-.785	.973
[Managerial level=Top]	0[a]	.	.	.	.

[Managerial experience=Less than 5 years]	-.806	.711	.257	-2.200	.588
[Managerial experience=5–9 years]	-.375	.736	.610	-1.817	1.066
[Managerial experience=10–14 years]	-.807	.673	.230	-2.126	.512
[Managerial experience=15-19 years]	-.383	.715	.592	-1.785	1.019
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	-.212	.712	.766	-1.608	1.184
[Geographical location=Urban Governorate]	-.261	.745	.726	-1.721	1.199
[Geographical location=Rural Governorate]	-.114	.889	.898	-1.857	1.629
[Geographical location=Village]	0[a]	.	.	.	.
Social Influence=[Low]	.453	.579	.434	-.682	1.589
Social Influence=[Medium]	-.296	.271	.274	-.827	.235
Social Influence=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

4. Facilitating Conditions (FC)

Ordinal regression results showed that FC was of significance to the Use Behaviour (UB) [p=0.02 (medium group)], however, the low group and all socio-demographic moderators showed no significance as shown in Table 4.31.

Table 4.31: Ordinal regression for FC to UB

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-3.984	1.263	.002	-6.460	-1.509
Use Behaviour=[Medium]	-2.420	1.248	.052	-4.867	.026
[Gender=Male]	.070	.337	.835	-.590	.731
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-1.703	1.535	.267	-4.713	1.306
[Age=25-34 years]	-.245	.734	.738	-1.684	1.194
[Age=35–44 years]	.242	.734	.742	-1.197	1.682
[Age=45–55 years]	.025	.770	.974	-1.484	1.534
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	-.316	.477	.507	-1.251	.618
[Managerial level=Middle]	.099	.451	.826	-.784	.983
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.847	.714	.235	-2.247	.552
[Managerial experience=5–9 years]	-.470	.737	.523	-1.914	.973
[Managerial experience=10–14 years]	-.874	.675	.196	-2.198	.449
[Managerial experience=15-19 years]	-.305	.721	.672	-1.718	1.108
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	-.359	.712	.614	-1.755	1.036
[Geographical location=Urban Governorate]	-.362	.745	.627	-1.823	1.099
[Geographical location=Rural Governorate]	-.202	.894	.821	-1.955	1.551
[Geographical location=Village]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	.028	.493	.955	-.939	.995
Facilitating Conditions=[Medium]	-.595	.256	**.020**	-1.096	-.093
Facilitating Conditions=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

5. Behavioural Intention (BI)

Ordinal regression results showed that BI has no significance to the Use Behaviour. No observed significance of any moderators as was shown in Table 4.32.

Table 4.32: Ordinal regression for BI to UB

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-3.602	1.287	.005	-6.124	-1.081
Use Behaviour=[Medium]	-2.054	1.273	.107	-4.549	.442
[Gender=Male]	.047	.335	.889	-.609	.703
[Gender=Female]	0[a]	.	.	.	.
[Age=Under 25 years]	-1.744	1.534	.256	-4.751	1.263
[Age=25-34 years]	-.270	.734	.713	-1.709	1.168
[Age=35–44 years]	.204	.734	.781	-1.235	1.644
[Age=45–55 years]	-.061	.772	.937	-1.574	1.453
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	-.258	.475	.587	-1.189	.673
[Managerial level=Middle]	.122	.451	.786	-.762	1.006
[Managerial level=Top]	0[a]	.	.	.	.
[Managerial experience=Less than 5 years]	-.814	.712	.253	-2.209	.582
[Managerial experience=5–9 years]	-.408	.735	.579	-1.848	1.032
[Managerial experience=10–14 years]	-.856	.674	.204	-2.177	.464
[Managerial experience=15-19 years]	-.363	.717	.612	-1.768	1.042
[Managerial experience=20 years and above]	0[a]	.	.	.	.
[Geographical location=City]	-.279	.710	.695	-1.669	1.112
[Geographical location=Urban Governorate]	-.344	.744	.644	-1.803	1.115

[Geographical location=Rural Governorate]	-.250	.888	.778	-1.990	1.489
[Geographical location=Village]	0[a]	.	.	.	.
Behavioural Intention=[Low]	.748	.544	.169	-.318	1.813
Behavioural Intention=[Medium]	.077	.329	.814	-.567	.722
Behavioural Intention=[High]	0[a]	.	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

First round (C): Identified significant factors from first round (A) and (B) were tested against separate moderators and results revealed that only two moderators, age and managerial level, were of significance to moderate PE, and SI to influence Behavioural Intention as shown in Tables 4.33 and 4.34.

Table 4.33: PE, EE, Si, and FC to BI moderated by age

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-2.499	.647	.000	-3.768	-1.230
Behavioural Intention=[Medium]	-.604	.617	.328	-1.813	.605
[Age=Under 25 years]	1.735	1.814	.339	-1.821	5.291
[Age=25-34 years]	1.828	.664	**.006**	.526	3.129
[Age=35–44 years]	1.289	.647	**.047**	.020	2.557
[Age=45–55 years]	1.025	.677	.130	-.302	2.353
[Age=55 years and over]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-2.949	1.348	**.029**	-5.592	-.306
Performance Expectancy=[Medium]	-.863	.403	**.032**	-1.654	-.073
Performance Expectancy=[High]	0[a]	.	.	.	.
Effort Expectancy=[Low]	-.995	.830	.230	-2.621	.631
Effort Expectancy=[Medium]	-.516	.318	.104	-1.139	.106
Effort Expectancy=[High]	0[a]	.	.	.	.
Social Influence=[Low]	-2.076	.571	**.000**	-3.196	-.957
Social Influence=[Medium]	-.573	.310	.064	-1.180	.034
Social Influence=[High]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	-.434	.564	.442	-1.539	.671
Facilitating Conditions=[Medium]	-.475	.310	.125	-1.083	.132
Facilitating Conditions=[High]	0[a]	.	.	.	.

Dependent variable (BI). Independent variables (PE, EE, SI, and FC)
a. This parameter is set to zero because it is redundant

Table 4.34: PE, EE, Si, and FC to BI moderated by managerial level

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-2.985	.430	.000	-3.827	-2.143
Behavioural Intention=[Medium]	-1.109	.378	.003	-1.850	-.368
[Managerial level=Lower]	.952	.421	**.024**	.128	1.777
[Managerial level=Middle]	.919	.384	**.017**	.167	1.672
[Managerial level=Top]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-3.025	1.347	**.025**	-5.665	-.385
Performance Expectancy=[Medium]	-.852	.395	**.031**	-1.627	-.077
Performance Expectancy=[High]	0[a]	.	.	.	.
Effort Expectancy=[Low]	-.961	.811	.236	-2.551	.630
Effort Expectancy=[Medium]	-.464	.316	.142	-1.083	.156
Effort Expectancy=[High]	0[a]	.	.	.	.
Social Influence=[Low]	-1.998	.556	**.000**	-3.088	-.908
Social Influence=[Medium]	-.519	.304	.088	-1.116	.078
Social Influence=[High]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	-.362	.570	.525	-1.479	.755
Facilitating Conditions=[Medium]	-.445	.309	.150	-1.051	.160
Facilitating Conditions=[High]	0[a]	.	.	.	.

Dependent variable (BI). Independent variables (PE, EE, SI, and FC)
b. This parameter is set to zero because it is redundant

At the end of the first regression analysis round, a modified version of the UTAUT model was formed as shown in Figure 4.9. However, in consultation with a Chartered Statistician, a second round was recommended to give a holistic view of all constructs confirmed significant.

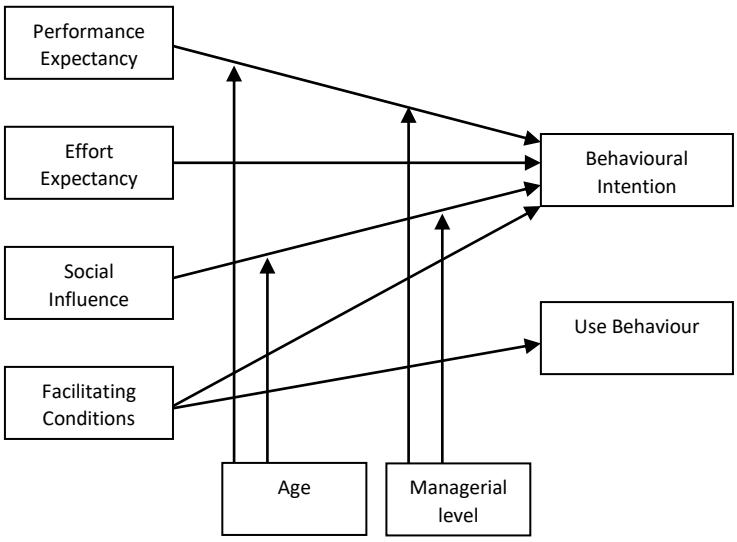


Figure 4.9: A modified version of the UTAUT model (Round one)

Second round (A): PE, EE, SI, and FC to Behavioural Intention (BI): An holistic view of the regression analysis results of significant constructs in round one showed that only two constructs, SI and PE, moderated by age were of significance to the Behavioural Intention (BI). Performance Expectancy (PE) which showed significance [p=0.034 (low group) and p=0.028 (medium group)] and Social Influence (SI) showed significance as [p<=0.05 (low group) only] as shown in Table 4.35.

Table 4.35: PE, EE, Si, and FC to BI moderated by age and managerial level

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-1.983	.704	.005	-3.362	-.603
Behavioural Intention=[Medium]	-.079	.681	.907	-1.414	1.256
[Age=Under 25 years]	1.582	1.826	.386	-1.996	5.161
[Age=25-34 years]	1.669	.676	**.014**	.345	2.993
[Age=35–44 years]	1.187	.656	.070	-.099	2.472
[Age=45–55 years]	.992	.684	.147	-.349	2.333
[Age=55 years and over]	0[a]	.	.	.	.
[Managerial level=Lower]	.718	.439	.102	-.142	1.578
[Managerial level=Middle]	.709	.397	.074	-.069	1.486
[Managerial level=Top]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-2.877	1.354	**.034**	-5.531	-.222
Performance Expectancy=[Medium]	-.890	.405	**.028**	-1.684	-.096
Performance Expectancy=[High]	0[a]	.	.	.	.
Effort Expectancy=[Low]	-1.056	.831	.204	-2.685	.572
Effort Expectancy=[Medium]	-.515	.320	.108	-1.142	.113
Effort Expectancy=[High]	0[a]	.	.	.	.
Social Influence=[Low]	-2.155	.574	**.000**	-3.281	-1.030
Social Influence=[Medium]	-.597	.311	.055	-1.208	.013
Social Influence=[High]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	-.381	.576	.508	-1.510	.748
Facilitating Conditions=[Medium]	-.441	.313	.158	-1.054	.172
Facilitating Conditions=[High]	0[a]	.	.	.	.

Dependent variable (BI). Independent variables (PE, EE, SI, and FC)
c. This parameter is set to zero because it is redundant

Second round (B): FC to Use Behaviour (UB): The results of the ordinal regression of actual Use Behaviour (UB) showed Facilitating Conditions (FC) was a significant construct to influence the actual use of eHealth services in KSA from a health manager's perspectives. The medium group also showed significance (n=162, p=0.047). However, the low group showed no significance. This can be attributed to the small number of the sample in the FC low group (n=31) when compared to the high group (n=192) (Table 4.36).

Table 4.36: Ordinal regression analysis for the Use Behaviour (UB)

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-2.886	.248	.000	-3.372	-2.400
Use Behaviour=[Medium]	-1.352	.178	.000	-1.702	-1.003
Facilitating Conditions =[Low]	.014	.478	.976	-.923	.952
Facilitating Conditions =[Medium]	-.481	.246	**.047**	-.964	.001
Facilitating Conditions =[High]	0[a]	.	.	.	.

Dependent variable (UB). Independent variable (FC)
a. This parameter is set to zero because it is redundant

Round two holistic ordinal regression analysis resulted in a new modified version of the UTAUT model which is a combination of two separated parts (Figure 4.10). In order to find a potential link, round three of analysis was conducted.

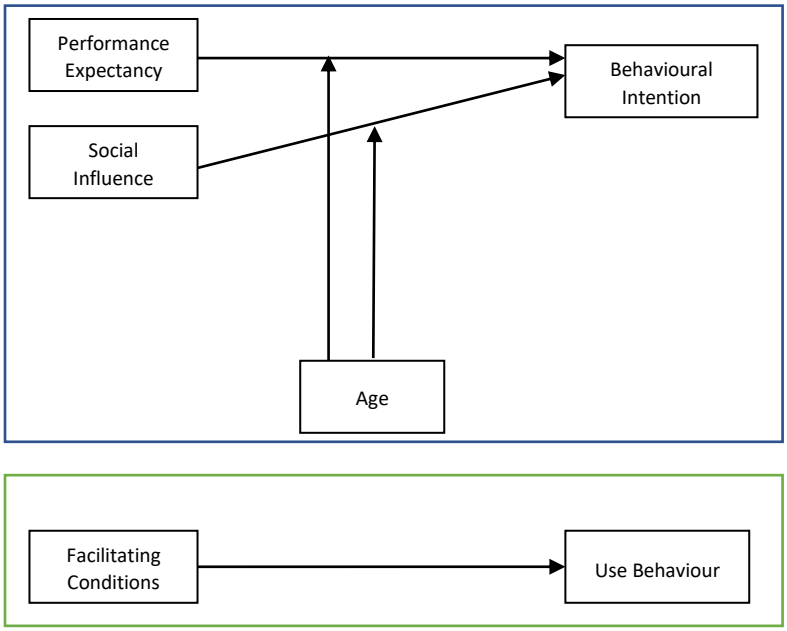


Figure 4.10: A new modified version of UTAUT (Round two)

Third round (A): Identified significant constructs (PE, SI, and FC) to Behavioural Intention (BI): Ordinal regression analysis results confirmed the significance of Performance Expectancy (PE) and Social Influence (SI) moderated by age at the following significance levels:

PE: [p=0.002 (low group) and p=0.007 (medium group)].
SI: [p<=0.05 (low group) and p=0.032 (medium group)].

Facilitating Conditions were confirmed as not significant to Behavioural Intention as shown in Table 4.37.

Table 4.37: Ordinal regression analysis for PE, SI, and FC to Behavioural Intention (BI)

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Behavioural Intention=[Low]	-2.451	.644	.000	-3.713	-1.189
Behavioural Intention=[Medium]	-.578	.614	.347	-1.782	.626
[Age=Under 25 years]	1.457	1.753	.406	-1.980	4.893
[Age=25-34 years]	1.786	.660	**.007**	.492	3.080
[Age=35–44 years]	1.281	.644	**.047**	.018	2.544
[Age=45–55 years]	1.015	.675	.132	-.307	2.338
[Age=55 years and over]	0[a]	.	.	.	.
Performance Expectancy=[Low]	-3.579	1.181	**.002**	-5.894	-1.265
Performance Expectancy=[Medium]	-1.042	.389	**.007**	-1.804	-.279
Performance Expectancy=[High]	0[a]	.	.	.	.
Social Influence=[Low]	-2.123	.567	**.000**	-3.234	-1.012
Social Influence=[Medium]	-.654	.305	**.032**	-1.253	-.055
Social Influence=[High]	0[a]	.	.	.	.
Facilitating Conditions=[Low]	-.713	.531	.180	-1.754	.329
Facilitating Conditions=[Medium]	-.561	.304	.065	-1.158	.035
Facilitating Conditions=[High]	0[a]	.	.	.	.

Dependent variable (BI). Independent variables (PE, SI, and FC)
d. This parameter is set to zero because it is redundant

Third round (B): Identified significant constructs (PE and SI) to Use Behaviour (UB): A new round was conducted on Use Behaviour revealed that PE is significant to Use Behaviour (UB) at: [p<=0.044 (medium group) only]. SI showed no significance as shown in Table 4.38.

Table 4.38: Ordinal regression analysis for PE and SI to Use Behaviour (UB)

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-2.786	.228	.000	-3.233	-2.339
Use Behaviour=[Medium]	-1.246	.150	.000	-1.539	-.953
Performance Expectancy=[Low]	-.741	.963	.441	-2.628	1.146
Performance Expectancy=[Medium]	-.779	.387	**.044**	-1.537	-.021
Performance Expectancy=[High]	0[a]	.	.	.	.
Social Influence=[Low]	.872	.735	.235	-.568	2.313
Social Influence=[Medium]	-.192	.271	.479	-.723	.339
Social Influence=[High]	0[a]	.	.	.	.

Dependent variable (UB). Independent variables (PE and SI)
e. This parameter is set to zero because it is redundant

To confirm the significance of PE to Use Behaviour (UB), a final step of analysing separately the PE to UB was conducted which confirmed the significance of PE to UB as shown in Table 4.39.

Table 4.39: Ordinal regression analysis for PE to Use Behaviour (UB)

Construct	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Use Behaviour=[Low]	-2.752	.215	.000	-3.172	-2.331
Use Behaviour=[Medium]	-1.217	.129	.000	-1.470	-.964
Performance Expectancy=[Low]	.107	.747	.887	-1.358	1.571
Performance Expectancy=[Medium]	-.738	.368	**.045**	-1.459	-.017
Performance Expectancy=[High]	0[a]	.	.	.	.

Dependent variable (UB). Independent variable (PE)
f. This parameter is set to zero because it is redundant

After the three rounds of ordinal regression analysis, the following constructs were confirmed significant:

- Performance Expectancy (PE) and Social Influence (SI) to influence Behavioural Intention (BI) moderated by age.
- Performance Expectancy (PE) and Facilitating Conditions (FC) to influence Use Behaviour (UB).

Final modified UTAUT model based on health managers acceptance of eHealth in KSA was built accordingly (Figure 4.11).

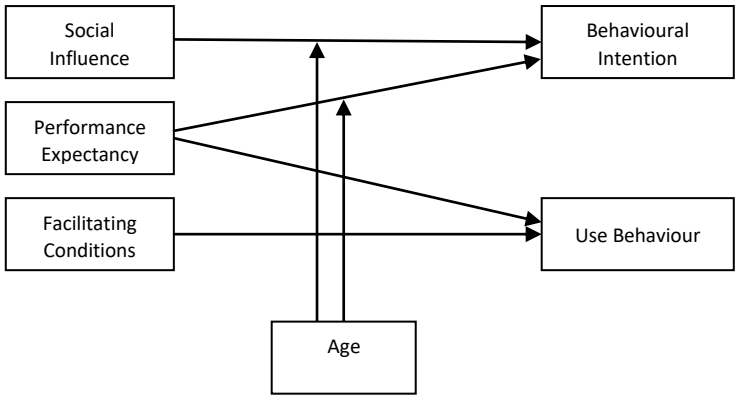


Figure 4.11: Final modified version of UTAUT

4.4 Discussion

4.4.1 Key findings

The UTAUT model was used as a theoretical framework to explain which factors are most influential for both Behavioural Intention and technology Use Behaviour (Venkatesh et al. 2003). The findings from this study demonstrate that all identified groups of themes of factors were of potential significance for health managers. Alaboudi et al (2016) examined the main barriers and challenges in the Saudi Telemedicine Network (STN) from the perspectives of health decision makers. Healthcare facility sector, type, and location were found to be the main moderators (Alaboudi et al. 2016). However, in this current study, three different dimensions were explored within the Saudi Arabian healthcare context which were gender, managerial level, and managerial experience. The identified themes were clustered against the UTAUT constructs prior to conducting the SPSS analysis. This procedure was consistent with a study conducted on healthcare providers' adoption of eHealth (Li et al. 2013).

The analysis showed significance of Social Influence (SI) which encapsulates factors such as management support, change resistance by some professionals, and stakeholders' voice which can play a crucial role in acceptance of technology as part of daily work. The more participants perceived management and colleagues were supportive, the higher the Behavioural Intention (BI) to utilise eHealth services. These conclusions have been found in studies conducted in the KSA health context with different stakeholder groups such as health professionals, health IT professionals, and health managers (El-Mahalli et al. 2012, Aldosari 2014, Alasmary et al. 2014, Alsulame et al. 2015, Alaboudi et al. 2016, and Alfarra 2016).

Performance Expectancy (PE) has also been shown to be of significance to the Behavioural Intention (BI) which confirms the importance of benefits that technology can bring to the job performance such as the privacy and connectivity of health information. Again, the more participants perceived help and encouragement to be available and the potential for perceived benefits, the higher the Behavioural Intention (BI) to utilise eHealth services. This showed consistency

with the findings from several studies (Li et al. 2013, El-Mahalli 2015, El Mahalli 2016, Jamal et al. 2016, and Hennemann et al. 2017).

Facilitating conditions (FC) showed significance to the actual Use Behaviour (UB). This demonstrated that existence of infrastructure, availability of financial support, knowledge support base, and related resources, are all of significance to influence health managers actual use of technology as was concluded in other studies (El-Mahalli 2012, Moen et al. 2013, Hasanain and Cooper 2014, Alaboudi et al. 2016, Uluc and Ferman 2016, Ariens et al. 2017, and Zaman et al. 2018). Some FC non-significant results were justified, however, further investigation is suggested to confirm or deny the ambiguity of significance of the FC.

Performance Expectancy (PE) also showed significance to the actual Use Behaviour (UB). Some PE non-significance results also indicate further research is required. One moderator showed significance, age, which has been shown in some studies to lead to technology acceptance resistance (Bah et al. 2011, Aldosari 2014, Alasmary et al. 2014, and Hossain et al. 2019) as age increases.

The explained findings from the three rounds that took place in a sequence meaning will inform further work in the next phase of this research.

Overall findings from this study draw a holistic, multi-factorial image of challenges facing eHealth acceptance in KSA from the perspectives of health managers. This is specifically of importance to health decision- and policymakers to map out the directions of technology acceptance in the healthcare sector in KSA in order to prioritise the main areas for eHealth improvement to support delivery of healthcare services.

4.4.2 Strengths and limitations

Strengths of this study include utilising a technology acceptance model such as UTAUT to explain the results in a meaningful way. This model having been utilised in explaining up to 70% of variance in technology acceptance in many key areas such as academia, business, government services, commerce and healthcare. Its impact on studying the field of behavioural intentions of individuals was globally recognised in different geographical settings. However, despite UTAUT being

widely used in identifying the likelihood to influence technology acceptance, there is no consensus on a standard model of the theory. There are studies that used fewer constructs of the original theory. Some other studies added new external constructs, and many other studies did not include the core moderators of the UTAUT model.

Thus, there is still a need to carry out more research investigating whether adding external constructs to the theory, reducing the current constructs, or modifying the moderators could make a difference to the overall picture the theory is trying to explain. This conclusion was recommended in a study conducted by Williams et al (2011). Another strength is that the study was conducted and reviewed by a multidisciplinary team with different levels of experience and skills, which has enriched the outcomes. However, like every study, there were some limitations. One of the limitations is that the study focused on investigating only the eHealth acceptance from the perspectives of health managers. Other health profession groups were not included and, therefore, we suggest applying caution on generalising the results as they do not represent KSA health workforce in general. Another limitation is that the data were only collected by one method which was an online questionnaire due to the purpose of the study and the resource limitations. The time spent in data collection and analysis was long due to the need to recruit as many participants as possible to reach a representative sample of the target population (two months for data collection and several months for data analysis). Finally, some difficulty in performing statistical analysis was faced as I come from professional background with no experience in complex statistics, therefore, the advice and expertise of a Chartered Statistician was required.

4.5 Summary of the chapter

This study has highlighted the main determinants that influence health managers' acceptance of eHealth services in KSA. The Unified Theory of Acceptance and Use of Technology (UTAUT) was adopted as a theoretical framework in this study as one of the widely used technology acceptance models. The themes of factors that were confirmed of significance mapped to the UTAUT constructs. Statistical analysis showed clear significance for two constructs, Social Influence (SI) and Performance Expectancy (PE) to the Behavioural Intention (BI) moderated by age,

as well as Facilitating Conditions (FC) and Performance Expectancy (PE) to the Use Behaviour (UB). However, the significance of the FC and PE were ambiguous and, thus, needs further investigation in the future studies. Effort Expectancy (EE) and BI showed no significance. The limitations of the study have suggested new research projects such as developing UTAUT through adding new constructs and adopt new moderators that meet the research objectives.

4.6 Implications on the next phase of the research

As mentioned in the limitations that data were collected by only one method, a mixed method would provide a better option to compare and confirm findings. Thus, findings from the quantitative study presented in this chapter informed a qualitative extension to this programme of research. The next phase was planned to be a qualitative based methodology to explore identified factors in more depth with key health managers in Aseer Province, KSA.

CHAPTER 5: QUALITATIVE INTERVIEWS OF FACTORS INFLUENCING EHEALTH SERVICES ACCEPTANCE: VIEWS OF HEALTH MANAGERS IN ASEER PROVINCE, KINGDOM OF SAUDI ARABIA

5.1 Introduction

In the systematic review (chapter 3), only two qualitative studies were found to meet the inclusion and exclusion criteria of conducting this study (Alsulame et al. 2015 and Alfarra 2016). Alsulame et al (2015) employed semi-structured interviews and targeted senior health information professionals. Alfarra (2016) used semi-structured interviews and focus groups with a mixed targeted population including middle and senior managers.

Both studies concluded that eHealth can bring a wide range of benefits such as:

- Improved communication flow between patients and healthcare providers
- Increased patient safety
- Facilitation of communication with external healthcare providers
- Easier access to patient's information

In addition, key challenges of utilising technology in healthcare settings were raised such as:

- Organisational and behavioural
- Technological and professional
- Privacy and confidentiality
- Attitude toward using eHealth
- Quality of healthcare services

In the quantitative survey phase (chapter 4), these key challenges identified in the systematic review (chapter 3) were investigated as potential factors that may influence health managers acceptance of eHealth services in the KSA. Findings showed that all of the factors were of significance with additional factors identified. And, thus, a qualitative extension was recommended to explore the factors in-depth to triangulate findings adding trustworthiness to the generalisability of the survey findings.

In this chapter, health managers' views of the acceptance of eHealth in Aseer Province, KSA will be explored. This chapter will present the study aim and research questions, methods for conducting this phase, and overall findings.

5.1.1 Study aim and questions

The aim of this phase of the study was to explore the views of health managers in Aseer Province towards factors that influence health managers' acceptance of eHealth services in the KSA.

This phase was designed to answer the following three research questions:

1. What do health managers in Aseer Province know about eHealth services in the KSA?

2. What advantages do health managers in Aseer Province think that eHealth services can bring to healthcare system in the KSA?

3. What factors do health managers in Aseer Province think are of significance to influence the acceptance of eHealth services in the KSA?

5.2 Methods

5.2.1 Study Design

In this phase, and for the given aim, a qualitative phenomenological methodology was adopted. This methodology was considered appropriate to provide in-depth and rich information from the views and experiences of health managers towards eHealth services in Aseer Province, KSA.

As per described in chapter 2, a phenomenological approach aims to discover lived experiences of individuals in order to provide an understanding of the phenomenon under investigation (Creswell 2016).

Both face-to-face and telephone semi-structured interviews were employed to reach participants across the province. This was the most practical method of data

generation in consideration of the job responsibility level of the targeted population (health managers) and geographical spread. Open-ended questions allow participants to express freely and openly their views about factors that have been found to be influential to eHealth services acceptance in the SR (chapter 3) and survey (chapter 4).

5.2.2 Ethical considerations

As explained in chapter 2, ethical approval to conduct the study was gained from both the Ethical Review Panel, School of Pharmacy and Life Sciences, Robert Gordon University, Aberdeen, UK with reference number: S72, 2017 and the Ethics Committee, Ministry of Health (MOH), KSA with an approval code IRB 18-259E.

All potential participants were provided with an information sheet and returned a signed participant consent form prior to conduct of the interviews (see Appendix 5.1 and 5.2). All study materials including audio-recordings and transcripts of the interviews were stored in accordance with the School of Pharmacy and Life Sciences standard operating procedures which reference Robert Gordon University Research Governance policies. In addition, all participants were assured that their confidentiality, anonymity and any personal information that could identify them will be strictly protected before, during and after the research life cycle and the access to this information will be restricted to the principal investigator and the research supervisory team.

5.2.3 Study setting

This part of the doctoral research was conducted within Aseer province, KSA. Geographically KSA has five regions, Eastern, Western, Northern, Southern, and Central. These five regions are comprised of thirteen provinces. Aseer province is located in the southern region of the country.

Aseer province was selected for the following reasons:

1. Phase one of this study (SR) showed that most of eHealth research in the country was conducted in only three provinces, Riyadh province, Makkah province, and Eastern province. It was recommended to extend the eHealth research into other provinces, such as Aseer, in order to be able to give a more holistic picture of eHealth practice countrywide.

2. Health services provided by the MOH facilities in Aseer province encompasses 20 hospitals with total bed capacity of 2408 bed (Table 5.1), 254 primary healthcare centres (PHCCs) and staffed by 12,283 health professionals as well as hundreds of administrative assistants (Statistics Yearbook, MOH, KSA 2018). Sampling from this number of facilities and professionals can provide rich data from the perspectives of health managers which may potentially be transferable to other provinces in KSA.

3. The principal investigator lives and has worked in Aseer and is familiar with healthcare system in the province. Conducting the study in the MOH facilities in Aseer makes best use of existing network of contacts and limited resources.

Figure 5.1 shows the map of KSA. The four provinces, Riyadh, Makkah, Eastern, and Aseer are highlighted in the map.

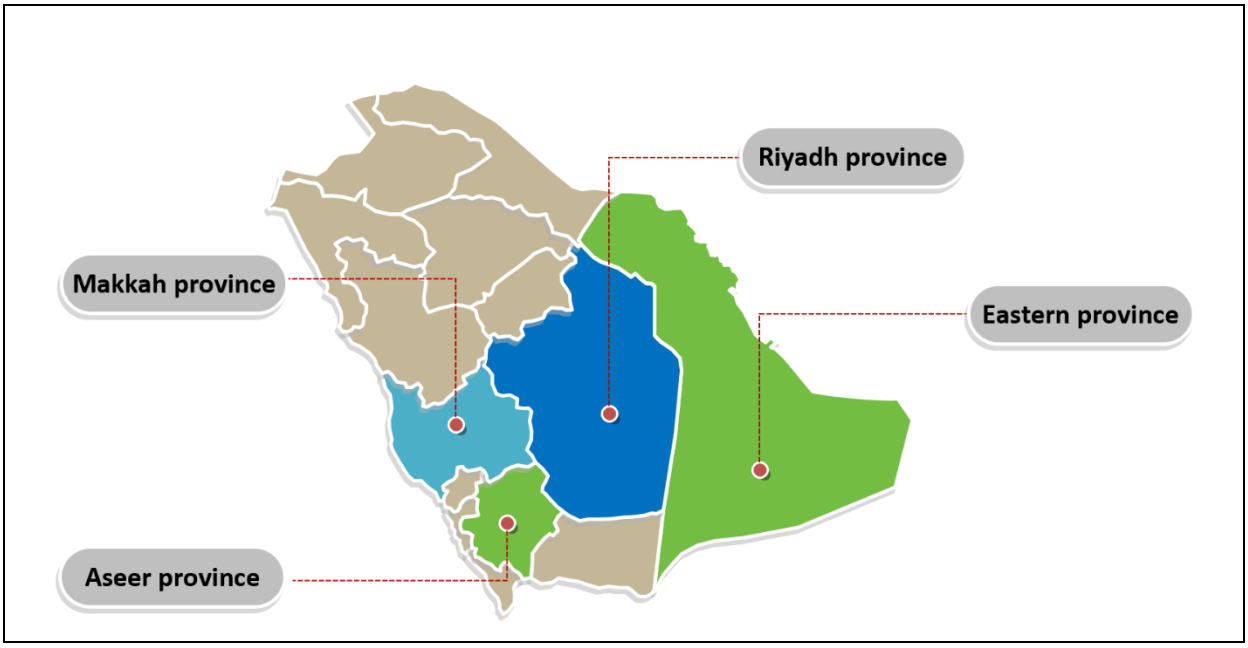


Figure 5.1: Map of the Kingdom of Saudi Arabia

Table 5.1: MOH hospitals in Aseer province, KSA. Source: Statistics Yearbook, MOH, KSA (2018)

Number	Hospital	Bed capacity
1	Aseer Central Hospital	465
2	Abha Maternity and Children Hospital	240
3	Khamis Mushaiyt Maternity and Children Hospital	200
4	Mahayl General Hospital	170
5	Khamis Mushaiyt General Hospital	150
6	Abha Psychiatric Hospital	123
7	Sarat Abidah General Hospital	110
8	Dhahran Aljanoub General Hospital	100
9	Ballasmar General Hospital	100
10	Alnamas General Hospital	100
11	Rejal Almaa General Hospital	100
12	Almajardah General Hospital	100
13	Ahad Rufaidah General Hospital	100
14	Alharajah General Hospital	50
15	Alfarshah General Hospital	50
16	Alberk General Hospital	50
17	Alqahmah General Hospital	50
18	Tanoumah General Hospital	50
19	Ballahmar General Hospital	50
20	Almadah General Hospital	50

5.2.4 Interview guide development

The initial draft of interview questions was informed by the findings from the two previous phases, SR (chapter 3) and survey (chapter 4). The draft was framed with relation to the study overall aim and objectives. Questions were to focus on the eHealth knowledge, eHealth services availability, easiness of using eHealth services, challenges and barriers to using eHealth, eHealth benefits, resource availability, training requirements, and factors that are of importance from the participants' perspective. The draft of questions was built by the principal investigator in English and reviewed for credibility by a member of the research team. Face and content validity of the questions were tested by two external health

managers who work for the Ministry of Health, KSA. Minor wording changes and combining some questions were suggested prior to confirming the final interview guide. The study information sheet, participation consent form, and interview questions were translated into Arabic language by the principal investigator. Translation was then checked for accuracy by an independent health professional.

5.2.5 Inclusion and exclusion criteria

Inclusion: All professionals from multiple disciplines such as health professions, Information Technology (IT), and administration that work for MOH healthcare facilities in Aseer province were eligible to participate if involved in a managerial role. Exclusion: Professionals that work for other healthcare providers such as the private sector.

5.2.6 Sampling and recruitment of participants

The survey conducted in Chapter 4 included an invitation to participate in a follow on interview. Of the 66 participants who indicated their interest, 37 met the inclusion criteria so were eligible for further contact.

Purposive sampling techniques have been employed in qualitative research for many years (Godambe 1982). It is one of the non-probability sampling techniques. Tongco (2007) defined it as a "deliberate choice of an informant due to the qualities the informant possesses" (Tongco 2007). This technique was selected in this study for best answering the study questions by generating rich information of the views and lived experiences of a range of participants.

In order to consider population characteristics, five stratification elements were employed upon selecting participants:

1. Gender (male or female)
2. Managerial level (top, middle, or lower)
3. Healthcare settings (hospital, primary healthcare centre, or others such as regional health directorate office)
4. Geographical location (urban and rural)
5. Professional background (health profession, IT, administration)

Qualitative studies are based on smaller numbers of participants than quantitative studies which aim for generalisability based on statistical probability. In contrast, qualitative studies are about richness of data, capturing life experiences and range of perspectives and views. The initial agreed number of participants by the research team was 15 participants (5 participants for every managerial level or 5 participants for every professional background). However, the stopping point in recruiting further participants in phenomenological studies is usually determined by approaching the saturation point, which means, to continue sampling until no new themes are emerging.

In this study, recruiting participants was done in three steps:

1. Potential participants from the survey who expressed interest in taking part and met the inclusion criteria were contacted. Those who responded were provided with the study information sheet and participation consent form in their preferred language (English or Arabic)

2. From the principal investigator's previous work experience, other groups of professionals who held key positions were thought to have relevant experience, perhaps with a different perspective, that is of importance to enrichen the topic of discussion and, thus, were invited to take part and provided with the study information sheet and participation consent form

3. Those who returned a signed participation consent form were contacted to set up a suitable date, time, and location for the interview.

Two pilot interviews were conducted (first was with a health manager from an IT background and the second with a health manager from a health profession background). Although one of the main reasons to conduct this pilot study was to estimate an approximate duration of the interview, other reasons for conducting a pilot were proposed by Kim (2011):

1. To provide an opportunity to clarify questions and plan any necessary adjustments
2. To evaluate the readiness of the researcher to conduct interviews

Pilot interviews concluded that the questions were well understood, however, it was suggested to start the interview by giving an oral overview of previous findings of the study before starting the audio-recording session. Duration for interview was estimated at around 30 minutes.

5.2.7 Data generation

All interviews were conducted by the principal investigator in both Arabic and English languages. With prior permission, all interviews were audio-recorded. Interview duration ranged between 22 minutes and 50 minutes. Each interview was transcribed in a separate Microsoft Word document. Those interviewees who requested to review their transcripts, known as member checking, were emailed their transcript and asked to make any amendments using Tracked Changes before returning. A member of the research team verified the quality of two interviews focusing on: the interviewer's skills in conducting an interview and the accuracy of transcription.

5.2.8 Data analysis

As described in chapter 2, five stages of qualitative data analysis proposed by Pope et al (2000) were followed. A Microsoft Excel document was created with separate rows for interviewees responses and separate column for initial themes. NVivo was used in the analysis procedures.

First stage: Familiarisation: Done independently by the principal investigator as it involved listening carefully to the audio-recorded interviews, reading transcripts thoroughly, and highlighting key ideas and themes.

Second stage: Themes identification: All themes were set deductively from the quantitative phase. Four preset umbrella domains were based on the four constructs of UTAUT (Please refer to figure 4.1):

Domain 1: Performance Expectancy

Domain 2: Effort Expectancy

Domain 3: Social Influence

Domain 4: Facilitating Conditions

Seventeen themes identified (Chapter 4) were pre-defined. One additional theme was added to the list of themes and later mapped against the related domain.

Third stage: Indexing: All potential extracts representative of the theme in the transcripts were indexed and highlighted in colors. If the texts encompassed more than one potential theme, a short comment was added to notice that this issue contains double coding.

Fourth stage: Charting: All texts related to a specific theme were placed together in a separate sheet for further analysis.

Fifth stage: Mapping and Interpretation: All theme-related texts were mapped against the pre-defined themes. Quotes that best represent themes were selected. Translation of quotes from Arabic to English was done by the principal investigator. Back-translation was performed by an independent researcher. After translation, all analysis steps including selecting best representative quotes were discussed between AA and KM to promote data credibility. Full data analysis report with interpretation was presented.

5.2.9 Trustworthiness of the study

As explained in chapter 2, trustworthiness in qualitative research can be achieved by addressing four criteria: credibility, transferability, dependability, and confirmability as proposed by Guba (1996).

- **Credibility**: Several steps were taken to reduce the following types of bias:
    i. The principal investigator attended training sessions on qualitative research, qualitative analysis tools, and reseach ethics (design bias)
    ii. Analysis steps were discussed between the principal investigator and research team (interviewer bias)
    iii. Sampling selection and recruitment of participants was done through systematic steps (sampling bias)
    iv. Interview transcripts were shown to those participants who requested to review and comment on their responses (reporting bias)

- **Transferability:** Selecting Aseer province as a study setting and MOH healthcare facilities as a study context were described and justified to promote the transferability of the findings.

- **Dependability:** Analysis procedures were checked by an experienced qualitative researcher who is part of the research team to ensure all steps taken fell within the approved plan.

- **Confirmability:** Although data in this qualitative phase were collected from health managers' perspectives, the variety of participants professional backgrounds and managerial level, as well as the bias reduction steps taken, have contributed to the richness and confirmability of the findings.

5.3 Results

5.3.1 Interviewee profiles

All interviews took place between December 2018 and January 2019. Twenty-nine participants agreed to participate. Data saturation point was reached after conducting twenty-one interviews. Table 5.2 shows the profile of the interviewees. Table 5.3 displays their characteristics for the stratification consideration.

Table 5.2: Profile of the interviewees

No.	Code	Managerial level	Managerial experience (in years)	Professional background
1	T1	Middle	6-10	IT
2	H1	Middle	1-5	Health profession
3	M1	Middle	11-15	Administration
4	H2	Middle	1-5	Health profession
5	H3	Middle	1-5	Health profession
6	T2	Middle	1-5	IT
7	H4	Lower	6-10	Health profession
8	H5	Lower	6-10	Health profession
9	H6	Middle	1-5	Health profession
10	H7	Lower	11-15	Health profession
11	H8	Lower	1-5	Health profession
12	M2	Middle	11-15	Administration
13	H9	Lower	6-10	Health profession
14	H10	Top	6-10	Health profession
15	T3	Top	1-5	IT
16	M3	Top	16-20	Administration
17	T4	Middle	1-5	IT
18	H11	Middle	11-15	Health profession
19	M4	Middle	1-5	Administration
20	T5	Middle	1-5	IT
21	M5	Top	6-10	Administration

Table 5.3: Interviewee characteristics

Characteristics/participant		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Gender	Male	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Female				✓			✓														
Managerial level																						
	Top												✓		✓	✓	✓					✓
	Middle	✓	✓	✓	✓	✓				✓								✓	✓	✓	✓	
	Lower						✓	✓	✓		✓	✓		✓								
Healthcare setting																						
	Hospital	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓				✓
	PHCC																		✓	✓		
	Other												✓	✓	✓	✓					✓	
Geographical location																						
	Urban	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓
	Rural																✓	✓	✓	✓		
Professional background																						
	Health professional		✓		✓	✓		✓	✓	✓	✓	✓		✓	✓				✓			
	IT	✓					✓									✓		✓			✓	
	Administration			✓									✓				✓			✓		✓

5.3.2 Thematic analysis

Eighteen themes were identified from the interview data. Of which, seventeen themes were pre-defined from the quantitative phase (Chapter 4) mapped against domains as shown in Table 5.4 with one new theme, 'eHealth benefits' was added under the Performance Expectancy domain.

Table 5.4: Domains and themes

Domains	Themes
Performance Expectancy	• eHealth benefits • Privacy, confidentiality, and security of health information • Connectivity of information systems • Customisability of systems functions according to users' needs • Willingness to utilise technology
Effort Expectancy	• Complexity of technology
Social Influence	• Stakeholders' voice upon planning and feedback on preferences • Uncooperative behaviour and resistance to change
Facilitating Conditions	• Availability of information and knowledge about eHealth services • Government legislation and constraints • Educational factors • Availability of operational resources • Organisational factors • Financial factors • Technical ability and work experience • Quality of eHealth systems and applications • Availability of adequate qualified human resources • ICT infrastructure and readiness

5.3.2.1 Domain 1: Performance Expectancy

As mentioned in chapter 2, Performance Expectancy means "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al. 2003). Five themes were agreed by AA and KM to be relevant to this domain; eHealth benefits; Privacy, confidentiality, and security of health information; Connectivity of information systems; Customisability of systems functions according to users' needs; and Willingness to utilise technology.

a) eHealth benefits

This theme refers to the perceived usefulness that helps individuals to accomplish their work. Health managers in Aseer province commented on benefits that eHealth could bring to their daily job. EHealth was thought to be beneficial in terms of saving time and effort for both staff and patients,

"It makes life easy, it is confidential and trustable. I don't need to run all over the hospital looking for old files, or going to the lab taking previous results or duplicate tests that have already been done. I can find all information I need electronically without leaving my room and while sitting on my chair"

H2, Health manager (Health profession background)

"On a personal level, electronic services save my time and help me get what I am looking for faster"

H6, Health manager (Health profession background)

"Electronic services bring many benefits, including easy delivery of health services, reduce waiting time for patients, and save professionals time"

T1, Health manager (IT background)

A health manager hoped to give patients access to their information,

"Some patients come from long distance to request a medical report or to inquire about their lab tests results. We hope that patients could have an access to their information through an application or system without leaving home"

H1, Health manager (Health profession background)

Some useful applications were reported to be beneficial in overcoming the delivery of health services without leaving home,

"Patients can make appointments or request medical consultation through Sehha Application. They can also make complaints to the direct consultation number 937. All of this can be done remotely without the need to come to the hospital"

H4, Health manager (Health profession background)

eHealth was widely reported to promote the quality of health services and save resources,

"eHealth helps to provide high quality care. Fast and safe. It also saves resources, as said, we can go green and be paperless. eHealth role is substantial in shaping the future of health care in the Kingdom in terms of improving the quality and delivery of services provided"

H3, Health manager (Health profession background)

"It enhances the quality of services by providing direct and easy access to patient information such as Lab results and X-rays. It can also reduce the financial burden on health institutions"

M5, Health manager (Administration background)

"The most important benefit from my point of view is producing performance reports. Electronic services make easy to measure performance and track achievements"

T1, Health manager (IT background)

"What we observed in the past few years is that electronic systems helped us to determine where we stand, what we need and where we want to go"

H7, Health manager (Health profession background)

"On the organisational level, it saves resources and reduces spend on disposables such as paper. It also helps to exchange patient's information faster when needed and thus we can say that patients get the most use of these services"

H6, Health manager (Health profession background)

eHealth can inform decision makers and support patient safety,

"eHealth is very helpful for decision makers upon planning process. Decision makers need accurate information. Reliance on paper reports may not be the right thing. They are not as accurate as electronic ones"

T3, Health manager (IT background)

"You can control the dispensing of medications, prevent wastage, and exclude human error. A long time ago, prescriptions were written by hand, and there was the possibility of dispensing medication by mistake. Now, with electronic prescriptions, the name of the drug, doses, and patient information have become clear"

T2, Health manager (IT background)

b) Privacy, confidentiality, and security of health information

Privacy, confidentiality, and security are major concepts of protection in which access to personal information are controlled. Confidentiality of patient's information is important and should be given priority. Some health managers were concerned about this issue,

"The easy accessibility to the eHealth system by healthcare workers is one of the main issues for me especially in our culture where people are curious to know everything about others. It is very important to me to keep my patients information very confidential. For example, the access to patients information should be restricted especially patients with infectious diseases such as HIV"

H2, Health manager (Health profession background)

"You cannot persuade the patient of the importance of eHealth services until he is convinced that his information is kept safe. When he trusts that the information will only be seen by authorized health professionals, he will feel comfortable dealing with it. There must be clear confidentiality policies that are strictly adhered"

H6, Health manager (Health profession background)

For patient privacy reasons, it is important to have a track record, an audit trail, of professionals who access patients' information,

"The information of patients will be kept in safe place such as iClouds and they can be stored and managed easily by electronic means. It will be easy to track who accessed this information as well"

M2, Health manager (Administration background)

Some health managers were conservative in using public PCs in the workplace,

"Using public PCs at work such as the ones in nursing stations to access to my personal accounts for example email could put my account at risk of being hacked or flood with viruses"

H2, Health manager (Health profession background)

Not all professionals take health information privacy as seriously. Some health professionals do not adhere to the standards that forbid using someone else's account,

"Some physicians are not interested in having an account, or they may have an account and do not use it. They use another physician's account and this is a serious violation of the standards of using electronic health services"

H3, Health manager (Health profession background)

c) Connectivity of information systems

Connectivity of information systems usually describes the communication between devices, systems, and applications either within the healthcare facility or with outside entities and facilities. Health managers showed awareness of the importance of connectivity of health systems,

"Kingdom of Saudi Arabia is very big country and eHealth services can play an important role in linking the three levels of healthcare across the country. Also, eHealth services aim to provide information and facilitate access to health services"

M2, Health manager (Administration background)

"The patient has the right to have a unified Electronic Health Record. If any health problem occurred outside the province where he lives, he still can receive treatment in any other province"

H7, Health manager (Health profession background)

"We started implementing the unified Electronic Health Record in 79 healthcare centres in Aseer province as first stage. The system is equipped with features of Artificial Intelligence. Based on the information entered such as age, weight, medical history, and patient's condition. The system supports diagnosis process. This electronic record system is connected to any healthcare centre operating same system all over the kingdom"

T3, Health manager (IT background)

Some examples of eHealth systems and applications which are in use. They keep the work flow connected and all concerned professionals informed within the organisation and with all relevant entities outside as well,

"We have Health Information System (HIS) that includes pharmacy system, Laboratory system, Outpatients Department system and patients admission system. We also have the PACS system for the radiology department. There are some other systems but not fully implemented such as the Electronic Medical Record"

T1, Health manager (IT background)

"We may not have advanced electronic health systems. We have an electronic prescribing system, we have a strong PACS system for the radiology department and it has made a real difference, and almost a year ago we started implementing human resources systems and this was something positive to save time and effort"

H5, Health manager (Health profession background)

"We have Maward system and Sahl system for administrative communications with other entities and facilities. Within our hospital, we have the HIS and PACS systems. We also have a telemedicine system, connected with King Faisal Specialist Hospital and Research Centre in Riyadh. We also have a referral system connected with other hospitals within the province"

H6, Health manager (Health profession background)

"We have a system that documents death certificates and this system is connected with some government authorities. We also have an electronic system that sends appointment reminder messages to patients' mobile phones"

H1, Health manager (Health profession background)

"Email is also an effective communication channel, It keeps us updated with the latest information and health services"

H7, Health manager (Health profession background)

"We implement many electronic services, including Mawid Application to book medical appointments, medical consultations services provided by family medicine consultants, and also referral system which has been active for almost seven years and the system has become flexible with the passage of time more flexible and trust in it is high."

H9, Health manager (Health profession background)

"Sehha application provides a video and audio consultation services. The service is managed by public health department in the regional health directorate. This service helped to provide health services to cold cases patients that do not require emergency service"

T3, Health manager (IT background)

Although eHealth connectivity proved to be helpful, few health managers showed concerns about some issues related to the connectivity of health systems which may lead to resource wastage and put patient's information at risk,

"It is difficult to connect. The problem is we have no unified health system implemented in the whole province. We have 21 hospitals, we have many PHCCs. In Aseer Central Hospital, they use HIS system and in Sarat Abidah Hospital they use Oasis system, in King Abdullah Hospital in Bisha they use a different system"

M2, Health manager (Administration background)

"The sharing of information across health providers all over the Kingdom will lead to a better quality of care. However, there are some disadvantages, such as the security of the information, system breakdown and losing information if no back up"

M2, Health manager (Administration background)

"In my hospital, the Emergency Department system is separate and not fully integrated with HIS system, therefore, if patients is admitted through Emergency, duplication in requesting x-rays and lab tests occur"

H8, Health manager (Health profession background)

"Some patients go to hospital for check-up and lab tests, then go to another hospital and do the same check-up and lab tests because there is no electronic connectivity among health facilities and this is a huge waste, I do not exaggerate if I told you that 50% of patients that come to my clinic did a CT scan and a sonograph in more than twice in MOH hospitals. If there was an electronic connectivity between hospitals, he wouldn't need that"

H10, Health manager (Health profession background)

Some solutions were suggested to deal with connectivity problems from the health managers point of view,

"I have no idea whether eHealth systems in Aseer province hospitals can be connected, maybe technologists are the best to answer this, however, I think it will be difficult to unify all these system together. These systems were provided by private companies. Maybe top level management should discuss this issue with these companies and find a way out"

M2, Health manager (Administration background)

Leaving health authorities to decide separately what system to use and setting their own practice and privacy standards may lead to compatibility and interoperability problems especially when the need arises for exchanging information. This is the reason that there were voices calling for an eHealth umbrella body to supervise and unify standards and systems,

"It is important to have central supervision, especially in a big country like KSA. So that the exchange of information between health facilities can go smoothly. If the connectivity issue is left to be decided by each province separately, we will eventually face a problem with many different systems and a difficulty in connecting them together"

T3, Health manager (IT background)

"Interoperability is probably a big issue but it is not difficult to find a solution if there is a clear plan. There are programming languages and technical solutions to integrate health systems, even if these systems were provided by different companies"

T3, Health manager (IT background)

d) Customisability of systems functions according to users' needs

Customisability of systems functions means adjusting them to give the best available experience to meet the needs of end-users. Some health managers found it difficult to change the system functionality due to the copyrights of the electronic systems,

"Unfortunately, all systems run by the MOH are owned by private companies and you cannot add to any system without the manufacturing company's approval. It is better for the ministry to purchase its version of these systems with all rights and undertake the process of updating them"

H10, Health manager (Health profession background)

Health managers agreed that taking end-users opinion is crucial. In fact, it can influence their acceptance,

"We were told by physicians that the system has many tabs such as prescriptions tab, discharge summary tab, and patient discharge tab and they suggested to make them all in one place under a menu tab. We took this suggestion to the IT department and they sort it out. When the opinion of the end-user is taken upon designing and customising the system, result will be easy system to work on and benefit from"

H3, Health manager (Health profession background)

"Before implementing, we must take the opinion of health professionals in the system as they are the ones working on it. It is very important that health professionals are aware that electronic systems is designed to facilitate their work not to keep an eye on them"

T3, Health manager (IT background)

"There are more than 100 functions in the system and we are still discovering the benefits of these functions. I suggest to benefit from the experiences of institutions with high developed eHealth systems. That can shortcut our process of eHealth implementation and improvement"

H2, Health manager (Health profession background)

***e)* Willingness to utilise technology**

Willingness to utilise technology is the positive engagement of individuals in using technology once they perceive its advantages. The awareness of utilising eHealth services starts from the point of perceiving the benefits that technology can bring. Willingness to utilise technology is strongly connected with eHealth benefits theme,

"When explaining the benefits of using eHealth services and how can they save time and effort, as well as their benefits to the patient as facilitating access to health services and increase the quality of healthcare. The higher this awareness, the greater the acceptance of eHealth services"

H9, Health manager (Health profession background)

Believing in the importance of technology and willingness to use it can be personal attitude driven rather than organisational job description,

"I am very open to eHealth services, I download every application recommended by MOH on my mobile phone, such as Maward App, Ashanek, and Mawid because I know that technology is the future of health"

H6, Health manager (Health profession background)

"Some people were apprehensive when using a computer and feel they cannot learn. In our department, we started by reducing paperwork and substitute electronically. The idea was difficult in the beginning for some, but the plan was to build awareness of how important is the electronic services"

H6, Health manager (Health profession background)

Motivation is an important concept to encourage professionals to optimise utilisation of technology. Appreciation, increased awareness, and provision of training courses have proven to be positive motivations for utilising technology,

"We issue monthly appreciation certificates for departments that use less paper to encourage utilising technology"

M3, Health manager (Administration background)

"Upon implementing new electronic system, people tend to resist but when they are explained about the benefits of using it and provided with good training, they will accept it"

T3, Health manager (IT background)

"To motivate accepting and using eHealth services, at first we should know staff needs and fulfil them. Provide good training, develop the infrastructure of healthcare facilities, and benchmark other organisations nationally and internationally to adopt good systems"

M2, Health manager (Administration background)

5.3.2.2 Domain 2: Effort Expectancy

Defined as "the degree of ease associated with the use of the system" (Venkatesh et al. 2003). Only one theme was found of relevance to this domain which is complexity of technology.

a) Complexity of technology

Complexity of technology means the degree to which systems and applications are difficult and complicated to operate without prior experience or training. Health managers in Aseer province believed that complexity of technology was not a core issue in accepting and using eHealth services and can be solved by proper training

prior to using any electronic system. Some of them thought that the difficulty is not in the technology itself but is an issue with users, especially older generation users, that were accustomed to paper work. Training was suggested to make technology easy to use and well-accepted,

"The difficulty is that we don't know and people tend to be against what they don't know, therefore, training before using any system is very important"

H3, Health manager (Health profession background)

"Technology is supposed to be easy, but our culture makes it difficult. If we notice, we work with two generations. A generation that believes in the importance of technology and an old generation that resists it"

H5, Health manager (Health profession background)

"There is difficulty in the beginning with any new system and sometimes old staff refuse to switch from the traditional paper work to the electronic-based work. Perhaps because they have difficulties in dealing with computers. Who is good at using computers will find dealing with eHealth services easy"

H4, Health manager (Health profession background)

"To the best of my knowledge, nothing is difficult but training is most important before using any system. Training should cover topics based on staff needs."

M2, Health manager (Administration background)

A health manager of IT background thought that academic and professional background of users plays a role in how difficult technology can be,

"It is easy for us as IT professionals, but for health professionals there might be difficulty in the beginning, especially in accepting technology taking over the place of paper work. They may need months to get used to this change"

T2, Health manager (IT background)

Few other health managers thought that eHealth systems design should consider the previous experience of end-users in dealing with eHealth. Training was also emphasised to solve the problem,

"eHealth systems are easy and do not require an expert user to use them. If the system is well-designed, it will be easy to use"

H8, Health manager (Health profession background)

"Some professionals say that we are not specialized in eHealth, but it is important to receive training on eHealth services as long as we will work on them"

M4, Health manager (Administration background)

"There may be difficulty in using some electronic systems. Training is the solution to improve users' experience and convince the end user to accept and use it"

T1, Health manager (IT background)

"Depends on the system itself, for example, Maward application was difficult to work on in the beginning due to some technical problems in the application itself"

H6, Health manager (Health profession background)

"I have an opinion from a technical point of view. It is all about how to design a simple interface. You need to conduct a study to find out what the staff need to improve their experience in using the system. Choose the right design and the right colours. There will be no difficulty! For example, smartphones are used by everyone even the elderly, with no problems"

T5, Health manager (IT background)

5.3.2.3 Domain 3: Social Influence

This refers to "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al. 2003). Two themes were found of relevance to this domain: Stakeholders' voice upon planning and feedback on preferences; and, Uncooperative behaviour and resistance to change.

a) Stakeholders' voice upon planning and feedback on preferences

Stakeholders' voice refers to the active participation and involvement of stakeholders in planning the necessary services. Health managers showed that sharing their needs for electronic services and eHealth strategy made them ready to accept and use these systems when they were launched,

"From time to time, we change certain functions in the system based on our needs and according to the new strategy coming from the MOH"

H2, Health manager (Health profession background)

"MOH always encourage us to use eHealth services but as staff, we have never been asked what we need. Sharing staff upon planning for new projects makes them ready"

H5, Health manager (Health profession background)

"Front line staff should share views on eHealth strategy. When you listen to the needs of staff, you can plan your strategy based on what they need"

M2, Health manager (Administration background)

b) Uncooperative behaviour and resistance to change

Uncooperative behaviour and resistance to change is the actions taken by some employees when they perceive that technology can be a threat to them. Health managers believed that some health professionals tend to reject utilising technology at the workplace for several reasons such as work load,

"Yes, some physicians resist using eHealth services, but personally I do not blame them. When you are supposed to see 40 patients in your clinic within four hours, using paper notes is easier and faster than using electronic system"

H1, Health manager (Health profession background)

"Some physicians are uncooperative and unaware of the importance of eHealth services, they do not take it for serious"

H8, Health manager (Health profession background)

There were a few differences noted between professionals that accept and professionals that resist technology,

"Knowledge, educational background, and technical skills, are the differences between the young generation that believe in technology and old generation that believe more in traditional work flow and that is why they resist any change"

M2, Health manager (Administration background)

5.3.2.4 Domain 4: Facilitating Conditions

This refers to "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al. 2003). The following pre-defined themes were found of relevance to this domain: Availability of information and knowledge about eHealth services; Government legislation and constraints; Educational factors; Availability of operational resources: Organisational factors; Financial factors; Technical ability and work experience; Quality of eHealth systems and applications; Availability of adequate qualified human resources; and ICT infrastructure and readiness.

a) Availability of information and knowledge about eHealth services

Availability of information and knowledge refers to the awareness of eHealth services information which include plans of implementations, strategy, and policies and procedures of the practice. Some health managers were knowledgeable on eHealth and aware of its importance in their daily work,

"eHealth was part of my study at the baccalaureate and master's degree as well. It is also one of my personal interests to explore"

M1, Health manager (Administration background)

"Because I work in the IT department, I know about eHealth services. I heard about the national eHealth strategy, but it did not impact our work until the last couple of years, perhaps because the decision makers in the MOH paid more attention to eHealth. In general, all government authorities including the MOH are going through electronic transformation process"

T3, Health manager (IT background)

"I began hearing about eHealth services 5 years ago, but the term has been focused on for the past 3 years. I think eHealth aims to archive the patient's data and convert it into an electronic version"

H5, Health manager (Health profession background)

"eHealth services have been around for years. For example, the electronic system in King Faisal Specialist Hospital and Research Centre, which started in 2001. Recently eHealth becomes more popular, you can even see eHealth department in the organisational structure of the MOH"

H10, Health manager (Health profession background)

"eHealth as a major was not known to us, we only knew the major of computer sciences. Five years ago, we started hearing about eHealth. Recently, the Electronic University opened a branch in Abha and few colleagues of mine showed interest in studying health informatics"

H5, Health manager (Health profession background)

"I know that eHealth is using technology in the provision of health care services in the Kingdom"

M5, Health manager (Administration background)

Although some health managers were not fully aware of the importance of eHealth, some even thought they were not ready to implement it. The younger generation of managers thought eHealth would lead the future of healthcare,

"I never heard about eHealth national strategy but I know that eHealth is the future, if you are asking my opinion, it is the future"

H2, Health manager (Health profession background)

"One of the hospital managers told me once that we are not ready to use eHealth services, we don't know about it, we don't know how to use it"

M1, Health manager (Administration background)

"Our information about eHealth is limited as front-line staff, but in general we know that eHealth is an internal system for communication between departments and the medical team"

H3, Health manager (Health profession background)

b) Government legislation and constraints

Government legislation and constraints are the plans, laws, rules and regulations imposed by governmental bodies such as the national eHealth strategy. Health managers think that top management teams headed by the Minister of Health encourage utilisation of technology. However, there are several unexpected consequences that hinder progress such as lack of clarity of plans and standards that should apply on all healthcare facilities, continuity and follow-up of implementation, and lack of resources,

"There is a plan for digital transformation, but our problem is with the continuity and follow-up in as well as the continuous need for financial and human resources to support this plan and strategy. The management of my facility is keen to support and encourage this transformation. I have read the national strategic plan for eHealth, but in general it is not clear to all employees, especially those working in hospitals and PHCCs. It needs to be explained by experts"

H4, Health manager (Health profession background)

"The vision is still not clear with regards to the unified health record, but we hope that within two or three years we will be able to reach the desired goal"

H7, Health manager (Health profession background)

It was suggested that the problem might be miscommunication or lack of understanding,

"There is no doubt that the eHealth services are the future of the MOH, but we need to know the official plans of the ministry with regard to these services. These plans might be found on the ministry's website but were not seen by employees, anyway, I hope these plans will be easy to understand at basic user level"

H6, Health manager (Health profession background)

Health managers should be the target to fully understand the MOH plans in order to lead the change, encourage the staff and achieve strategic aims,

"I hope managers will be provided with full explanation about systems and applications, the benefits and implications on both the facility and staff. When the manager is aware of project's plans and goals, they will have a role in supporting the project, motivating employees, and heading to achieve success"

M5, Health manager (Administration background)

c) Educational factors

Educational factors are those related to the level of education, training and proficiency required to feel confident in performing the job. Lack of training in eHealth services was an important issue raised by most of health managers but it was not clear what training courses were needed. There was a need for awareness promotion courses to keep health managers updated and boost their eHealth acceptance,

"Training courses are constantly needed. The electronic services are developing and the employees should keep up with these updates"

H5, Health manager (Health profession background)

"Every application or eHealth system should have a training course. We need to enhance the level of awareness towards the importance and benefits of eHealth services and I think training should be run by professionals in health informatics or eHealth as well as health professionals to share their experiences"

H9, Health manager (Health profession background)

"We need training sessions on the advantages of eHealth services as well as training on how to deal with electronic risks. For example, what is the procedure that should be followed if I receive an email from unknown person with attachments. We want clear steps to deal with a situation like this"

H4, Health manager (Health profession background)

Health IT professionals are the ones to run the training courses,

"Training on new applications and systems is carried out at first by companies that provide these systems. Usually the training target IT professionals and the training course length varies from one course to another. After that, IT department runs training for the rest of the hospital staff"

T2, Health manager (IT background)

"The IT department undertakes the training courses, but they need support from the top management to provide resources and training places"

T1, Health manager (IT background)

"The IT department provides training in applications and eHealth systems, after training we provide technical support. We target to train health professionals including physicians, nurses, technicians, and pharmacists"

T2, Health manager (IT background)

Tailored courses based on staff needs were reported to be essential,

"I think we should have a separate training programme for each stakeholder's group based of what they need from the system. IT should be the ones conducting these training courses in order to improve the end user's experience"

H2, Health manager (Health profession background)

"In all courses that we provide we consider that the content is appropriate for the target group. For example, the training will be on specific screens or certain functions in the system. We run these courses as needed and sometimes when updating or adding new functions to the system"

T2, Health manager (IT background)

"There is a company (ELM), they have conduct training courses for the PHCCs staff and managers to prepare them for implementing eHealth services in PHCCs. It is more like a workshop in a real IT labs. Training in the first phase targeted 18 health managers and we will plan the second soon after the evaluation of the outcome from the first training course. We need to know if the course content was suitable for all attendees or we should make some changes to meet their needs"

M2, Health manager (Administration background)

"The content of these courses should consider the experience of the target groups. Courses then can be provided on three levels; beginner; intermediate; and advance level"

T3, Health manager (IT background)

Courses on PC basics and technical skills were required in order to make them ready to work in a technical-based environment,

"There are issues that must be addressed, such as the lack of training courses on eHealth services and systems. We studied electronic services theoretically, but we did not receive enough training courses to enhance our technical skills"

H3, Health manager (Health profession background)

"We need foundation courses on using computers and solving simple technical problems. In general, there are employees with no computing background and they need these kind of courses"

T1, Health manager (IT background)

However, not all health facilities are able to provide foundation courses as staff are expected to be at good level of obtaining technical skills,

"We do not offer any foundation courses because we assume that everyone works on eHealth systems should know the basics, so there is no need for foundation courses"
T2, Health manager (IT background)

English language is the language that is in use for healthcare in KSA. eHealth services users need a good understanding of English language to deal with these services,

"It is also very important for the employee to have a good knowledge of English language. This should increases employee understanding of the system"

H1, Health manager (Health profession background)

"Some employees are not good in English and that is why we had to translate the system functions into Arabic and print a hard copy for their daily use"

M4, Health manager (Administration background)

d) Availability of operational resources

Operational resources are the tools that are used to handle daily work such as computers, laptops, printers, print papers and ink. Health managers agreed that operational resources are essential in healthcare facilities. PCs, printers, and scanners were the resources that should be adequately provided in order to perform the job,

"Poor infrastructure is what hinders the implementation of eHealth services systems. This is followed by lack of resources such as devices, printers, and scanners. You will not be able to implement any eHealth system before addressing these two issues"
T3, Health manager (IT background)

"The real challenges are the lack of standards and policies. In addition, the lack of resources, it is difficult to ask me to use an electronic system if I do not have a computer or fast internet connection"
H6, Health manager (Health profession background)

"We have only two computers in every admission ward. Do you think this number is enough for daily use by nurses and physicians? If enough resources are available as well as an easy and well-designed system. This will motivate us to use eHealth services"
H5, Health manager (Health profession background)

"I used to work in a hospital that lacks resources. We suffered from the lack of devices, printers, and internet. I think they still suffer from this problem"
H10, Health manager (Health profession background)

e) Organisational factors

Organisational factors are those factors that influence behaviour at work such as the mission, vision, size and type of the healthcare facility. Absence of plans and clear goals was raised by health managers as an obstacle,

"There is no strategic plan that is clear and known by everyone. We need for example to know what are we trying to reach by the end of the first year. And in the second, third, fourth, and so on"

H5, Health manager (Health profession background)

"It is very important that we work based on clear foundation, clear plans, and clear goals. It is also very important to keep a continuous development and update our policies and standards that are of relation to the practice"

H7, Health manager (Health profession background)

f) Financial factors

Financial resources are the funds secured to establish, operate, and maintain infrastructure, systems and applications. Financial factors were focused on as one of the most important resource needs. Health managers emphasised that without adequate financial resources, eHealth systems will be at serious risk of failure,

"No project can be done, developed or improved without financial support"

T1, Health manager (IT background)

"If you do not have enough budget for electronic services, it will only be on paper"

T5, Health manager (IT background)

"We know that electronic services cost much and, therefore, there must be enough budget allocated, especially for the maintenance. If we lack financial resources, devices security, for example, would be at risk"

M3, Health manager (Administration background)

Several reasons were reported to be the cause for the high cost of eHealth systems,

"One of the biggest challenges facing healthcare facilities is the high cost of eHealth systems. The issue is left to commercial companies, which increase the cost and there is no national umbrella that deals with this"

M5, Health manager (Administration background)

"I think the most important resource is financial; when available it becomes easy. Most systems and applications are designed by programmers that work for private companies. They need to be updated. Licenses need to be purchased or renewed"

T2, Health manager (IT background)

Top managers were viewed as having a role to play in securing this funding in order to improve the services,

"Financial support is the main issue from my point of view, I am the chair of one of the clinical committees in the hospital and we were in need to change our electronic system. We could not do this until I met the top manager who secured for me a budget to purchase it"

H2, Health manager (Health profession background)

g) Technical ability and work experience

Technical ability and work experience refer to the competency in carrying out the technical tasks without help from others such as using eHealth systems and applications. A health manager believed that the more the manager was good at using computers and has good technical ability, the more his staff will follow and accept utilising technology,

"I think that my computing skills are excellent and that has influenced my acceptance and use of eHealth services as well as has a positive impact on my staff. Sometimes, we have technical problems that I can fix myself without asking help from the IT department"

H1, Health manager (Health profession background)

Other health managers confirmed that technical ability and working with someone skilled would give confidence and make less resistant,

"If you work with someone who is skilled at computers, you will accommodate his skills by time and you can learn a lot from him"

H2, Health manager (Health profession background)

"I imagine if my technical ability was not good, I would definitely resist and refuse electronic services and go for paper work"

H3, Health manager (Health profession background)

However, another health manager believed that technical ability was not a crucial factor compared to other factors such as education,

"I do not think that technical ability is a key factor in accepting eHealth services, if we assume that it was weak, training can promote it and, therefore, educational factors are much more important than technical ability"

H9, Health manager (Health profession background)

This was confirmed in a quote from another health manager,

"Training is number one priority followed by technical ability. I worked in hospitals outside the Kingdom. All employees were very good at using the electronic system, but here, I see the opposite. There are employees at certain age find it difficult to use the system and say that they are not used to it"

H3, Health manager (Health profession background)

A health manager thought that technical ability varied from one professional to another,

"55% of healthcare professionals in Saudi Arabia are foreigners from different countries and we know nothing about their technical ability background. Did they study IT basics? Have they worked on eHealth systems before? We find big technical ability gap between staff that come from both developing and developed countries"

M2, Health manager (Administration background)

Another health manager encouraged teaching IT skills and English language at early school age,

"I personally encourage that computing skills and also English language to be included in the curriculum of the primary schools. They are very essential for any future career. We can see the difference between the manager who is good at dealing with computers and the manager who is not"

H10, Health manager (Health profession background)

h) Quality of eHealth systems and applications

Quality of eHealth systems and applications means smooth and efficient performance with no technical crashes, failures or frozen screen difficulties. A health manager believed that the variation in the quality level of health systems can be attributed to the companies that provided eHealth systems,

"We still deal with commercial companies. Every healthcare facility purchases eHealth system separately, and therefore, we see difference in the quality of eHealth applications and systems. If there was a national company that provide these electronic systems for all healthcare facilities across the country, that would give more confidence in both the quality of the system and the safety as well"

M5, Health manager (Administration background)

Health managers believed that good quality systems saved time,

"As an end-user, I care about my time, if access to the system takes a long time, I would probably not use it"

H6, Health manager (Health profession background)

"We used to work on one of the poor quality archiving systems. We had to restart the system to recover the data every time we look for file information. We had to store a copy of the data on external hard disk"

H1, Health manager (Health profession background)

Health managers confirmed that the more they trust the system, the more they will be encouraged to use it. System safety was referred to as an important feature that enhanced trust,

"When the system is frequently down, we will lose confidence in it. To use the system, we need it to be easy with modern interface. We care also about the confidentiality, beneficiaries of the services will never accept that their sensitive health information will be in a system that anyone can easily access"

T3, Health manager (IT background)

"In order to reduce human errors, the quality of eHealth systems should meet the international standards in terms of safety and efficiency of use"

M1, Health manager (Administration background)

"One of the physicians found that any user can add or delete in the medical information section. This caused fear in dealing with the system, some of the physicians decided to go back to handwriting notes. At least it is safer and no one can add or delete. This is an evidence that the quality of the system was poor. A system that you cannot trust"

H8, Health manager (Health profession background)

i) Availability of adequate qualified human resources

Human resources are skilled professionals that manage systems and provide technical support. Healthcare facilities are in need for eHealth specialists,

"The availability of highly qualified human resources in eHealth is great support for two reasons. The first is to ensure ideal and professional handling of the eHealth systems, and the second is to train other staff to use and benefit from these systems"

M1, Health manager (Administration background)

Health managers believed that Aseer province lacked human resources specialised in eHealth,

"We significantly have shortage in eHealth specialists in the province. When we have adequate qualified human resources, the quality of work can be enhanced as well as the quality of outcomes"

H7, Health manager (Health profession background)

"In my hospital, we have only one health informatician, the rest are just IT professionals"

H10, Health manager (Health profession background)

"Most professionals currently are computer sciences specialists and there are no specialists in the field of eHealth. eHealth specialist is the one that is aware of both technology and health and that is what we need"

M5, Health manager (Administration background)

"Human resources, in general, are computer sciences specialists and there is no specialist in health informatics or eHealth"

T2, Health manager (IT background)

A health manager said that it was not just health informaticians that are needed,

"We need specialists in health informatics, not just IT specialists. We specifically need professionals that are specialised in certain areas such as nursing informatics because these professionals are the ones most familiar with nursing and know best what nurses need from the eHealth system"

H5, Health manager (Health profession background)

j) ICT infrastructure and readiness

Infrastructure is the physical structure of the healthcare facility including buildings, internet connection, network points, and power supplies. When a question was asked about, 'How important was the infrastructure?' Health managers answered,

"A good infrastructure in any healthcare facility helps systems to work efficiently and effectively"

M1, Health manager (Administration background)

"I think that the main obstacle is poor infrastructure, many places inside the hospital have no network points. System breakdown happens frequently, and there has been no update of the infrastructure for years"

T1, Health manager (IT background)

"Even if you have a very good eHealth system but your hospital infrastructure is not good, that will lead to the failure of the project"

T2, Health manager (IT background)

A health manager that works for a remotely located primary health care centre raised a problem with internet connection,

"The internet connection is weak in the remote PHCCs that are far from urban area. Sometimes we have to use our personal mobile phones as a solution when we face this problem"

H11, Health manager (Health profession background)

Top management teams were eager to update the infrastructure but,

"Top management in the hospital really encourage eHealth services, but there is always this lack of financial support. There are continuous communication with the MOH IT team. They look forward to updating our current eHealth system and infrastructure"
T1, Health manager (IT background)

5.4 Discussion

5.4.1 Findings discussion

The aim of this phase of study was to explore the views of health managers in Aseer province, KSA towards factors that influence health managers' acceptance of eHealth services. The discussion of the interview findings is presented based on the research questions and the UTAUT model.

What do health managers in Aseer Province know about eHealth services in the KSA?

Health managers in Aseer province showed different levels of knowledge about eHealth services. That can be seen as inevitable given the variation in the level of education and personal preference towards accepting technology as stated in the literature of eHealth in KSA (El Mahalli et al. 2012, Hasanain and Cooper 2014, and Jamal et al. 2016). This knowledge was gained from many sources such as universities of undergraduate or postgraduate studies as well as continuing professional development training courses. Few health managers knew about the eHealth National Strategy (National eHealth Strategy 2011), which indicated a gap in communication of intention between the policy makers and front line staff that work in field. So while they know which eHealth services are in use in Aseer

province and other services that are available elsewhere in KSA, their knowledge was limited to the guidance of current eHealth practice but nothing was clear to them with regards to eHealth future plans.

Lack of eHealth knowledge was evidenced to be one of the main challenges in accepting healthcare technology from the views and experiences of health professionals and health managers in several studies that were conducted in Saudi Arabian contexts such as: El Mahalli et al (2012), Hasanain and Cooper (2014), and Jamal et al (2016). Schreiweis et al (2019) conducted a systematic review to study the relevant barriers and facilitators to eHealth services implementation and concluded that limited knowledge of eHealth is one of the top factors addressed in the literature (Schreiweis et al. 2019). Given the timeline evidenced in the literature, there appears to be a lack of progress in advancing the awareness of the revolution of eHealth services. This issue is of importance to concentrate on especially in planning training courses that aim to embrace technology in healthcare in line with the National Transformation Programme (NPT) 2020 which is part of the Saudi Vision 2030.

What advantages do health managers in Aseer Province think that eHealth services can bring to healthcare system in the KSA?

A wide range of benefits of utilising eHealth services were reported by health managers in Aseer province. They thought that eHealth benefited patients by enabling them to book appointments remotely, request medical consultations, meet GPs virtually, reduce waiting time to receive healthcare services, and feel comfortable that their information can only be accessed by authorised professionals. Any violation or unauthorised access to this information is auditable so can be easily tracked and investigated.

To the health managers, eHealth benefits include saving time and effort of professionals, minimizing human error such as in handwritten prescriptions and notes, providing accurate information and statistics for decision makers, interoperability, and increasing the confidentiality of health information. Health managers saw benefits to healthcare providers to promote the quality of healthcare services and delivery, save resources and reduce the spend on

disposables, prevent wastage of medication and duplication of medical procedures, such as laboratory tests, and to exchange health information faster with other related authorised entities.

These benefits were some of the advantages of using eHealth services in Aseer province from the perspectives of health managers. They showed consistency with benefits cited by different stakeholder groups in many studies such as: Altuwaijri (2008), El Mahalli et al (2012), Cilliers and Stephen (2014), Alasmary et al (2014), and Alfarra (2016).

What factors do health managers in Aseer Province think are of significance to influence the acceptance of eHealth services in the KSA?

As described in the result section, all themes were clustered under four domains which were derived from the UTAUT model in chapter 4.

1. Performance expectancy

Five themes were considered to be related to this domain. Health managers in Aseer province showed the importance of this domain which confirmed the perceived usefulness of eHealth services. The findings provided an extension to what has been found in the literature of eHealth acceptance in the KSA. They were consistent with studies that found eHealth benefits including confidentiality, connectivity, customisability, and willingness to utilise technology, were of significance to different groups of professionals including health managers such as: El Mahalli et al (2012), Li et al (2013), Hasanain and Cooper (2014), Alsulame et al (2015), Alloghani et al (2015), Alaboudi et al (2016), Almuayqil et al (2016), Jamal et al (2016), Hennemann et al (2017), and Hossain et al (2019). This means that health managers perceive the importance of eHealth and believe that acceptance of eHealth can bring benefits to all stakeholders. The more they perceive this, the better they accept utilising technology in their workplace.

2. Effort expectancy

Complexity of technology was the only theme that related to this domain. The complexity of technology was found not to be an issue in itself. It was claimed to

be similar to many other things in life that starts with some difficulty but, with time, things become clear. Two main factors were associated with the complexity of technology from the views of health managers which were eHealth knowledge and technical training. Health managers did not see any difficulty in eHealth services if end-users have a good level of knowledge about eHealth and receive technical training and orientation on the system that will be used.

Three studies: El Mahalli et al (2012); Hasanain and Cooper (2014); and El Mahalli (2015) concluded that the three factors of association: complexity; lack of eHealth knowledge; and lack of training, were the main challenges to acceptance of technology. These studies were quantitatively based and targeted health professional groups (Alshahrani et al. 2019). This current study targeted a different professional group in health managers, and was conducted qualitatively. Findings showed that complexity of technology was not of concern to health managers and by providing adequate knowledge about eHealth, and conducting technical training on eHealth systems, the challenge of complexity would be overcome.

3. Social influence

Two themes were of relevance to this domain: stakeholder's voice upon planning; and resistance to change. The consideration of stakeholders' voice upon planning eHealth projects was of significance to health managers in Aseer province. They reported that sharing their views was an important step in making them ready to accept any eHealth technology. This conclusion showed consistency with a study that was conducted in 2016 by Alfarra which focused on revealing how King Faisal Specialist Hospital and Research Centre in Riyadh took into account the views of multiple stakeholders to plan and implement a new electronic health record in the centre.

Resistance to change also showed significance from the viewpoint of health managers and was attributed to the professionals' variation in eHealth knowledge, educational background, load of work, and technical skills. Uncooperative behaviour of professionals and resistance to change were reported in several studies such as: Bah et al (2011) which investigated physicians' resistance to accept electronic health records and El Mahalli et al (2012) which reported health

professionals' resistance of adopting telemedicine in Eastern province hospitals, KSA as one of the challenges facing eHealth acceptance.

4. Facilitating conditions

Ten themes were of relevance to this domain. Health managers in Aseer expressed how significant these themes were in their context. The interviews showed different levels of eHealth understanding especially for the front line staff who said that they knew nothing about the national eHealth strategy. This issue can be associated with lack of communication of national policy and strategy between top management that work on making regional policies and strategies and front line staff that deliver health services while planning for eHealth progress. This communication gap was also reported in answers received about government legislations and constraints in which some health managers showed concerns about future eHealth systems and hoped they would be explained to end-users in a basic way that non-experts can understand. These factors were previously discussed in studies such as: Hasanain and Cooper (2014), Sulaiman and Magaireah (2014), Alaboudi et al (2016), and Uluc and Ferman (2016).

All themes showed significance, however, the top facilitating condition themes that were reported to play a crucial role in eHealth acceptance were: Availability of operational resources; Availability of human resources; ICT infrastructure; education and training; quality of eHealth systems and applications; and finally financial factors. This result was consistent with other studies that reported the significance of the above mentioned themes in the technology acceptance such as: Moen et al (2013), Aldosari (2104), Alaboudi et al (2016), Ariens et al (2017), Zaman et al (2018), Kesse-Tachi et al (2019), and Alshahrani et al (2019).

5.4.2 Strengths and limitations

Strengths of this qualitative study include utilising one of the technology acceptance models which was the UTAUT as a theoretical approach to help analyse the findings. Another strength is the lack of qualitative studies that explore technology acceptance in the Saudi Arabian healthcare context. As described in the introduction of the phase, only two studies were found in the literature search (Alsulame et al. 2015 and Alfarra 2016). However, neither extended to explore a

specific geographical setting. This study's third phase focused on a previously unexplored geographical area (Aseer province).

In order to promote the trustworthiness of this qualitative study the:

- Principal investigator attended training on conducting qualitative data collection and using qualitative analysis tools
- The analysis of the findings was conducted by the principal investigator (AA) and double checked by an independent researcher (KM)

However, as with every study, there were some limitations. First, is that the study was conducted in Aseer province and it is recommended to apply caution upon interpreting the results as they may not necessarily represent other provinces. This is due to the differences in availability of advanced healthcare facilities, availability of adequate manpower, and the culture of the province itself. Another limitation is the sensitivity of talking about the support of top management. Some interviewees showed signs of not wishing to discuss issues that were related to the support of top management prior to recording the interviews as they thought that might reveal their identity. In this case, their responses may not express their true experience, especially upon avoiding to give clear views on questions of relevance to management role in promoting eHealth acceptance. In addition, due to the small sample size of the study and the specific geographical setting explored, findings cannot be generalised on the community of health managers in the KSA.

5.5 Summary and conclusion

This qualitative phase in the explanatory sequential mixed methods research identified the key significant themes that influence health managers acceptance of eHealth services in Aseer province (Table 5.5). The level of influence was determined based on the emphasis the interviewees showed to a specific theme. These themes were analysed under four domains pooled from the UTAUT theoretical framework. Three domains showed significance: Performance Expectancy, Social Influence; and Facilitating Conditions, however, the fourth domain, Effort Expectancy did not.

The final chapter discusses the findings from the three phases: SR, survey, and interviews in light of identifying new knowledge based on the research and making final recommendations for future work.

Table 5.5: Influential level of all themes

Domains	Themes	Influential level
Performance Expectancy	• eHealth benefits	• High influence
	• Privacy, confidentiality, and security of health information	• High influence
	• Connectivity of information systems	• Influence
	• Customisability of systems functions according to users' needs	• Influence
	• Willingness to utilise technology	• Influence
Effort Expectancy	• Complexity of technology	• No influence
Social Influence	• Stakeholders' voice upon planning and feedback on preferences	• High influence
	• Uncooperative behaviour and resistance to change	• Influence
Facilitating Conditions	• Availability of information and knowledge about eHealth services	• Influence
	• Government legislation and constraints	• Influence
	• Educational factors	• High influence
	• Availability of operational resources	• High influence
	• Organisational factors	• Influence
	• Financial factors	• High influence
	• Technical ability and work experience	• Influence
	• Quality of eHealth systems and applications	• Influence
	• Availability of adequate qualified human resources	• High influence
	• ICT infrastructure and readiness	• High influence

CHAPTER 6: DISCUSSION AND RECOMMENDATIONS

6.1 Overall aim and key findings

Research aim and questions:

The overall aim of this research was to explore factors that influence health managers acceptance of eHealth services in the KSA. This research was conducted in three sequential phases. The aim and key findings of each phase are described below.

In this doctoral research, a mixed methods design presented in three phases was adopted with each phase informing the next. Overall, all phases confirmed the same identified factors which influence health managers' acceptance of eHealth services in KSA as follows:

First phase was a systematic review which aimed to critically appraise, synthesise and present the available evidence on the status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia from the perspectives of multiple stakeholders. The systematic review protocol was developed by the principal investigator, reviewed by the research team, and finally registered with the prospective register of systematic reviews (CRD Prospero). Fifteen papers of quantitative, qualitative and mixed methods studies met the inclusion criteria. A critical appraisal tool for each study design was applied to assess the quality of the included studies. Three original findings were generated from this phase:

1. Thirty-nine factors which influence eHealth acceptance in the KSA based on the views of multiple stakeholders were identified
2. There was a need identified to investigate the views of specific stakeholder groups, such as health managers, towards eHealth acceptance
3. All existing literature focused on only three out of thirteen provinces in the KSA which raised the need to extend research into the experience and extent of eHealth adoption and acceptance levels into other geographical settings across the country.

Since completing the systematic review in phase one, several primary studies have been published. Zaman et al (2018) carried out a study in three hospitals in Makkah city that aimed to: 1) Assess the utilization status of eHealth in Makkah city hospitals, 2) Measure the usefulness of eHealth in delivering healthcare in Saudi Arabia, and 3) Find out the challenges / barriers in implementing eHealth services in Saudi Arabia. The study used a questionnaire to collect data from a sample size of 51 administrative and medical staff. It concluded that apart from the shortage of operational resources, such as computers and staff with technical ability, cost and expertise in innovative systems in IT were the main challenges (Zaman et al. 2018). This confirms the published findings from the first phase of this doctoral research (Alshahrani et al. 2019).

Al-Kwaiti et al (2018) conducted a study that aimed to raise attention of stakeholders to the need to implement digital health technology in Academic Medical Centres (AMCs) in KSA. This paper focused on evaluating the impact of digital technology on healthcare including telehealth and health applications on the healthcare sector in KSA. It found benefits such as reduced costs and improved quality of care (Al-Kwaiti et al. 2018). The study also recommended that AMCs in KSA should further expand plans to adopt health technology interventions while identifying any potential challenges that could hinder full utilisation. This reflects the findings from phase 1 (SR).

Alsubaie (2019) investigated the readiness to implement EHRs in PHCCs in Riyadh, KSA by surveying a sample of 100 nurses. The study determined that the top three factors that could lead to better adoption of EHRs were the leadership support, the willingness to utilise technology, and better consideration of some organisational factors such as the mission aims and strategic plans towards the implementation process (Alsubaie 2019). This again demonstrates the timeliness and relevance of this doctoral research which engaged a much larger sample of the population (n=385).

Finally, Sayed (2019) discussed the knowledge, attitude and behaviour towards EHR systems in Saudi Arabia by collecting data from 270 dental care providers across KSA. Three factors were identified to influence staff attitudes towards accepting EHRs which were privacy, providers compliance, and cost of services

(Sayed 2019). This was again consistent with the findings from this doctoral research albeit from the perspective of a different group of healthcare providers.

All of the identified factors and perceived benefits from using eHealth technology from these studies were consistent with the findings from the systematic review conducted and published as the first phase of this research (Alshahrani et al. 2019).

Second phase of quantitative survey was informed by the findings from the first phase systematic review (Alshahrani et al. 2019). The overall aim of this phase was to investigate the factors that influence health managers' acceptance of eHealth services in KSA. A cross-sectional survey methodology with an online questionnaire tool was used to collect data from health managers across KSA (n=385). This phase was determined to be the first of an explanatory sequential mixed methods design which was followed by qualitative design in the third phase. An initial modified version of the UTAUT (Figure 4.2) was utilised as a theoretical framework to understand or explain the findings and inform the cross-sectional survey phase. All identified factors were clustered into 17 themes based on their nature (Table 4.1) then mapped against the four main independent UTAUT constructs that would influence overall Behavioural Intention and Use Behaviour, namely: Performance Expectancy; Effort Expectancy; Social Influence; and Facilitating Conditions (Figure 4.3). Five moderators were used: gender; age; managerial level; managerial experience; and geographical location. The Relative Importance Index (RII), Descriptive statistics, Principal Component Analysis (PCA), and Ordinal regression analysis were used for data analysis. Three rounds of regression analysis were conducted to explain the ambiguity of some initial results and confirm a final modified UTAUT model (Figure 4.11). Statistical analysis showed clear significance for two constructs, Social Influence (SI) and Performance Expectancy (PE) to influence the Behavioural Intention (BI) moderated by age, as well as Facilitating Conditions (FC) and Performance Expectancy (PE), to influence the actual all encompassing Use Behaviour (UB). Limitations of the study were highlighted such as the need to apply caution upon interpreting the results as they do not represent the KSA health workforce in general, however, they do represent the health managers group. Another limitation raised the need to apply another methodology and collect data through

a new data collection tool for triangulation purposes and investigate the confirmation of results. The final modified UTAUT model (Figure 4.11) has shown potential to be adopted to investigate the views of unexplored health provider population KSA-wide.

Third phase was qualitative phenomenological informed by the findings from the survey in the second phase. This phase aimed to explore the views of health managers in Aseer Province, KSA towards factors that influence health managers' acceptance of eHealth services in KSA. A purposive sample was recruited from the survey respondents by invitation to participate in an interview. In-depth face to face and telephone interviews were conducted with 21 health managers across different healthcare settings. All analysis themes were preset deductively from the quantitative phase. Four preset umbrella or over-arching domains were based on the four constructs of UTAUT: Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions. The key dominant factors were eHealth benefits as well as the Privacy, confidentiality, and security of health information from the Performance Expectancy domain; Stakeholders' voice upon planning and feedback on preferences from the Social Influence domain; and Availability of operational resources; Availability of adequate qualified human resources; Quality of eHealth systems and applications; Educational factors; Financial factors; and ICT infrastructure and readiness from the Facilitating Conditions domain (Table 5.5). Complexity of technology from Effort Expectancy domain showed no clear influence (Table 5.5).

As mentioned in the introduction chapter, the healthcare system in KSA is classified as a national system. This means that the majority of primary, secondary and tertiary healthcare services in the country are provided by the government represented by the Ministry of Health as well as other government authorities such as Armed Forces Medical Services and University Hospitals (Statistics Yearbook, MOH, KSA 2016). Moving toward eHealth solutions has been one of the main goals for healthcare policy makers in KSA but sometimes plans fail to meet expectations. One of the reasons was the dependence on individual more localised or regional efforts rather than considering the national governance umbrella (National eHealth Strategy 2011). National policy is intended to supervise eHealth processes and projects and set the practice standards for all healthcare authorities across the

country. Exchanging health information between providers was reported as a barrier due to the lack of technical integration – the interoperability and compatibility - of the different eHealth systems (Aldosari 2014). Governance considerations in the field of digital health were found to be pivotal in a recently published qualitative systematic review conducted by Ekeland and Linstad (2020). This further supports the findings of this doctoral programme of research.

6.2 Originality of the research

Original findings of eHealth acceptance in the KSA have been generated from this research and would potentially impact the professional practice of healthcare.

First phase: Registering and publishing the systematic review provides evidence of the originality of this work as no previous studies of the topic within KSA context have been reported. The findings were original as they draw a holistic picture of all potential factors that influence eHealth acceptance from many sources. No previous paper had given this comprehensive overview.

Second phase: Two originalities were generated. The first was employing the UTAUT model as a theoretical framework to help explain the results in the healthcare sector of KSA. Second was the use of social media to support the study as a novel approach. The high level of adoption of social media platforms across KSA population was utilised to distribute the online questionnaire in order to reach a wider community of the target group.

Third phase: This phase was conducted in Aseer province, KSA which adds to the body of knowledge on eHealth in KSA. The originality evidenced was exploring eHealth practice in a new part of the country. No published literature around eHealth in Aseer has been found in the well-established electronic databases. In addition, The UTAUT constructs were applied as umbrella domains to host all the pre-defined themes for further analysis which again is a first for KSA.

6.3 Role of the researcher

The literature shows the substantial role of the researcher in designing and conducting the research process. This includes the researcher's background, their training, their supervisory support, their environment, family and peer support, their familiarity with the context of the research and their existing network of contacts. It also requires reflection and self-awareness as well as cognisance of how the researcher can impact the whole research journey.

This role differs based on the adopted approach (Fink 2000). In quantitative studies, the sample size is usually large. Participation is anonymous and data are collected through an instrument that allows participants to act independently with no central role of the researcher beyond survey design. Analysis of quantitative data normally goes through pre-determined systematic and structured steps using an analysis tool such as the Statistical Package for Social Sciences (SPSS). Unlike the quantitative studies, the qualitative researcher plays a crucial role in collecting and interpreting data in a way that promotes understanding of the phenomena under investigation (Xu and Storr 2012). The sample size in qualitative research is limited to few respondents that are not anonymous to the researcher and data are generated through direct interaction between the respondent and the researcher (Fink 2000).

In this current study, steps were taken to reflect the role of the main researcher throughout the study. Prior to commencing with collecting data of both the quantitative and the qualitative phases of this research, a proposal of the study was submitted by the researcher to the Ethical Review Panel, School of Pharmacy and Life Sciences at Robert Gordon University and the Ethics Committee, Ministry of Health, Kingdom of Saudi Arabia to gain the ethical approval to conduct the study. The researcher read widely and deeply around the research area and received both formal and self-directed training in the research methodologies and methods. To encourage more participation in quantitative phase, and free and open expression of views in the qualitative phase, respondents to both questionnaire and interviews were assured by the researcher that their anonymity and all information that may reveal their identity would be strictly protected. All participants were given the chance to discuss any concerns prior to participation

and were given contact details of the principal researcher as well as the other team members. All collected data were stored and processed according to the regulations of the Robert Gordon University Research Governance policies (RGU Research Governance Policy 2014). Prior to interview sessions, some concerns about audio-recording were raised. The researcher explained individually to all participants why recording is required and how this material would be stored and subsequently destroyed after reporting the anonymised results. A professional rapport was established with the interviewees and there was no pressure on them to disclose any sensitive information. However, it was observed that some interviewees were hesitant to speak freely about the top management support. As requested, some interviewees were given the opportunity to review the transcript of their responses and have the final say on any changes. Upon interpretation, steps to reduce risk of bias and subjectivity were taken. Translation from Arabic to English which was done by the researcher was back-translated by an independent researcher. Full interpretation and quotes were discussed within the team before final presentation of findings. Throughout the doctoral research the researcher was encouraged to seek peer review through dissemination and exposure to the wider research community.

6.4 Impact of the research

Impact of this research extends to embrace health managers, healthcare organisations, patients, and academia. Understanding the factors that influence eHealth acceptance has the potential to give health managers confidence to deal with the challenges of implementing eHealth and plan more effectively for future work. This would also encourage health managers to engage in eHealth research projects and contribute to the growth of publications in order to improve the working practices and promote better patient care. The organisational impact includes informing decision makers and health policy planners about the challenges in the field of eHealth and technology acceptance in the healthcare sector and priorities for consideration. That would add to the national eHealth strategy and room for improvement would be highlighted for further action. Patients are the most important link in the chain in the process of eHealth improvement. This study has brought into light factors that are of relevance to the role of eHealth

interventions and the wide range of benefits from adopting them including promoting patient safety, increasing the quality of healthcare delivery, and granting ease of access to healthcare services especially for patients in rural areas. In academia, the research findings have been presented in national and international conferences in oral and award winning poster presentations. Several publications out of this work have been published in peer reviewed high impact factor journals which include the published systematic review protocol, full paper, conference proceedings, and abstracts. The work will continue to evidence original contribution as an additional paper from phase two is currently under review with the journal of Computer Methods and Programs in Biomedicine. Another paper from phase three is also under development and target publishing with the journal of Health and Technology. These papers may contribute to the improvement of the national eHealth strategy plans in the KSA.

6.5 Future work

Several potential future research works would be extended from this doctoral research including three priority studies that could have a great impact on the healthcare sector in KSA.

Study 1) aims to investigate the views of health professionals who work for the MOH (physicians, nurses, pharmacists, … etc) towards accepting eHealth services in KSA

Inclusion criteria:

1. This study could target groups of health professionals who work for the MOH, or
2. Health professionals who work for private healthcare sector or healthcare institutions that are run by other governmental authorities

Methodology: Quantitative cross-sectional survey. This study will adopt UTAUT with modification as a theoretical framework and will be informed by the findings of the systematic review conducted by Alshahrani et al. (2019)

Method: Online questionnaire

Study questions:

1. What are the factors that influence health IT professionals' acceptance of eHealth services in KSA?

2. What UTAUT constructs are of significance to the health IT professionals' behavioural intention to utilise eHealth services in the KSA?

3. What UTAUT constructs are of significance to the health IT professionals' actual use of eHealth services in the KSA?

Study 2) aims to investigate the views of health IT professionals who work for the MOH towards accepting eHealth services in KSA

Inclusion criteria:

1. This study could target health IT professionals who work for the MOH, or
2. Health IT professionals who work for private healthcare sector or healthcare institutions that are run by other governmental authorities

Methodology: Quantitative cross-sectional survey. This study will adopt UTAUT with modification as a theoretical framework and will be informed by the findings of the systematic review conducted by Alshahrani et al. (2019).

Method: Online questionnaire

Study questions:

1. What are the factors that influence health IT professionals' acceptance of eHealth services in KSA?

2. What UTAUT constructs are of significance to the health IT professionals' behavioural intention to utilise eHealth services in the KSA?

3. What UTAUT constructs are of significance to the health IT professionals' actual use of eHealth services in the KSA?

Study 3) Extends the research into new geographical settings. Baha, Jazan, and Najran provinces are being chosen for financial and time considerations as they are on the border to Aseer province (Figure 6.1). eHealth published literature showed that these provinces have never been explored before in eHealth research and the geography contains many rural and remote areas that would greatly benefit from eHealth services. This study aims to explore the views of health managers who work for the MOH in Baha, Jazan, and Najran provinces towards accepting eHealth services in KSA

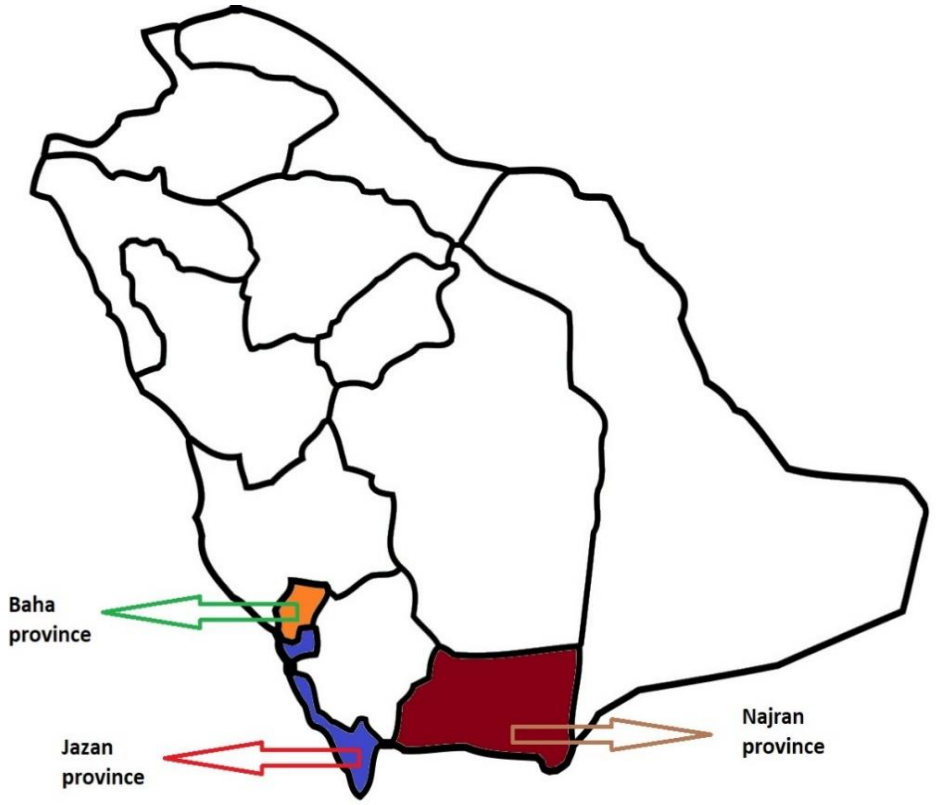


Figure 6.1: Map of Baha, Jazan, and Najran provinces, KSA

Inclusion criteria:

All professionals from multiple disciplines such as health professions, information Technology (IT), and management that work for MOH healthcare facilities in Baha, Jazan, and Najran provinces were eligible to participate if involved in a managerial role

Methodology: Qualitative phenomenological methodology. This study will deductively adopt the pre-defined themes from the systematic review conducted by Alshahrani et al. (2019) and the findings from the quantitative phase of this doctoral research to inform the interview questions. The four UTAUT constructs will be used as umbrella domains

Method: In-depth face to face and telephone interviews

Study questions:

1. What do health managers in Baha, Jazan, and Najran provinces know about eHealth services in the KSA?
2. What advantages or disadvantages do health managers in Baha, Jazan, and Najran provinces think that eHealth services can bring to healthcare system in the KSA?
3. What factors do health managers in Baha, Jazan, and Najran provinces think are of significance to influence the acceptance of eHealth services in the KSA?
4. What do health managers in Baha, Jazan, and Najran provinces think about resources that are needed to enhance the acceptance of eHealth services in the KSA?

6.6 Conclusion

Although my previous experience was mainly in the health services administration field, I have been privileged to take this opportunity to study the acceptance of eHealth and contribute to the role of health technology in shaping the future of healthcare in KSA. Before I started, I thought I should have had at least a degree

in computer sciences to understand what eHealth is. By the time, I learned that it is not just about computing skills but more of a multidisciplinary field that is very challenging to explore.

All objectives set for each of the phases have been achieved. The original findings that were generated from the three phases of this doctoral research have bridged the identified knowledge gaps and recommended further studies in the future. Seventeen themes of factors were identified in the first phase have informed the aim and questions of the second phase. The UTAUT model was used to explain findings of the second phase which showed significance of Performance Expectancy and Social Influence to the Behavioural Intention as well as the Performance Expectancy and Facilitating Conditions to the actual Use Behaviour. However, some ambiguous results were recorded. These findings had been placed under further investigation in the third phase to explain the ambiguity in the results. The third phase findings confirmed the previous findings of all potential factors that influence health managers acceptance of eHealth services in KSA.

The findings were in line with the National eHealth Strategy, MOH, KSA (National eHealth Strategy 2011) with relation to identifying the benefits that will impact patients, professionals, and healthcare providers. The strategy set both eHealth governance and the roadmap for the transition into digital health practice in order to serve the geography across the country. This study of both findings and recommendations may draw a general overview of all potential challenges leading eHealth practices. They could also work as a foundation base to prepare many stakeholder groups including health managers for accepting eHealth services and effectively utilising health technology interventions as key concepts in making successful and positive transformational change.

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APPENDICES

Appendix: 2.1: Ethical approval for conducting phase 2 & 3 of this research. School of Pharmacy and Life Sciences, RGU

ROBERT GORDON UNIVERSITY ABERDEEN

SCHOOL OF PHARMACY & LIFE SCIENCES
Robert Gordon University
Sir Ian Wood Building
Garthdee Road
Aberdeen
AB10 7GJ
United Kingdom
Tel: 01224 262500/2800
www.rgu.ac.uk

Ref: S72

Dear Abdullah

Re.: An exploration of factors influencing the adoption and acceptance of eHealth in Saudi Arabia: a Health Managers' perspective.

The School Research Ethics Committee has assessed your application and the overall decision is that there are no ethical issues with your project. However, they have provided some comments that you may find useful going forward.

I can now confirm that you are able to proceed with your research and any further ethics applications.

Should there be any amendments to this project during the research we would advise you to consult with the convener of the ethics committee as to whether a further ethical review would be required.

Please use the reference number above in any future correspondence.

We wish you success with your project.

Regards

Convener of the School Ethics Review Panel

Appendix: 2.2: Preliminary approval letter to conduct the study, MOH, KSA (Two letters in English and Arabic)

Kingdom of Saudi Arabia
Ministry of Health
General Directorate for Research and Studies
(GDRS)

Robert Gordon University
School of Pharmacy & Life Science
United Kingdom

Date: 17/07/2017

Subject: To facilitate the mission of Mr. Abdullah Mohammed H. Alshahrani
Academic No.: 1417920

To whom it may concern

Dear Sir/Madam,

This is to inform you that This is a preliminary approval letter to ***Mr. Abdullah Mohammed H. Alshahrani,*** who submitted an application to The General Directorate for Researches and Studies, Ministry of Health, Kingdom of Saudi Arabia (***GDRS-MoH***) to conduct his research project titled ***"An exploration of factors influencing the adoption and acceptance of e-Health in Saudi Arabia: a Health Managers' perspective"*** as a part of his Ph.D degree thesis at General Directorate of Health Affairs, Aseer Region, KSA to be started from April 2018 to August 2018 ***(1st. Phase)*** and from April 2019 to August 2019 ***(2nd. Phase)***.

Please note that according to our rules and regulations, the proposal needs to be accepted by MoH scientific and ethical reviewing committees prior conducting the study at MoH facilities.

Yours Faithfully,,,,,

Assistant Director
General Directorate for Research and Studies

Athari F. Alotaibi

Phone: +966114735038 Fax: +966114735039 P.O. Box: Riyadh 2775 Postal Code: Riyadh 11176
e-mail: research@moh.gov.sa

المملكة العربية السعودية
الإدارة العامة للبحوث والدراسات
وزارة الصحة

١٤٣٨/١٠/٢٣هـ الموافق ٢٠١٧/٧/١٧م

موافقة مبدئية على إجراء دراسة

المحترم **سعادة / الملحق الثقافي السعودي – لندن**

السلام عليكم ورحمة الله وبركاته،،،

إشارة إلى موضوع الطالب/ **عبدالله محمد حسن الشهراني**، المبتعث من وزارة الصحة (الشؤون الصحية بمنطقة عسير) لدراسة درجة الدكتوراه في تخصص "**إدارة صحية/ معلوماتية صحية**" بكلية الصيدلة وعلوم الحياة - بجامعة روبرت جوردون – أبردين، بالمملكة المتحدة، رقم الهوية الوطنية (١٠٠٠٨٣٨٩١٠)، والرقم الأكاديمي (١٤١٧٩٢٠) وعنوان الرسالة: " **إستكشاف العوامل المؤثرة على تبني وقبول الصحة الالكترونية في المملكة العربية السعودية من منظور المدراء الصحيين**".

نحيط سعادتكم علماً بأن هذه موافقة مبدئية من الإدارة العامة للبحوث والدراسات بوزارة الصحة على إجراء هذا البحث لجمع المعلومات والبيانات اللازمة من الشؤون الصحية ومستشفيات منطقة عسير على مرحلتين: المرحلة الأولى تبدأ في أبريل ٢٠١٨م إلى أغسطس ٢٠١٨م، والمرحلة الثانية تبدأ في أبريل ٢٠١٩م إلى أغسطس ٢٠١٩م، على أن لا يسمح للطالب بجمع بيانات الدراسة من منشآت وزارة الصحة إلا بعد إستيفاء جميع المستندات المطلوبة لتسهيل مهمته من الإدارة العامة للبحوث والدراسات وكذلك الحصول على موافقة لجنة الأخلاقيات بالوزارة على البحث وتوقيع إتفاقية المشاركة في البيانات.

وقد أعطي هذا الخطاب بناءً على طلبه لتقديمه للملحقية الثقافية السعودية في لندن.

وتفضلوا بقبول أطيب التحيات ،،،

مساعد مدير عام الإدارة العامة للبحوث والدراسات

١٠/٢٤

ص. عذاري فيصل العتيبي

الرمز البريدي: ١١١٧٦ ص.ب الرياض: ٢٧٧٥ فاكس: ٠١١٤٧٣٥٠٣٨، هاتف: ٠١١٤٧٣٥٠٣٩،
e-mail: research@moh.gov.sa

Appendix: 2.3: Ethical approval letter for conducting phase 2 & 3 of this research. MOH, KSA

Kingdom of Saudi Arabia
Ministry of Health
King Fahad Medical City
(162)

مدينة الملك فهد الطبية
King Fahad Medical City

المملكة العربية السعودية
وزارة الصحة
مدينة الملك فهد الطبية
(١٦٢)

IRB Registration Number with KACST, KSA: H-01-R-012
IRB Registration Number with OHRP/NIH, USA: IRB00010471
Approval Number Federal Wide Assurance NIH, USA: FWA00018774

May 23, 2018
IRB Log Number: 18-259E
Department: External
Category of Approval: EXEMPT

Dear Abdullah Alshahrani,

I am pleased to inform you that your submission dated May 17, 2018 for the study titled **'An exploration of factors influencing health managers' acceptance of eHealth services in Saudi Arabia'** was reviewed and was approved according to ICH GCP guidelines. Please note that this approval is from the research ethics perspective only. You will still need to get permission from the head of department or unit in KFMC or an external institution to commence data collection.

We wish you well as you proceed with the study and request you to keep the IRB informed of the progress on a regular basis, using the IRB log number shown above.

Please be advised that regulations require that you submit a progress report on your research every 6 months. You are also required to submit any manuscript resulting from this research for approval by IRB before submission to journals for publication.

As a researcher you are required to have current and valid certification on protection human research subjects that can be obtained by taking a short online course at the US NIH site or the Saudi NCBE site followed by a multiple choice test. Please submit your current and valid certificate for our records. Failure to submit this certificate shall a reason for suspension of your research project.

If you have any further questions feel free to contact me.

Sincerely yours,

F M Approved 23 MAY 2018 I R B

Prof. Omar H. Kasule
Chairman, Institutional Review Board (IRB)
King Fahad Medical City, Riyadh, KSA
Tel: + 966 1 288 9999 Ext. 26913
E-mail: okasule@kfmc.med.sa

Appendix: 2.4: Certificate of completion, protecting human research participants. An online training course provided by the National Institute of Health (NIH)

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Abdullah Alshahrani** successfully completed the NIH Web-based training course "Protecting Human Research Participants."

Date of Completion: 05/03/2018

Certification Number: 121334

NIH National Institutes of Health
Office of Extramural Research

Appendix: 3.1: Protocol registration of the systematic review, PROSPERO

NIHR | National Institute for Health Research

PROSPERO
International prospective register of systematic reviews

Status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia: a systematic review protocol

Abdullah Alshahrani, Katie MacLure, Derek Stewart

Citation

Abdullah Alshahrani, Katie MacLure, Derek Stewart. Status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia: a systematic review protocol. PROSPERO 2017 CRD42017065009 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42017065009

Review question

What are the views of health professionals, health managers and health IT professionals towards eHealth status in KSA?
What are the main factors that influence eHealth adoption and acceptance in KSA from perspectives of health professionals, health managers and health IT professionals?
What are the main facilitators and barriers to implementing eHealth in KSA from perspectives of health professionals, health managers and health IT professionals?
What methods have been adopted to eHealth research in KSA?

Searches

• Search Databases:
The following databases were chosen to be the source based on their reputation in the topic of this review and on the variety of citations which cover wider publication and topics.
1. MEDLINE
2. Web of Science
3. Association for Computing Machinery (ACM)
4. Google Scholar
5. ScienceDirect
Database Focus
MEDLINE: Medicine, Nursing, Dental, Clinical, Health and Biomedicine Science
Web of Science: Science, Technology, Social and Humanities, and Health Informatics
Association for Computing Machinery (ACM): Technology, Innovation, Computing Science, and Project Management
Google Scholar: Business Administration, Management, Social and Life Sciences.
ScienceDirect: Science, Technology. Computing, and Healthcare research
• Search language:
This literature is restricted to studies that were conducted in English language only, as English has been proven to be the primary language for eHealth articles in GCC region (Weber et al. 2016).
• Search period:
All published as peer reviewed articles will be included: Conference abstracts, blogs, books chapters and health websites contents will be excluded. The search will include peer reviewed articles published between January 1993 and May 2017 (1993 is known to be the year telemedicine and Internet Technology introduced in Saudi Arabia (Al-Tawil, 1999) and, therefore, was chosen to be the search starting date. May 2017 is the anticipated start date of this systematic review which makes it the proposed end date for the searching period).
• Terms to be searched:
The Search strategy aims to find published articles as follows:
1. An initial scoping search will be undertaken of all sources databases using the following terms ["eHealth" OR "e-health" OR "telemedicine" OR "telehealth"* OR "telecare" OR "remote health"]
AND ["health professionals" OR "health managers" OR "health IT professionals"
AND ["adoption" OR "acceptance" OR "barriers" OR "facilitators"]
AND ["Saudi Arabia"]
2. Key terms will be synonymised and a new search will be undertaken using the sub-terms as follows:
Key term
1. eHealth

1.1 E-health
1.2 telemedicine
1.3 telehealth
1.4 telecare
1.5 remote health
1.5 Summary (1 OR 1.1 OR 1.2 OR 1.3 OR 1.4 OR 1.5)
2. adoption
2.1 acceptance
2.2 barriers
2.3 facilitators
2.4 Summary (2 OR 2.1 OR 2.2 OR 2.3)
3. health professionals
3.1 health managers
3.2 health IT professionals
3.3 Summary (3 OR 3.1 OR 3.2)
4. Saudi Arabia
5. (1.5 AND 2.4 AND 3.3 AND 4)

All identified papers and articles will be screened and listed for further studies.

Types of study to be included

This systematic review will focus on peer reviewed primary published articles and literature. All types of study design will be included including quantitative, qualitative and mixed approaches.

Condition or domain being studied

The healthcare sector in Saudi Arabia

Participants/population

Inclusion:
1) Health professionals (Medical Doctors, Nurses, Midwives, Pharmacists, Dentists, all other Allied Health Professionals e.g. Radiology and laboratory technicians).
2) Health managers with primary responsibility for the health services, resources and partnership, many of them are clinicians who also work as managers as described by the World Health Organisation (WHO).
3) Health Information Technology (IT) professionals.
Exclusion:
IT professionals who do not have a role in any of the healthcare facilities in KSA.

Intervention(s), exposure(s)

Inclusion:
This systematic review aims to include all published articles and literature around eHealth adoption, acceptance, barriers, facilitators and research methods in Saudi Arabia from the perspective of health professionals, health managers and health IT professionals.
Exclusion:
1) Studies that demonstrate and focus on pure technological infrastructure and products such as: health technology applications and Internet of Things for health.
2) conference abstracts, blogs, books chapters and health websites contents.

Comparator(s)/control

There is no comparator for this review of eHealth in Saudi Arabia.

Context

The Saudi government have invested heavily in the strategic vision for 2030 which relies on the quality of digital and electronic based services. Therefore evaluation of the health services from views of multiple stakeholders is important.

Main outcome(s)

Likely to be qualitative studies identified therefore no measures or specific outcomes beyond the aim of the review

Timing and effect measures

None

Additional outcome(s)

None

Timing and effect measures

None

Data extraction (selection and coding)

Three reviewers will be working on this systematic review (AA, KM and DS)
1) All papers and studies with the targeted search terms will be screened by two reviewers (AA and KM), firstly based on titles, followed by abstracts and key words and finally by full text. A record will be kept of studies which are rejected along with reasons for exclusion. The full inclusion will be discussed with the third reviewer (DS) as well as any articles on which AA and KM fail to reach an agreement.

2) Inclusion and exclusion criteria will be set following the PRISMA guidelines and followed consistently by the team of reviewers with regular meetings to ensure the protocol is followed.
3) The following information will be extracted from the studies selected for inclusion:
- Author(s) details
- Year of publication
- Title of the study
- Details of publishing journal
- Aim
- Any definitions, for example, eHealth or health services manager
- Geographical setting
- Population
- Intervention
- Methodological approaches and methods
- Key findings

Risk of bias (quality) assessment

The Critical Appraisal Skills Program (CASP) will be utilised in this systematic review. This helps to minimise the risk of bias by evaluating the methodological quality by applying the CASP quality assessment tools on every study included in this review by two reviewers of the team.

Strategy for data synthesis

Step 1: Findings from data extraction phase will be put into a table to categorize them based on characteristics as listed above.
Step 2: Where quantitative data are homogenous, a meta-analysis will be conducted otherwise a narrative synthesis will be used to describe findings from all studies and present the range of evidence found from all study types.

Analysis of subgroups or subsets

None

Contact details for further information

Mr Abdullah Alshahrani
a.m.h.alshahrani@rgu.ac.uk

Organisational affiliation of the review

Robert Gordon University
https://www.rgu.ac.uk

Review team members and their organisational affiliations

Mr Abdullah Alshahrani. Robert Gordon University
Dr Katie MacLure. Robert Gordon University

Professor Derek Stewart. Robert Gordon University

Type and method of review
Meta-analysis, Systematic review

Anticipated or actual start date
01 May 2017

Anticipated completion date
01 January 2018

Funding sources/sponsors
This review is part of a PhD study which is mainly funded by the Ministry of Health, Saudi Arabia

Conflicts of interest
None known

Language
English

Country
England, Saudi Arabia

Stage of review
Review Completed published

Details of final report/publication(s)

International Journal of Medical Informatics. Volume 128, August 2019, Pages 7-17

Review article. A systematic review of the adoption and acceptance of eHealth in Saudi Arabia: Views of multiple stakeholders. Abdullah Alshahrani, Derek Stewart, Katie MacLure.
https://www.ScienceDirect.com/science/article/pii/S1386505618307226

Subject index terms status
Subject indexing assigned by CRD

Subject index terms
Humans; Research; Saudi Arabia; Telemedicine

Date of registration in PROSPERO
01 May 2017

Date of publication of this version
23 October 2019

Revision note for this version
This systematic review has been published.

Details of any existing review of the same topic by the same authors

Stage of review at time of this submission

Stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	Yes
Formal screening of search results against eligibility criteria	Yes	Yes
Data extraction	Yes	Yes
Risk of bias (quality) assessment	Yes	Yes
Data analysis	Yes	Yes

Revision note

This systematic review has been published.

Versions

01 May 2017
23 October 2019

Appendix: 3.2: Poster presentation award, HIMSS conference, KSA, 2018

HIMSS Saudi Arabia
CONFERENCE & EXHIBITION 2018

Certificate of a Poster Presentation Award

This is to certify that

Abdullah Alshahrani, Derek Stewart and Katie MacLure

has received an outstanding poster presentation award entitled

Factors influencing health managers' acceptance of eHealth services in Saudi Arabia

at the HIMSS Saudi Conference and Exhibition 2018
at the Four Seasons Hotel Riyadh, Kingdom of Saudi Arabia on
9 October 2018

Organising Partners:

وزارة الصحة
Ministry of Health

Harold 'Hal' Wolf III
President & CEO
HIMSS

HIMSS
Middle East

Appendix: 4.1: Online questionnaire

An exploration of factors influencing health managers' acceptance of eHealth services in Saudi Arabia

Page 1: Information sheet

Dear participant,

Electronic health (eHealth) is defined as the use of Information and Communication Technology (ICT) for healthcare. Literature on eHealth in the Kingdom of Saudi Arabia (KSA) has documented a wide range of benefits, such as improving the quality and efficiency of healthcare services, cost reduction, and inter- and intra-organisational communications. In this survey which is being conducted as part of a PhD research study sponsored by the Ministry of Health (MOH), KSA and supervised at Robert Gordon University (RGU), Aberdeen, UK, we aim to explore factors that influence health managers' acceptance of eHealth services in KSA such as but not limited to:

- Electronic Medical Records (EMRs)
- Telemedicine
- E- Prescription
- Electronically-based work packages such as E-Statistics, E-Learning, and email communications

Please note:

- Professionals from multiple disciplines such as: health professions, management, and health IT are eligible to participate **IF** currently or previously involved in a managerial role at any healthcare facility in KSA
- Your participation is completely voluntary and you can withdraw at any time before the submission
- Confidentiality of data, anonymity and personal information of all participants will be protected throughout the study. Access to this information will be restricted to the research team for academic uses only. All data will be stored, processed and

destroyed in accordance with Robert Gordon University Research Governance and Integrity Policy

- The questionnaire should take no longer than 10 minutes to be completed
- There are no direct benifits to you for participating, however, your input will be invaluable as to help promoting the acceptance of eHealth services in KSA
- The study has been approved by the Ethics Review Panel, School of Pharmacy and Life Sciences, RGU, UK and the Research Ethics Committee, MOH, KSA. However, should you have any queries or concerns about it, please contact the research team via the contact information below:

Abdullah Alshahrani, Doctoral Researcher, a.m.h.alshahrani@rgu.ac.uk,

Dr Katie MacLure, Principal Supervisor, k.m.maclure@rgu.ac.uk,

Prof Derek Stewart, Supervisor, d.stewart@rgu.ac.uk

Thank you very much in advance for your support and valuable participation.

Sincerely,

Abdullah M. Alshahrani
PhD candidate,
Robert Gordon University, Aberdeen, UK
email: a.m.h.alshahrani@rgu.ac.uk
Mobile: +966504784341 (KSA) or +447586841010 (UK)

Page 2: Demographics, please indicate your:

1. Gender: * *Required*

- ○ Male
- ○ Female
- ○ Prefer not to say

2. Age: * *Required*

- ○ under 25 years old
- ○ 25 to 34 years old
- ○ 35 to 44 years old
- ○ 45 to 54 years old
- ○ 55 years and above

3. Number of years of work experience in managerial role: * *Required*

- ○ less than 5 years
- ○ 5 to 9 years
- ○ 10 to 14 years
- ○ 15 to 19 years
- ○ 20 years or more

4. Which of these best describes your managerial level: * *Required*

- ○ Top level manager e.g. Hospital Directors, CEO, CIO.
- ○ Middle level manager e.g. Heads of Department, Medical Directors, Health IT Managers.
- ○ Lower level manager e.g. Shift Supervisors, Administrators.
- ○ I do not know

4.a. What is your current job title?

5. What was the highest level of qualification you have obtained: * *Required*

- ○ High school diploma e.g. Health Institute
- ○ Associate degree e.g. Health Sciences College
- ○ Bachelor degree
- ○ Masters degree
- ○ PhD or Professional Doctorate

6. The location of the healthcare facility you work in: * *Required*

- ○ A city
- ○ An urban governorate
- ○ A rural governorate
- ○ A village
- ○ Other

6.a. If other, please specify:

Page 4: Acceptance and use of eHealth services:

7. This section aims to measure the intention to accept and use eHealth services. Please indicate your level of agreement with each statement: ✱ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 20 answer(s).

	strongly disagree	disagree	neutral	agree	strongly agree
eHealth services are useful for my work	☐	☐	☐	☐	☐
eHealth services enable me to accomplish my work more quickly	☐	☐	☐	☐	☐
eHealth services saves my time	☐	☐	☐	☐	☐
By using eHealth services, I will increase my chances of job promotion	☐	☐	☐	☐	☐
My interaction with eHealth services are clear and understandable	☐	☐	☐	☐	☐
It is easy to be skilful at using eHealth services	☐	☐	☐	☐	☐
eHealth services are easy to use	☐	☐	☐	☐	☐
Learning how to use eHealth services is easy	☐	☐	☐	☐	☐

People who influence my behaviour think that I should use eHealth services	☐	☐	☐	☐	☐
People who are important to me think that I should use eHealth services	☐	☐	☐	☐	☐
The senior management at my work place encourage using eHealth services	☐	☐	☐	☐	☐
In general, my work place gives importance and supports the use of eHealth services	☐	☐	☐	☐	☐
I have the resources necessary to use eHealth services	☐	☐	☐	☐	☐
I have the knowledge necessary to use eHealth services	☐	☐	☐	☐	☐
The eHealth services are not compatible with other electronic services I use	☐	☐	☐	☐	☐

A specific person (or group) is available for assistance with technical problems of eHealth services	☐	☐	☐	☐	☐
I intend to use eHealth services in the next 6 months	☐	☐	☐	☐	☐
I predict I would use eHealth services in the next 6 months	☐	☐	☐	☐	☐
I plan to use eHealth services in the next 6 months	☐	☐	☐	☐	☐
I frequently use technology and Internet at work	☐	☐	☐	☐	☐

Page 5: Factors influencing the acceptance of eHealth services:

8. In your opinion, please indicate the level of importance of the following factors to your acceptance of eHealth services, where 5 is most important and 1 is least important: * *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 17 answer(s).

	5 (most important)	4	3	2	1 (least important)
Availability of operational resources (computers, printers and internet connection)	☐	☐	☐	☐	☐
Availability of qualified human resources (Health Informaticians and IT support professionals)	☐	☐	☐	☐	☐
Educational factors (computer literacy, English proficiency, availability of technical training sessions)	☐	☐	☐	☐	☐

Organisational factors (size of the health facility, type, plans, policies, standards, vision, mission, eHealth implementation roadmap)	☐	☐	☐	☐	☐
Financial factors (economic feasibility, cost-effectiveness, start-up costs, systems' upgrade costs, on-going maintenance costs)	☐	☐	☐	☐	☐
Government legislation and constraints (integrated national system and national eHealth strategy)	☐	☐	☐	☐	☐
ICT infrastructure and readiness	☐	☐	☐	☐	☐
Trust in confidentiality, security, and data privacy of eHealth services	☐	☐	☐	☐	☐
Stakeholders' voice upon planning and feedback on preferences	☐	☐	☐	☐	☐
Quality of eHealth systems and applications	☐	☐	☐	☐	☐

Customisability of systems functions according to users' needs	☐	☐	☐	☐	☐
Connectivity of information systems under central supervision	☐	☐	☐	☐	☐
Availability of information and knowledge about eHealth services	☐	☐	☐	☐	☐
Uncooperative attitude and resistance to change of some professionals such as: managers, doctors, nurses, pharmacists, etc	☐	☐	☐	☐	☐
Willingness to use and utilise technology	☐	☐	☐	☐	☐
Technical ability and work experience	☐	☐	☐	☐	☐
Complexity of technology	☐	☐	☐	☐	☐

9. If you have any additional factors, general comments, or suggestions, please add them below:

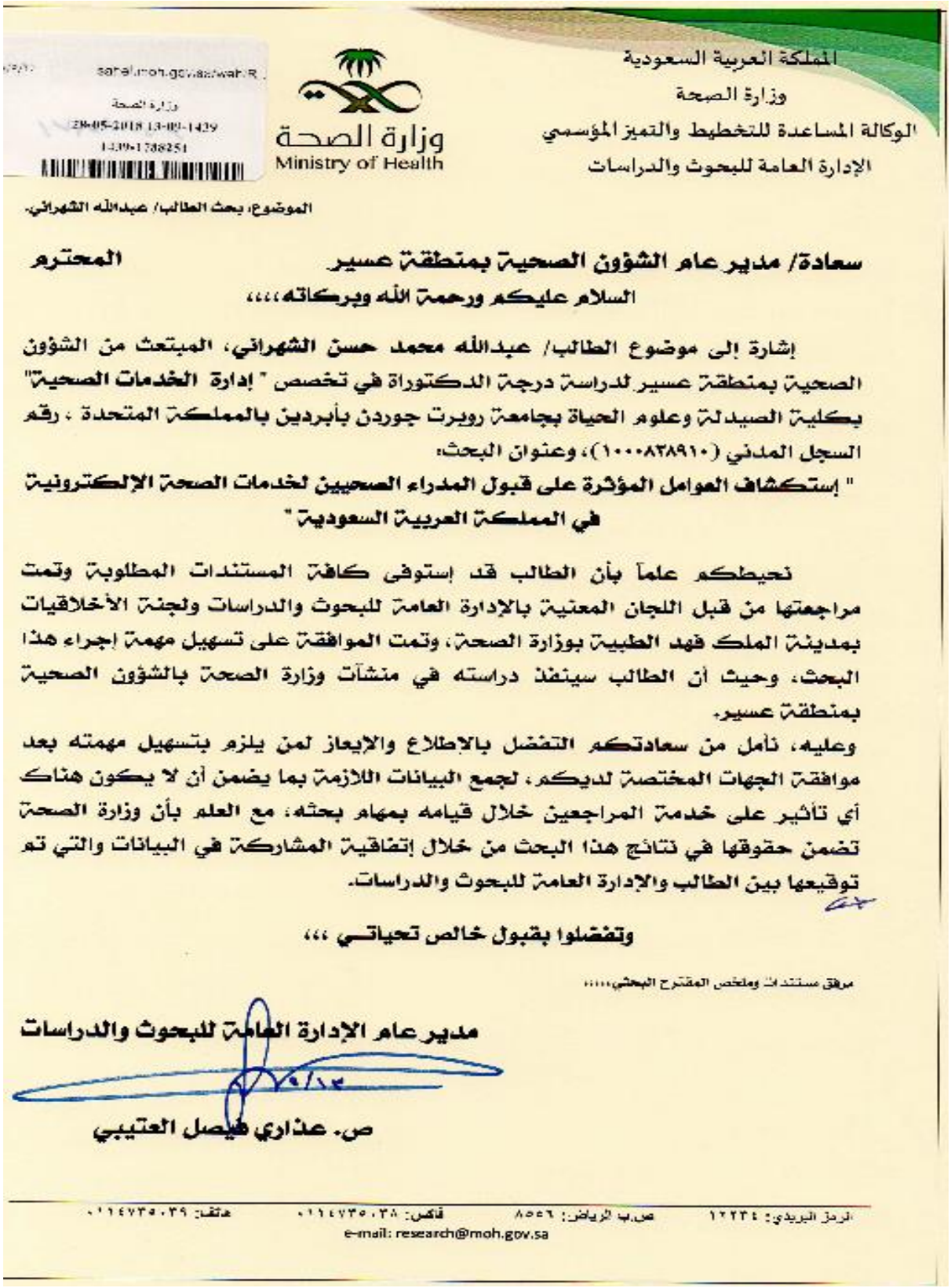
Page 6: Research plan in the next phase:

10. The research plan in the next phase requires further face to face and telephone interviews with sample of health managers in Aseer province. If you work in any MOH healthcare facility in Aseer province and would like to take part in the interviews, please enter your name and an email or mobile number below so that we can contact you later

13 / 14

Page 7: Thank you for your participation

Appendix: 5.1: Approval decision letter to conduct phase 3, addressed to the Director General of Health Affairs, Aseer province, KSA



المملكة العربية السعودية
وزارة الصحة
الوكالة المساعدة للتخطيط والتميز المؤسسي
الإدارة العامة للبحوث والدراسات

وزارة الصحة
Ministry of Health

الموضوع: بحث الطالب/ عبدالله الشهراني.

المحترم
سعادة/ مدير عام الشؤون الصحية بمنطقة عسير
السلام عليكم ورحمة الله وبركاته،،،

إشارة إلى موضوع الطالب/ عبدالله محمد حسن الشهراني، المبتعث من الشؤون الصحية بمنطقة عسير لدراسة درجة الدكتوراة في تخصص " إدارة الخدمات الصحية" بكلية الصيدلة وعلوم الحياة بجامعة روبرت جوردن بأبردين بالمملكة المتحدة ، رقم السجل المدني (١٠٠٠٨٣٨٩١٠)، وعنوان البحث:

" إستكشاف العوامل المؤثرة على قبول المدراء الصحيين لخدمات الصحة الإلكترونية في المملكة العربية السعودية "

نحيطكم علماً بأن الطالب قد إستوفى كافة المستندات المطلوبة وتمت مراجعتها من قبل اللجان المعنية بالإدارة العامة للبحوث والدراسات ولجنة الأخلاقيات بمدينة الملك فهد الطبية بوزارة الصحة، وتمت الموافقة على تسهيل مهمة إجراء هذا البحث، وحيث أن الطالب سينفذ دراسته في منشآت وزارة الصحة بالشؤون الصحية بمنطقة عسير.

وعليه، نأمل من سعادتكم التفضل بالاطلاع والإيعاز لمن يلزم بتسهيل مهمته بعد موافقة الجهات المختصة لديكم، لجمع البيانات اللازمة بما يضمن أن لا يكون هناك أي تأثير على خدمة المراجعين خلال قيامه بمهام بحثه، مع العلم بأن وزارة الصحة تضمن حقوقها في نتائج هذا البحث من خلال إتفاقية المشاركة في البيانات والتي تم توقيعها بين الطالب والإدارة العامة للبحوث والدراسات.

وتفضلوا بقبول خالص تحياتي ،،،

مرفق مستندات وملخص المقترح البحثي،،،

مدير عام الإدارة العامة للبحوث والدراسات

ص. عذاري فيصل العتيبي

الرمز البريدي: ١٢٢٣٤ ص.ب الرياض: ٨٥٥٦ فاكس: ٠١١٤٧٣٥٠٣٨ هاتف: ٠١١٤٧٣٥٠٣٩
e-mail: research@moh.gov.sa

Appendix: 5.2: Participant's information sheet

Research Title: An exploration of factors influencing health managers' acceptance of eHealth services in the Kingdom of Saudi Arabia

You are invited to take part in this research study. Please take time to read the information about this study as it is important for you to understand why it is being conducted and what it will involve. Please ask if there is anything that is not clear or if you would like more information. Take your time to decide whether or not you wish to take part.

Study overview and purpose

E-Health is defined as all forms of digital and electronic processes found in healthcare and provided via Information and Communication Technology (ICT) channels. This research study has been carried out in three phases. First phase was a systematic review to present the available evidence on the status of eHealth adoption and acceptance in the Kingdom of Saudi Arabia (KSA) from the perspectives of multiple stakeholders. Second phase was informed by the findings from phase 1 and aimed to determine the main factors that influence health managers' acceptance of eHealth services in KSA. The third phase will be informed by the findings from phase 2 and aims to explore more in-depth the factors that influence health managers' acceptance of eHealth services in Aseer Province, KSA through face-to-face interviews.

Research team

The main researcher of the study (Abdullah Alshahrani) is a specialist health services & hospitals administration at the General Directorate of Health Affairs, Aseer province, KSA. Abdullah is currently studying at Robert Gordon University (RGU), Aberdeen, UK and this study is part of his work towards the submission for a Doctor of Philosophy qualification from the university. Abdullah is supported by experienced RGU academics, principal supervisor Dr Katie MacLure, a Senior Research Fellow & Lecturer with wide range of experience in eHealth, IT, and research methodologies; and Professor Derek Stewart, a Professor of Pharmacy Practice with wide experience in research methodologies, strategies, and development.

Why have I been chosen?

Professionals from multiple disciplines such as: health professions, management, and health IT who are currently involved in a managerial role at Ministry of Health (MOH) healthcare facilities in Aseer province, KSA will be invited to take part in this research study.

Do I have to take part?

No. your participation in this study is completely voluntary. However, you still can withdraw at any time without giving a reason. Your relationship with the research team or MOH will not be affected by your decision to take part or not.

What will happen to me if I take part?

If you decide to take part, you will be given this information sheet to keep and will be asked to sign an informed consent form. An interview will be arranged for a date and time convenient for you and will last approximately 20-30 minutes. The interview will be digitally recorded for the research purposes only.

What are the possible benefits of taking part?

There is no direct benefit to you from participating in this study. However, your input will be invaluable to help promoting the acceptance of eHealth services in KSA.

Will my contribution to this study be kept confidential?

The confidentiality and anonymity of personal information of all participants will be strictly protected. No names will appear on any report and the information given will be used only anonymously in presentation and publication of findings.

Who has reviewed the study?

Ethical approvals to conduct this study were gained from the Ethics Review Panel, School of Pharmacy and Life Sciences, RGU, UK and the Research Ethics Committee, MOH, KSA.

What if I have a questions complain?

If there is anything that is not clear or if you would like to have more information about any aspect of this study, please contact Mr Abdullah Alshahrani vial email: a.m.h.alshahrani@rgu.ac.uk and we will be happy to answer all your questions to the best of our knowledge.

For any complaints about how interviews were dealt with, please address them to Dr Katie MacLure via email k.m.maclure@rgu.ac.uk or by phone +441224262556.

On behalf of the research team, I thank you for your time to read this information sheet and consideration to take part in the study.

Best Regards

Abdullah Alshahrani
PhD candidate
Robert Gordon University, Aberdeen, UK
Email: a.m.h.alshahrani@rgu.ac.uk

Appendix: 5.3: Participant's consent form

Participant consent form

An exploration of factors influencing health managers' acceptance of eHealth services in the Kingdom of Saudi Arabia

	Please **initial** where you agree
I confirm that I have read the participant information sheet for the above named study. I have had the opportunity to ask questions where needed.	☐
I understand that my participation is voluntary and that I am free to withdraw from the study at any time, without giving any reason	☐
I agree to take part in the above named study.	☐
I agree to my interview being audio-recorded.	☐
I understand that data collected may be used for research purposes including publication of anonymised findings and quotations.	☐

Name of participant: Date: / / 20 Signature:

Name of researcher: Date: / / 20 Signature:

Appendix: 5.4: Interviews questions guide

Interview questions

1. What do you know about eHealth services in Saudi Arabia? (eHealth national strategy, implementation standards in your setting ....etc. and how did you hear about eHealth?
2. To what extent do you believe eHealth can play a role in shaping future healthcare? Explain please?
3. Which eHealth services are effective in your setting? Can you give example(s)?
4. How complicated or easy are eHealth services to use? Can you give example(s)?
5. What challenges or barriers are there to accepting/using eHealth services?
6. To what extent does your top management encourage you to use eHealth services? Could you give examples of eHealth implementation, please?
7. What benefits and advantages could using eHealth services bring to you or to your organisation?
8. What resources are needed to enhance the acceptance/use of eHealth services? Are these readily available? From where?
9. What steps could motivate and encourage your staff and yourself to accept and use eHealth services?
10. What training did you have prior to using eHealth services?
11. Do you think specific training courses on using eHealth services are needed? Shall they increase the acceptance and use of eHealth services? What do you suggest to include in the training courses (content of the course)?
12. How confident are you in your computing skills? Has that affected your acceptance/use of eHealth services? Has it affected your staff use of eHealth?
13. Looking at the factor ranking, Could you explain why you think these factors are most important?
14. Do you have any additional comments you would like to add?