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Evaluating Patient and Health Care Provider Acceptance of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia

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Evaluating Patient and Health Care Provider Acceptance of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy

by

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In the name of Allah, the most Gracious, the most Merciful

"…O My Lord, increase me in knowledge" Surah Taha. Verse 114

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Abstract

EVALUATING PATIENT AND HEALTH CARE PROVIDER ACCEPTANCE OF A PERSONAL HEALTH RECORD IN AN INTEGRATED HEALTH CARE SYSTEM IN THE KINGDOM OF SAUDI ARABIA

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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With the shift to patient- and person-centered care, personal health records (PHRs) have been touted as a strategy to empower patients, improve patient-provider communication, and support self-management. Health care organizations around the world have implemented PHRs in a global push to meet three aims of health care—improve access to care, reduce costs, and increase the quality of care. The capabilities that PHRs support vary by organizations, yet basic functions include allowing patients to view their laboratory results, refill prescription medications, and request appointments. More advanced PHRs enable patient-centered communication through secure messaging.

As the burden of chronic disease grows, PHRs are expected to provide individuals with the health information needed to track their health status and stimulate shared decision-making. Although many health care organizations have PHRs, adoption by patients has been low. Various reasons have been identified, including a lack of health care provider support. Most research has focused on the patient perspective since patients are seen as the primary users. The goal of this research was to better understand patient and health care provider adoption of a PHR in a large government health system in the Kingdom of Saudi Arabia. This study was

guided by an adapted model of the unified theory of acceptance and use of technology (UTAUT), a widely used technology adoption model.

This study found that performance expectancy, effort expectancy, and attitude were significant predictors of patients' behavioral intention to use a PHR. Experience with health applications moderated the relationship between social influence and behavioral intention in patients. In health care providers, performance expectancy and attitude were significant predictors of behavioral intention to accept the PHR. Age, years of experience, and professional role did not moderate any relationships. For behavioral intention to accept secure messaging, performance expectancy and attitude were significant predictors. There were no moderating effects of age, years of experience, or professional role. This study provides useful insights for health care organizations, health care providers, and patients.

Chapter One: Introduction, Theory, and Research Objectives

Shifting Towards eHealth

Health care in the 21st century has been transformed by the power of the Internet. Patients and health care providers (HCPs) are increasingly engaging through eHealth tools. eHealth tools include health information systems, telemedicine, electronic health records (EHRs), personal health records (PHRs), clinical decision support tools, online or e-learning tools, and mobile devices (Deluca & Enmark, 2000; Gerber, Olazabal, Brown, & Pablos-Mendez, 2010; Lancaster et al., 2018). The term eHealth was first coined in 1999 to describe "the combined use of electronic communication and information technology in the health sector" (Schreiweis et al., 2019, p. 2). A global agenda was implemented for eHealth, "the electronic exchange of health-related data collected, generated, or analyzed," to improve the health status of patients (Deluca & Enmark, 2000, p. 4).

With the shift toward patient- and person-centered models of care, health care organizations are expected to implement health information technology (HIT) and eHealth tools to support daily self-management, positively impacting the knowledge and motivation of patients. In 2001, the Institute of Medicine (IOM) endorsed patient-centered care as one of the six aims for health care systems, along with safe, effective, timely, efficient, and equitable care (Institute of Medicine, 2001). Patient-centered care includes the following seven dimensions: (a) physical comfort; (b) coordination and integration of care; (c) information, communication, and education; (d) emotional support and alleviation of fear and anxiety; (e) respect for patients' values, preferences, and needs; (f) involvement of family and friends; and (g) attention to transitions and continuity of care (Lambert et al., 1997). In 2018, the Committee on Improving the Quality of Health Care Globally released the report *Crossing the Global Quality Chasm*

Improving Health Care Worldwide with a change from patient-centered to person-centered care to reflect the current view of providing holistic care to individuals rather than solely treatment of disease (National Academies of Sciences and Medicine, 2018). Person-centered care is a term first used in the field of geriatrics but has evolved and is now considered the gold standard for global health care (Brummel-Smith et al., 2016). It encompasses "the entirety of a person's needs and preferences, beyond just the clinical or medical" (Brummel-Smith et al., 2016, p. 15).

The American Geriatrics Society Expert Panel on Person-Centered Care recognized person-centered care as the health care provider supporting autonomy and individual choice in health care decisions with the essential elements of:

- Individualized, goal-oriented care based on the person's preferences
- Regular review of the goals and care plan
- Interprofessional team care with the patient as a central team member
- Sole primary health care provider as the point of contact
- Care coordination among all providers
- Communication and information sharing
- Education and training as needed for health care providers and the patient
- Quality improvement and performance measurement with feedback from the person and caregivers (Brummel-Smith et al., 2016)

PHRs are an eHealth tool to support patient- and person-centered care by encouraging patient engagement and empowerment through tracking of their personal health information (Huba & Zhang, 2012; Kildea et al., 2019; Reti, Feldman, Ross, & Safran, 2010; Wildevuur & Simonse, 2015). The concept of the PHR has been around for decades. Historically, patient records have been paper-based and sequestered in hospitals and clinics with patients only able to

access them by visiting the medical records departments and obtaining paper copies (Halamka, Mandl, & Tang, 2008). Individuals stored accumulated paper-based health documents in their homes in binders, envelopes, or shoe boxes (Detmer, Bloomrosen, Raymond, & Tang, 2008). The PHR became a way for individuals to store their health information electronically, making it easily accessible. It was created as a way to bring together health information that has traditionally been scattered among multiple health care providers and to allow tracking of health activities across an individual's lifespan (Markle Foundation, 2003).

PHR Definition and Capabilities

The Markle Foundation created the Connecting for Health collaborative to develop coordinated and standardized methods for individuals to have their integrated health information in a single place (Markle Foundation, 2003). They defined the PHR as "an Internet-based set of tools that allows people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it" (p. 3). However, there is no uniform definition of PHR. Various terms have been used interchangeably with PHR in the literature, including patient portal, patient web portal, computerized patient portal, patient accessible EHR, tethered PHR, and electronic PHR, to name a few. The broader term of PHR will be used predominantly throughout this dissertation. Following are definitions for the purpose of comparison.

Tethered PHR: "An online interface tied to an EHR with which patients may view and sometimes interact with their health data" (Heath, 2017, p. 8).

Patient portal: "A patient portal is a secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an internet connection. Using a secure username and password, patients can view health information such as recent doctor

visits, discharge summaries, medications, immunizations, allergies, and lab results" (Heath, 2017, p. 8).

Patient portal: "Provider-tethered applications that allow patients to electronically access his health information that is documented and managed by a health care institution" (Ammenwerth, 2018, p. 21).

PHRs capture information from an EHR, directly from the patient, or from other sources (Markle Foundation, 2003). The three PHR models are shown in Table 1 (Alsahafi & Gay, 2018; Detmer et al., 2008).

Table 1

Comparison of PHRs

	Standalone	Tethered	Integrated or Unified
Control of information stored in the record	Individual manually enters and maintains the data	Single health care provider	Multiple health care providers
Access	Individual has complete control and decides who can access parts of it	Health care provider owns the data and allows individual to gain access	Health care providers own the data and allow individuals some control (e.g., add or amend information, limit access to certain information)
Origin of information in the record	From any health care provider or self-generated	EHR from the health care provider	EHRs, insurance claims, pharmacy data, home diagnostics

Table 2 shows the categorization of the tethered PHR (portal) features by level based on Ammenwerth (2018). PHRs differ in the features available by health care organization. The most basic features allow patients to view discharge summaries, laboratory results, and medication information as shown in Level 1 on Table 2. The most advanced tethered PHRs

support communication with HCPs and disease-specific management and may include Level 2 and Level 3 features along with Level 1 features.

Table 2

Tethered PHR Features

Level 1	Level 2	Level 3
Discharge summaries	Appointment scheduling	Personal reminders
Laboratory values	Secure messaging	Clinical guidelines
Medication information	Prescription refills	Educational materials
	eVisits	Self-documentation
		Feedback

PHRs connect patients to health care organizations in a "hub and spoke model," allowing for the exchange of data (Kaelber, Jha, Johnston, Middleton, & Bates, 2008). Various stakeholders (e.g., patients, policymakers, health care providers, health care organizations) can benefit from PHRs through better care coordination, improved patient engagement and satisfaction with care, better patient-provider communication, and reduced costs (Halamka et al., 2008; Kaelber et al., 2008; Tang, Ash, Bates, Overhage, & Sands, 2006). The ultimate goal is a less fragmented system of accessing essential patient health data to promote optimal outcomes (Tang et al., 2006).

Secure messaging through PHRs is a feature offered increasingly by health care organizations (Heisey-Grove & Carretta, 2020). Integrating secure messaging with the PHR enables communication between HCPs and patients and their family members. Effective communication is a critical component of high quality health care delivery (National Academies of Sciences and Medicine, 2018). Secure messaging supports patient-centered care by contributing to patient-centered communication, which has been shown to improve outcomes through better satisfaction with care and greater treatment adherence (Heisey-Grove & DeShazo, 2020). Fundamental components of patient-centered communication are: (a) understanding the

patient perspective; (b) understanding the cultural and psychosocial contexts of the patient; and (c) shared decision-making to align health care with patient values (Naughton, 2018). Secure messaging contributes to patient-centered communication by allowing patients to communicate their questions and concerns directly to their health care team. HCPs may respond to patients or initiate communication to patients to ensure safe care outside of the clinical environment.

However, there has been resistance to this feature among some HCPs due to a variety of concerns, including privacy and security, loss of interpersonal contact, and increased workloads (Sieck et al., 2017). In a small study of physicians and allied health professionals, the authors found physicians expressed less value and greater doubt about the potential benefits of secure messaging than allied health professionals (Popeski et al., 2015). Understanding HCPs' acceptance of secure messaging will aid in the development and implementation of this form of communication.

Theoretical Foundation

Several theories and models have been used to explain individual acceptance and use of information technology based on technology attributes and contextual characteristics (Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2019). As technology is progressively used in health care, studies have been undertaken to better understand factors that drive the acceptance by end-users. The technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) have been two widely used models to understand technology acceptance in health care although they were developed outside of health care (Ammenwerth, 2019). TAM, developed in 1989 by Fred D. Davis, was based on the theory of reasoned action and hypothesizes that two constructs—perceived usefulness and perceived ease of use—affect attitude, which then influences behavioral intention to use the technology (Ajibade, 2018; Ammenwerth, 2018). The

basic TAM with two constructs is very intuitive and simplistic, which has led researchers to modify it by adding additional constructs to increase the predictive ability. The variance in behavioral intention to use technology in health care has ranged from 29%-70% with TAM (Holden & Karsh, 2010).

Despite the high predictive power of TAM, it has several limitations. Parsimony is both the strength and weakness of TAM (Bagozzi, 2007). The original TAM model is too simple to explain decisions to use technology across a wide range of technologies, environments, and end-users (Bagozzi, 2007). Subsequently, TAM2 was developed in 2008 to extend TAM by adding constructs related to cognitive instrumental processes (job relevance, output quality, result demonstrability), social influence (subjective norm, image, and voluntariness), and experience with all of them acting on perceived usefulness (Rahimi, Nadri, Lotfnezhad Afshar, & Timpka, 2018; Rondan-Cataluña, Arenas-Gaitán, & Ramírez-Correa, 2015). TAM3 further extended TAM2 by adding the constructs of computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability to influence perceived ease of use (Rondan-Cataluña et al., 2015). However, researchers also point to the fact that individual differences, such as age and education, can be important drivers of the acceptance and willingness to use technology but are not included in TAM (Ajibade, 2018).

For these reasons, this research was viewed through the lens of the unified theory of acceptance and use of technology (UTAUT). Venkatesh et al (2003) developed UTAUT to provide a comprehensive model to explain acceptance, intention, and usage of information technology in organizations. A strength of UTAUT is the integration of eight theories and models related to technology adoption and behavior (Venkatesh, Morris, Davis, & Davis, 2003). It is a synthesis the theory of reasoned action, TAM, motivational model, theory of planned behavior

(TPB), combined TAM-TPB, model of personal computer utilization, diffusion of innovation theory, and social cognitive theory. UTAUT was tested and validated using longitudinal data collected over six months from four organizations that introduced new technology. Subsequently, there was cross-validation with new data from two other organizations. UTAUT explained approximately 77% of the variance in behavioral intention and 52% of the variance in technology use (Venkatesh et al., 2003).

Since its development, UTAUT has been used to explain technology acceptance in different user groups in a wide-range of contexts with various technologies, strengthening the generalizability (Venkatesh, Thong, & Xu, 2012). UTAUT has also been used broadly in studies on health care technology adoption using the core constructs and exploring additional constructs and relationships to modify and extend it based on the context (Venkatesh, Thong, & Xu, 2016). The model explains end-users' intention to use a specific HIT with four constructs to represent the technological dimension (performance expectancy and effort expectancy) and organizational/environmental dimension (social influence and facilitating conditions). Table 3 shows the definitions of the constructs and the associated root constructs based on Venkatesh et al. (2003).

Table 3

UTAUT Constructs

Construct	Definition of construct	Root constructs
Performance expectancy	The degree an individual believes the technology will help him or her to improve in job performance	Perceived usefulness Extrinsic motivation Job-fit Relative advantage Outcome expectations
Effort expectancy	The degree of ease associated with use of the technology	Perceived ease of use Complexity Ease of use

Social influence	The degree an individual perceives important others believe he or she should use the new technology	Subjective norm Social factors Image
Facilitating conditions	The degree an individual believes an organizational and technical infrastructure exists to support use of the new technology	Perceived behavioral control Facilitating conditions Compatibility

Figure 1 shows the UTAUT model. The core constructs of performance expectancy, effort expectancy, and social influence directly influence behavioral intention to use a technology. The core construct of facilitating conditions directly influences actual use behavior of the technology. Behavioral intention to use technology is expected to have a positive influence on actual use behavior. The four moderators are gender, age, experience, and voluntariness of use. Gender moderates all constructs except facilitating conditions. Age moderates all constructs. Experience moderates all constructs except performance expectancy. The final moderator, voluntariness of use, only moderates social influence. Experience refers to the stage of technology use. Voluntariness of use reflects whether the context of technology use is mandatory or voluntary.

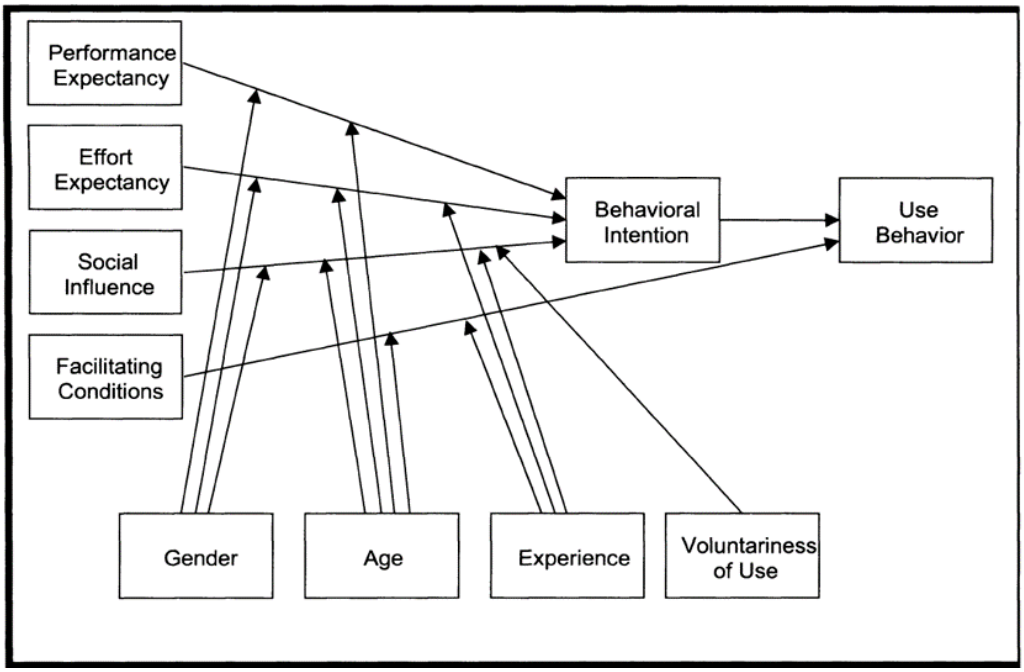

Figure 1. UTAUT (Venkatesh et al, 2003).

An expanded version of UTAUT was proposed for technology acceptance and use in the consumer context (Venkatesh et al., 2012). Venkatesh et al. (2012) suggested specific situations or contexts may require extensions of UTAUT with new constructs, moderators, or relationships. While in organizational contexts, performance expectancy drives employees' technology acceptance and use behavior, other factors were hypothesized to be primary motivators for consumers. Therefore, three additional constructs expected to be important drivers were added to UTAUT2—hedonic motivation, price value, and habit—as shown in Figure 2. Voluntariness of use was dropped as a moderator because technology use is not mandatory for consumers. Hedonic motivation is "the fun or pleasure derived from using a technology" and predicts the behavioral intention to use technology" (Venkatesh et al., 2012, p. 161). Price value is the tradeoff between the perceived benefits and cost for using a technology and is a predictor of behavioral intention. The final construct added was habit, the "extent to which people tend to perform behaviors automatically," and is a predictor of behavior intention (Venkatesh, Sykes, & Zhang, 2011, p. 161).

The revised model was shown to explain 74% of the variance of behavior intention and 52% of the variance in technology use in consumers, which is similar to what was seen in the original UTAUT framework (Venkatesh et al., 2012).

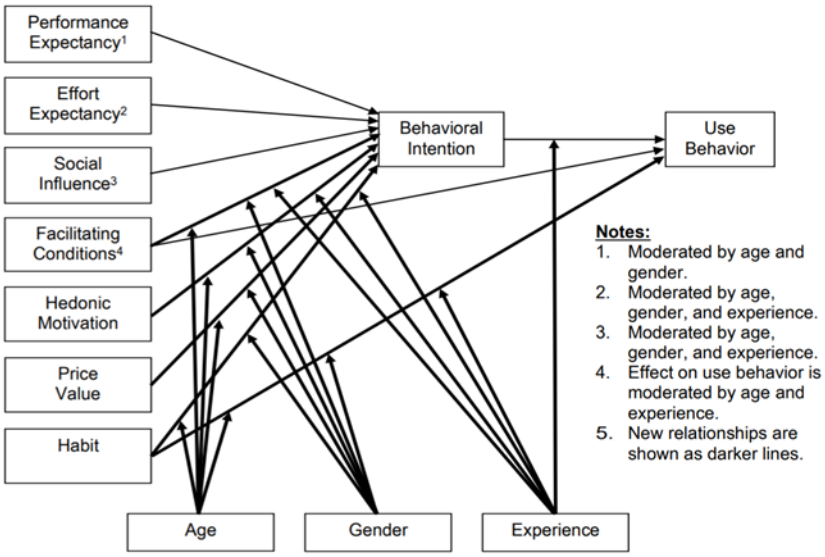

Figure 2. UTAUT2 (Venkatesh et al., 2012).

There has been substantial latitude in the application of UTAUT and UTAUT2. Using UTAUT as baseline model allows for the flexibility to adapt to each environment, making it invaluable in advancing generalizability across time, populations, and contexts (Venkatesh et al., 2011). Venkatesh et al (2016) proposed that future research should use UTAUT or UTAUT2 as a basic model, transforming the theory from static to dynamic. Therefore, this research tested the effects of a baseline UTAUT model with the constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions. Individual traits, such as attitude, are not included in UTAUT but, nevertheless, may explain the acceptance of technology (Dwivedi et al., 2019; Rosen, 2004; Venkatesh et al., 2012). This research sought to extend the model by using the construct of attitude.

Problem Statement

The redesign of health care called for by the World Health Organization (WHO) has driven the application of technology to health services globally. With the paradigm shift from disease-centered care to person-centered care, technology has played an increasingly important role in the 21st century "continuum-of-care-model" of health care (Deluca & Enmark, 2000, p. 4). eHealth, with its merging of HIT and direct access to clinicians, education, wellness, and care management, is vital to achieving the aims of this new paradigm of care (Deluca & Enmark, 2000).

After the WHO's call for implementation of eHealth initiatives around the world to support patient-centered care, the Kingdom of Saudi Arabia initiated its own national eHealth initiative in 2011 (Ministry of Health, 2018). The Ministry of Health actively adopted HIT to support health service delivery guided by the National Transformation Program, a critical component of Saudi Vision 2030 (Alshahrani, Stewart, & MacLure, 2019). Their theme is: "safe, efficient health system, based on the care centered on a patient, standard-oriented, and supported by the eHealth" (Ministry of Health, 2018, p. 1). The Ministry of Health's objective is to integrate and connect health care organizations, providers, and patients through eHealth.

PHRs are a recent phenomenon in the Kingdom of Saudi Arabia. The Ministry of National Guard Health Affairs (MNGHA), a large integrated health care system, implemented the MNGHA Care PHR in 2018. MNHGA Care allows patients to schedule appointments, request medical reports and prescription refills, view radiology reports, check laboratory results, and receive vaccination reminders ("MNGHA Care," 2020). Personal health information such as weight, blood pressure, blood sugar, and exercise details can be uploaded. A self-assessment

feature permits patients to enter information related to pain control, performance status, and quality of life. Finally, MNGHA Care contains links to health education information.

This research examined patient and HCP acceptance of the PHR. Since MNGHA Care does not have secure messaging, this study examined HCP acceptance towards adding this feature. The two-dimensional view is complementary and an important step in encouraging patient involvement and engagement in their health care through the use of the PHR. The three manuscripts included in this study attempted to provide a broader view of PHR acceptance. The first paper evaluated predictors of PHR acceptance among patients. The second paper assessed predictors of PHR acceptance among HCPs. The final paper evaluated the acceptance of HCPs to adding a secure messaging feature to the PHR.

Purpose of the Study

The purpose of this quantitative study was to investigate patients' and HCPs' acceptance of the PHR in order to improve the adoption by patients.

The specific objectives of this study were to:

1. Examine the behavioral intention of patients to use the PHR
2. Examine the behavioral intention of HCPs to recommend the PHR
3. Assess HCP reported barriers to PHR use
4. Examine the behavioral intention of HCPs to support the addition of a secure messaging feature to the existing PHR.
5. Assess HCP reported barriers to adding a secure messaging feature

Research Questions

Question 1: Does an adapted UTAUT model predict patients' behavioral intention to use the PHR?

Question 2: Does an adapted UTAUT model predict HCPs' behavioral intention to recommend the PHR?

Question 3: What barriers do HCPs believe prevent patient use of the PHR?

Question 4: Does an adapted UTAUT model predict HCPs' behavioral intention to support a secure messaging feature be added to the existing PHR?

Question 5: What barriers do HCPs believe will affect the acceptance of a secure messaging feature to the PHR?

Significance

There has been considerable research on acceptance of PHRs over the past two decades in various populations and settings, primarily from the patient perspective (Agarwal, Anderson, Zarate, & Ward, 2013; Emani et al., 2012; Graetz et al., 2018; Kharbat, Razmak, & Shawabkeh, 2017; Tenforde, Nowacki, Jain, & Hickner, 2012; Tulu et al., 2012; Wells, Rozenblum, Park, Dunn, & Bates, 2014; Yaacob et al., 2019). Despite the proposed benefits of PHRs, adoption has remained low around the world with estimates ranging from 0.13% in the United Kingdom to 10% in the United States (Abd-Alrazaq, Bewick, Farragher, & Gardner, 2019). Researchers have pointed to the role of the HCP in positively influencing adoption when they recommend use to patients (Abd-Alrazaq et al., 2019; Alanazi & Al Anazi, 2019; Hoogenbosch et al., 2018; Tang et al., 2006; Vydra, Cuaresma, Kretovics, & Bose-Brill, 2015). The attitudes and behaviors of HCPs toward the PHR influence the willingness of individuals to use the PHR. With HCP endorsement, it builds trust in patients for the technology (Abd-Alrazaq et al., 2019; Kujala, Hörhammer, Kaipio, & Heponiemi, 2018; Zhao et al., 2017).

This study is the first, to my knowledge, to (a) explore factors that influence HCPs to endorse the use of a PHR, and (b) examine factors associated with HCP acceptance of secure

messaging in Saudi Arabia. Furthermore, it also examined factors that predict patient use of the PHR and allowed for a look at the alignment between the predictors for patient and HCPs. Such an understanding is imperative as the focus on remote health care engagement and patient-centered care grows. The findings are useful for HCPs, patients, and the health care organization. Decision-makers within the organization can use the information to develop and introduce strategies and initiatives to support the adoption of PHRs and successful integration of a feature such as secure messaging.

Overview of Upcoming Chapters

This dissertation was written in the three-paper option format as specified by the College of Health Professions at Virginia Commonwealth University. The goals of this dissertation were addressed in a series of three papers (Chapters 2 through 4) that will be submitted for publication. The chapters are as follows.

Chapter 2: The title of the manuscript is "Predicting Patients' Intention to Use a Personal Health Record: An Adapted UTAUT Model." This was a secondary analysis of a cross-sectional study. The four UTAUT constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions were used along with the construct of attitude to evaluate patient acceptance of PHR use. The research question is: Does the adapted UTAUT framework predict patient acceptance of PHR use? The hypotheses are: (a) performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude have a positive relationship on patient acceptance, and (b) age, gender, experience and health status are expected to moderate the relationship between the constructs and behavioral intention to use the PHR. Hierarchical multiple regression analysis was used to identify predictors of the dependent variable—behavioral intention to use the PHR.

Chapter 3: The title of the manuscript is "Health Care Providers' Acceptance of a Personal Health Record: An Application of UTAUT." A cross-sectional survey of HCPs examined predictors of PHR acceptance. The four UTAUT constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions were used along with the construct of attitude to evaluate HCP acceptance of PHR use. The first research question is: Does the adapted UTAUT framework predict HCP acceptance of PHR use? The hypotheses are: (a) performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude have a positive relationship on HCP acceptance, and (b) age, years of experience, and professional role are expected to moderate the relationship between the constructs and HCP acceptance. Partial least squares structural equation modeling was used to assess the proposed model. The second research question is: What barriers do HCPs believe prevent patient use of the PHR?

Chapter 4: The title of the manuscript is "Health Care Providers' Acceptance towards Adding a Secure Messaging Feature to a PHR." A cross-sectional survey of HCPs examined predictors of securing messaging acceptance. The four UTAUT constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions were used along with the construct of attitude to evaluate HCP attitudes towards adding secure messaging to the PHR. Understanding the perspectives of HCPs is crucial to develop the PHR by adding secure messaging. The research question for this paper was: Does the adapted UTAUT framework predict HCP acceptance of secure messaging? The hypotheses were: (a) performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude have a positive relationship on acceptance of secure messaging; and (b) age, years of experience, and professional role were expected to moderate the relationship between the constructs and HCP

acceptance of securing messaging. Partial least squares structural equation modeling was used to evaluate the proposed model. The second research question is: What are barriers to HCPs supporting the addition of secure messaging?

Chapter 5 is a summary and conclusion of the research study. The key findings of the three studies are linked, and the study limitations, implications, and future directions are presented.

Chapter 2: "Predicting Patients' Intention to Use a Personal Health Record: An Adapted UTAUT Model"

Abstract

Background

With the rise in the use of information and communication technologies in health care, there has been a push for patients to accept more responsibility for their health and wellbeing using eHealth tools such as personal health records (PHRs). PHRs support patient-centered care and patient engagement. To support the achievement of the Kingdom of Saudi Arabia's Vision 2030 ambitions, the National Transformation program provides a framework to use PHRs in meeting three aims for health care – increased access, reduced cost, and improved quality of care – and to provide patient- and person-centered care. However, there has been limited research on PHR uptake within the country.

Objective

The aim of this study was to identify predictors of patient intention to utilize the Ministry of National Guard Health Affairs (MNGHA) PHR using an adapted model of the unified theory of acceptance and use of technology (UTAUT).

Methods

This cross-sectional study utilized survey items developed based on UTAUT to measure behavioral intention to use the MNGHA Care PHR among adults visiting MNGHA facilities in Riyadh, Jeddah, Dammam, Madinah, Al Ahsa, and Qassim. The main theory constructs—performance expectancy, effort expectancy, social influence, facilitating conditions, and positive attitude toward using the PHR—were independent variables. Age, gender, experience with

health applications, and health status were tested as moderators between the main theory constructs and behavioral intention using hierarchical multiple regression.

Results

Of the eligible population, a total of 261 adult patients were included in the analysis with a mean age of 35.07 years (± 9.61), male (n=132, 50.6%), university-educated (n=118, 45.2%), and at least one chronic medical condition (n=139, 53.3%). The overall model including the main theory constructs explained 48.9% of the variance in the behavioral intention to use the PHR but was not significant (p =.377). Performance expectancy, effort expectancy, and positive attitude were significantly associated with behavioral intention to use the PHR ($p < .05$). Prior experience with health applications moderated the relationship between social influence and behavioral intention to use the PHR (p =.043).

Conclusion

This research contributes to the existing literature on PHR adoption broadly as well as in the context of the Kingdom of Saudi Arabia. Understanding which factors are associated with patient adoption of PHRs can guide future development and support the country's aim of transforming the health care system through eHealth. Similar to other studies on PHR adoption, performance expectancy, effort expectancy, and positive attitude are important factors and practical consideration should be given to how to support patients in these areas.

Predicting Patients' Intention to Use a Personal Health Record: An Adapted UTAUT Model

As the prevalence of chronic diseases has increased along with the rise in information and communication technologies, there has been a push for patients to accept more responsibility for their health and wellbeing (Ariaeinejad & Archer, 2014; Tenforde, Jain, & Hickner, 2011). Health care has transformed from the paternalistic "doctor knows best" model to one where individuals are encouraged to play an active role in the health care process (Meier, Fitzgerald, & Smith, 2013). The eHealth movement, defined as "any electronic exchange of health-related data collected, generated, or analyzed," is considered an essential element in transforming health care delivery by the World Health Organization (WHO; Deluca & Enmark, 2000, p. 4). eHealth is a broad term that encompasses various types of electronic exchanges involving "citizens, patients, physicians, other care providers, healthcare provider organizations, healthcare payers, regulatory agencies, pharmacies, labs, healthcare information technology (HIT) or e-health vendors in any combination" (Deluca & Enmark, 2000, p. 5). Personal health records (PHRs) are an eHealth tool to increase patient engagement and empowerment by allowing individuals to keep track of their personal health information and hold great potential in chronic disease management.

Health care organizations face the challenges of providing high quality, accessible care and reducing costs (Meier et al., 2013). In order to meet these challenges, the new paradigm of health care delivery has led to the growth of consumer-facing eHealth applications such as PHRs. PHRs are an eHealth tool to strengthen the ability of patients to better manage their care (Detmer et al., 2008; Tang et al., 2006). The concept of the PHR has been around for decades with individuals storing accumulated paper-based health documents in their homes in binders,

envelopes, or shoe boxes (Detmer et al., 2008). As HIT advanced, the PHR became a way for individuals to store their health information electronically, making it easily accessible.

The Markle Foundation created the Connecting for Health collaborative to develop coordinated and standardized methods for individuals to have their integrated health information in a single place (Markle Foundation, 2003). The Markle Foundation defined PHR as "an internet-based set of tools that allows people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it" (p. 3). Nevertheless, there is no uniform definition of PHR. Numerous terms have been used interchangeably with PHR in the literature, including patient web portal, patient portal, computerized patient portal, patient accessible electronic health record, tethered PHR, and electronic PHR, to name a few. The broader term of PHR will be used predominantly throughout this paper.

Health care organizations adopt PHRs to increase patient engagement in the drive to meet three aims of health care: increase access, reduce cost, and improve quality of care (Abd-Alrazaq et al., 2019; Wolfe, 2001; Zhao et al., 2017). Managing chronic diseases requires regular use of self-management skills such as identifying problems, finding solutions, using information sources, collaborating with healthcare providers (HCPs), altering behavior, and assessing results (O'Leary, Vizer, Eschler, Ralston, & Pratt, 2015).

Benefits of PHR Use

As the number of health care organizations implementing PHRs grows, research into the impact on health care outcomes is required. Some of the proposed benefits from the use of PHRs are empowerment, continuity of care, education, patient-provider partnership, individual control, and engagement. In the research agenda proposed by Kaelber et al. (2008), the authors recommended studying PHR functionality in relation to health care quality, cost, efficiency,

safety, and patient and provider satisfaction. Ammenwerth et al. (2012) conducted a systematic review of four controlled trials on the impact of patient portals (defined as provider tethered applications) on patient care. PHR use was significantly associated with a decrease in the numbers of office visits, number of telephone contacts, increase in messages sent, more changes in medication regimen, and better treatment adherence. Overall, the authors considered the results to provide weak evidence for a positive impact on clinical outcomes, resource consumption, patient satisfaction, and communication.

One year later Goldzweig et al. (2013) published their systematic review on health outcomes, satisfaction, efficiency, and attitudes associated with portals (defined as tethered to an existing health care institution). Some of the benefits seen in the randomized, controlled trials of patients with diabetes were increased patient empowerment, less treatment distress, greater treatment satisfaction, and more intensive medication management. In patients with hypertension, one study showed better blood pressure control in the group that used the portal and had access to case management with face-to-face visits and secure messaging. A cross-sectional study found high patient satisfaction, especially with medication refills, secure messaging, and laboratory tests. Results on efficiency and utilization were highly variable with some studies showing increases in office visits, emergency department visits, hospitalizations, secure messaging, and telephone encounters while others showed no difference. Similar to Ammenwerth (2012), positive effects were more likely when portal use was used in conjunction with another service such as case management. Variations in many aspects of the studies (e.g., study design, portal functionality, and implementation processes) made it difficult to reach conclusions on the benefits of portal use.

Kruse, Bolton, and Freriks (2015) duplicated the review of Ammenwerth (2012) with 27 studies published from 2011 to 2014. Unlike Ammenwerth (2012), they chose to include a wider range of studies—observational, qualitative, and mixed-methods—and did not include the term PHR in their search strategy. In contrast to the Ammenwerth (2012) review, the authors found an association between portal use and medication adherence, sense of autonomy, disease control, self-care, patient satisfaction, decreased office visits, and better patient-provider communication; however, none of the studies were randomized, controlled trials. The authors recommended health care organizations train patients on portal use to improve the meaningful use.

Sun et al. (2018) conducted a literature review of patient portal use in diabetes mellitus. Like the studies referenced above, portal features varied across health care systems. Most portals provided basic features except for those in diabetes-specific programs where patients could perform more activities. The authors evaluated impact on glycemic control and other diabetes-related outcomes. For effects on glycemic control as measured by hemoglobin A1c, some studies showed an effect but either the effect was small or not sustained. Several studies showed lower diabetes-related distress and higher self-efficacy with portal use. The authors found the greatest benefits when the portal was used along with education and tailored feedback. They also noted the generally low engagement of patients with portals and highlighted the need for physician involvement since provider endorsement has been cited as an influential contributing factor in patient portal use.

Ammenwerth et al. (2019) performed a systematic review of 10 RCTs investigating the effects of portal use on patient empowerment and health-related outcomes. The studies were heterogeneous in terms of disease states and outcome measures. Two of four studies evaluating patient empowerment showed a small statistically significant effect. Eight studies evaluated

health-related outcomes. Only two out of six studies that measured hemoglobin A1c found a small but statistically significant effect. One out of four studies that evaluated blood pressure found a small but statistically significant improvement. The authors concluded the limited benefits seen were possibly due to low fidelity to the intervention. In several studies they included, the intervention group did not use the portal consistently. All of the reviews discussed point to the diversity of PHR features, populations, and implementation processes.

Abd-alrazaq et al. (2019) conducted a systematic review of 104 studies on PHR adoption and found a positive relationship between facilitating conditions, perceived usefulness, internet access, and internet use for intention to use a PHR. However, the majority of studies were conducted in the U.S., limiting the generalizability of the findings to other countries. The first step in realizing the proposed benefits is through adoption. To facilitate PHR adoption, researchers must identify contextual factors on the individual, environmental, organizational, and technical levels.

PHRs in the Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia launched its national eHealth strategy in 2011 as a part of Vision 2030—a roadmap for economic growth and national development (Ministry of Health, 2018). The National Transformation Program is included in their strategy and has one of eight themes focused on improving the quality and efficiency of healthcare services by enhancing patient-centered healthcare culture and increasing patient involvement via technology ("National Transformation Program," 2018). As eHealth has made its way to the Kingdom of Saudi Arabia, researchers have begun to study various aspects of PHRs (Alanazi & Al Anazi, 2019; Alhammad, 2017; Al-Mifgai, Sharit, Onar-Thomas, & Asfour, 2020; Alsahafi, Gay, & Khwaji, 2020; Al Sahan & Saddik, 2016; Belcher, Vess, & Johnson, 2019; Yousef et al., 2020).

In the thesis by Alhammad (2017), there was an atheoretical examination of the attitudes and expectations of Saudi patients toward a PHR. This study was conducted in Riyadh in the outpatient departments of four government hospitals and had a large sample of 440 participants. The majority (91.6%) of participants believed a PHR would contribute to better quality of health care.

Al Sahan and Saddik's (2016) study was the first to evaluate the knowledge and perceptions of a PHR in 454 patients and nine technical staff from the Ministry of National Guard Health Affairs (MNGHA) hospital in Riyadh. The mixed-methods study was conducted two years prior to the implementation of the organization's PHR. The authors found a high level of patient interest (very interested: 60.6%, interested: 25.2%) in an online PHR.

In 2018 MNGHA implemented its PHR known as MNGHA Care. MNHGA Care features include: checking laboratory results, scheduling appointments, requesting medical reports, requesting prescription refills, viewing radiology reports, and providing vaccination reminders. It allows patients to upload personal health information such as blood pressure, blood sugar, weight, and exercise details. A self-assessment feature allows patients to enter information on pain control, performance status, and quality of life. There are also links to health educational information. Since the implementation, further research is needed on patient adoption.

The aim of this study was to identify a set of determinants in the behavioral intention to use the MNGHA Care PHR by patients using a theoretical foundation. Before a technology is accepted, a user must first intend to use the technology (Venkatesh et al., 2003). The benefits of increased accessibility, reduced costs, and better quality of health care with the PHR can only be achieved through an understanding of what motivates individuals to use the technology.

Theoretical Foundation

Many theories and models have been utilized to explain user acceptance of information technology. Venkatesh et al. (2003) developed the unified theory of acceptance and use of technology (UTAUT) to provide a comprehensive model to explain acceptance, intention, and usage of information technology in organizations. It is a synthesis of the theory of reasoned action, technology acceptance model (TAM), motivational model, theory of planned behavior (TPB), combined TAM-TPB, model of personal computer utilization, diffusion of innovation theory, and social cognitive theory (Venkatesh et al., 2003). Venkatesh et al. evaluated the independent variables that influence behavioral intention and actual use of technology. The three independent constructs—performance expectancy, effort expectancy, and social influence—directly influence behavioral intention to use technology. Facilitating conditions and behavioral intention act directly on actual use of technology. Gender, age, voluntariness, and experience are moderators in the model. This study will adapt UTAUT to investigate the factors that influence patients' intention to use MNGHA Care.

The adapted UTAUT model for this study is presented in Figure 3. Figure 4 shows the original UTAUT. There are four adaptations to the original model. First, the construct of attitude was added. Individual characteristics are not included in UTAUT. However, researchers have found individual traits to be important predictors of technology acceptance (Rosen, 2004; Williams, Rana, & Dwivedi, 2015). In the critical review of the UTAUT model, Dwivedi et al. (2019) recommended revising the model to include the construct of attitude. Yeo and Sohn (2021) found attitude towards PHRs predicted intention. Secondly, the moderators of gender, age, experience, and voluntariness of use are used in the original UTAUT model. In the adapted model, voluntariness of use was dropped as a moderator since PHR use is voluntary. Next, use

behavior was dropped and facilitating conditions acts on behavioral intention rather than use behavior. Finally, health status was added to moderate the relationships between the main constructs and the behavioral intention to use the PHR.

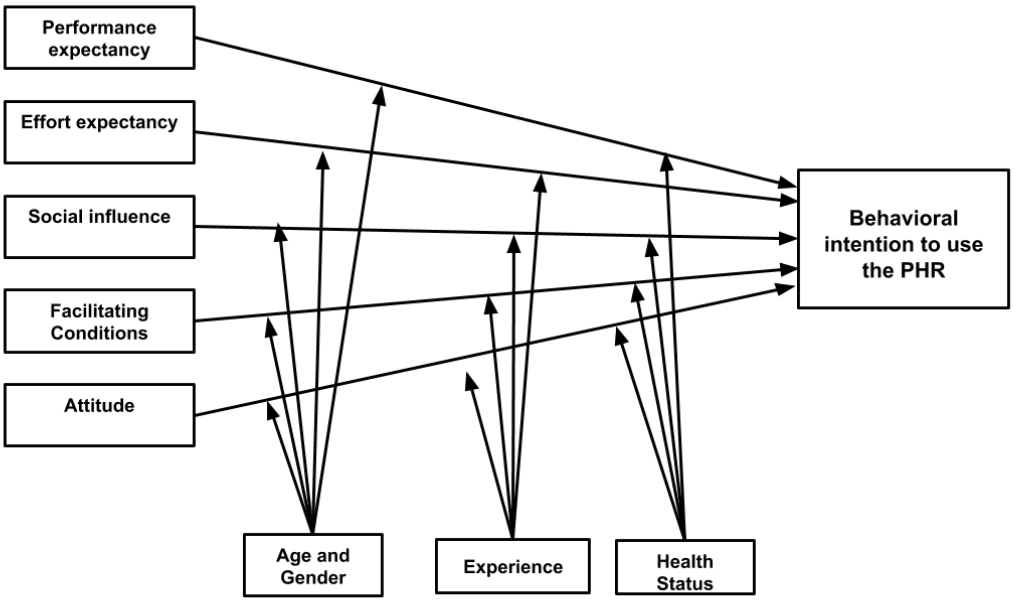

Figure 3. Adapted UTAUT model to predict patient intention to use MNGHA Care.

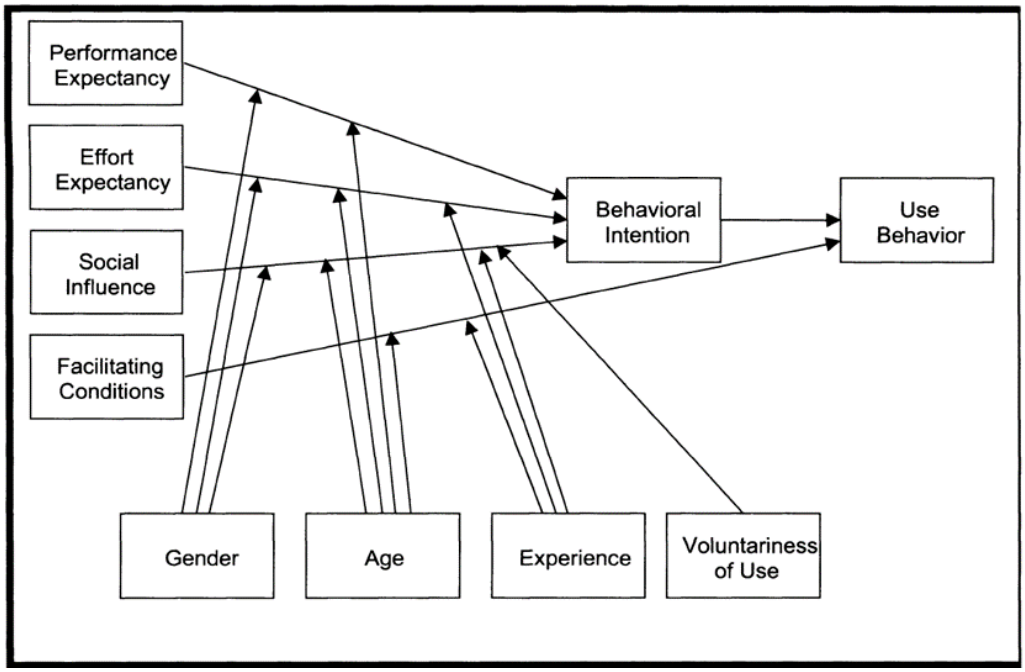

Figure 4. Original UTAUT (Ventaketesh et al., 2003).

The proposed differences between this research model and the original UTAUT model are shown in Table 4. Moderating variables allow an assessment of differences among groups and provide a more detailed explanation of relationships (Fritz & Arthur, 2017; MacKinnon, 2011). The selection of moderating variables should be based on considerations of whether the strength or direction of the relationship between the independent and dependent variable are different as a moderator variable changes (Fritz & Arthur, 2017).

This study used the moderator variables of age, gender, experience, and health status. Age and gender moderate all relationships. Age is expected to negatively moderate the relationship between performance expectancy and behavioral intention, so the effect would be stronger for younger individuals. Younger individuals are less likely to have the extrinsic motivation to use the PHR due to better overall health; therefore, perceived benefits of use matter more. Venkatesh et al (2003) hypothesized younger workers placed greater emphasis on extrinsic rewards of using a technology. Age is expected to positively moderate relationships

between all other main constructs and behavioral intention. The relationships between behavioral intention and effort expectancy, facilitating conditions, social influence, and attitude were expected to be stronger in older individuals. Although older adults are using the Internet in greater numbers, there is still a digital divide (Taha, Czaja, Sharit, & Morrow, 2013). Older adults may have a wide range of cognitive abilities and may not have the skills, knowledge, or experience with information technologies (Taha et al., 2013). In terms of social influence, older individuals may be more susceptible to social influences with less experience with a technology (Venkatesh et al., 2003).

For gender effects, it was expected that males would be more motivated by perceived benefits of PHRs, and, hence, there would be a stronger relationship between behavioral intention and performance expectancy in males. There were expected to be stronger effects for females for the relationships between behavioral intention and effort expectancy, facilitating conditions, social influence, and attitude. Venkatesh et al (2003) predicted there would be a stronger effect for women with between behavioral intention and social influence due to women's roles and more concern for the opinions of others.

Experience was operationalized as the prior use of health applications. Venkatesh et al. (2003) characterized experience as experience with the system being implemented. Experience using a health application would imply the individual has the necessary computer and internet skills to use a PHR. Limited computer and internet experience has been identified as a barrier to PHR adoption (Taha et al., 2013). The influence of effort expectancy, facilitating conditions, and attitude on behavioral intention was expected to be stronger in individuals without experience using health applications. The relationship between social influence and behavioral intention was expected to be weaker in individuals with experience using health applications.

Finally, health status is a moderator because it has been shown to be an important driver of PHR acceptance (Abd-Alrazaq et al., 2019; Najaftorkamam, Ghapanchi, & Talaei-Khoei, 2014). If resources and support are available, individuals with poorer health are more likely to use eHealth technologies (Tavares & Oliveira, 2016). Health status in this study was based on self-reported health status. The influence of performance expectancy, social influence, facilitating conditions, and attitude on behavioral intention was predicted to be stronger in individuals with poorer health status.

Table 4

Original UTAUT Versus Adapted UTAUT for Patients

	Original UTAUT Moderators				Adapted UTAUT Moderators			
	Gender	Age	Experience	Voluntariness	Age	Gender	Experience	Health Status
PE→BI	✓	✓			✓	✓		✓
EE→BI	✓	✓	✓		✓	✓	✓	
SI→BI	✓	✓	✓	✓	✓	✓	✓	✓
BI→Use								
FC→Use		✓	✓					
FC→BI					✓	✓	✓	✓
ATT→BI					✓	✓	✓	✓

Note. PE=performance expectancy; EE= effort expectancy; SI= social influence; BI= behavioral intention; FC= facilitating conditions; ATT= attitude; Use= actual usage.

The research question for this study was: Does an adapted UTAUT model predict patients' behavioral intention to use the PHR? The hypotheses were: (a) performance expectancy, effort expectancy, facilitating conditions, social influence, and positive attitude influence patients' intention to use MNGHA Care; and (b) age, gender, experience, and health status moderate the relationship between the main constructs and behavioral intention to use MNGHA Care.

Methods

Study Design. This study is a secondary analysis of data obtained from a cross-sectional study entitled "Adoption of a Personal Health Record in the Digital Age: Cross-Sectional Study" (Yousef et al., 2020). The authors of this study collected the data between December 2019 and February 2020 from 546 adult participants visiting outpatient centers under MNGHA. Institutional Review Board (IRB) approval (RD19/002/D) was obtained from King Abdullah International Medical Research Center (KAIMRC; Appendix A). This study was intended to evaluate the relationship between online health-information seeking behavior and use of MNGHA Care.

In the original study, the target population consisted of adults who visited the outpatient waiting areas at Imam Abdulrahman Bin Faisal Hospital in Dammam, King Abdulaziz Medical City in Riyadh, King Abdulaziz Medical City in Jeddah, Prince Mohammad Bin AbdulAziz Hospital in Madinah, and King Abdulaziz Hospital in Al Ahsa, Primary Health Clinic in Riyadh, and Primary Health Clinic in Qassim. This study was carried out at each site independently with each site's research team. Participants were eligible if they were: (a) at least 18 years of age, and (b) able to read and understand either Arabic or English.

Setting and participants. MNGHA is a government-funded, multispecialty, accountable health system established in 1983 with facilities across the country. It provides state of the art medical care to the National Guard's soldiers and their dependents and is a leader in healthcare services in the Middle East. The organization includes five medical cities, several specialist hospitals, and primary health care clinics.

The sample size was calculated through the 10 times rule, meaning the minimum sample size should be 10 times the number of predictors (Hair, Hult, Ringle, & Sarstedt, 2016).

Following this rule, the sample size was calculated to be 270 as the number of predictors were 27 (five independent variables, four moderators, and 18 interaction terms).

For the purposes of this secondary data analysis, 546 responses collected for the paper by Yousef et al. (2020) were reviewed, and 324 participants reported using MNGHA Care and completed the items adapted from UTAUT on the use of MNGHA Care.

Measures. In the original study, some items were included related to the acceptance of MNGHA Care. Most items were adapted from Hoogenbosch et al. (2018) with minor modifications or either self-constructed and were answered on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). However, questions were limited to avoid respondent burden resulting in one or two items used for each construct.

Dependent variable measurement: Behavioral intention to use the PHR. Behavioral intention is the measure of the strength of an individual's intention to perform a specific behavior (Davis, Bagozzi, & Warshaw, 1989). A two-item scale was used to measure behavioral intention (Hoogenbosch et al., 2018): "I will probably use MNGHA Care in the future," and "I intend to use MNGHA Care regularly." The reliability coefficient for this scale was $\alpha = 0.76$.

Independent variable measurement. The independent variables were performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude.

Performance expectancy is the degree to which an individual believes using a technology will help in the attainment of significant rewards. A single-item scale was used to measure performance expectancy, whereas Hoogenbosch et al. (2018) used a three-item scale. The item was: "By using MNGHA Care, I feel more involved in my care."

Effort expectancy is the degree of ease associated with use of a technology (Venkatesh et al., 2003). This measure was operationalized as the degree of ease associated with using the

PHR. A single-item was used to measure effort expectancy while Hoogenbosch et al. (2018) used a five-item scale. The item was "Information in MNGHA Care is understandable."

Social influence is the degree to which an individual perceives important people in their social circle are using a technology (Venkatesh et al., 2003). In line with Hoogenbosch et al. (2018), the following item was used to measure this construct: "My healthcare professional encouraged me to use MNGHA Care."

Facilitating conditions is the degree to which an individual believes that an organizational and technical infrastructure supports the use of technology (Venkatesh et al., 2003). A single-item, "Technical help is available when I do not know how to use MNGHA Care," was used in this regard. Hoogenbosch et al. (2018) used a three-item scale.

Attitude is the degree of positive or negative feelings associated with the use of technology (Davis et al., 1989). A single-item, "MNGHA Care is a valuable service" (self-constructed), was used to assess this measure.

Moderator variables. The proposed moderators for the model were age, gender, experience with health applications, and health status. The definitions of all variables are shown in Table 5. Health status was a categorical variable self-reported as excellent, very good, good, fair, or poor. Experience was a dichotomous variable defined as experience with health applications and assessed through the question: Do you use health applications (apps) on your mobile phone?

Demographic and health status characteristics. Demographic characteristics were self-reported and collected to describe the study sample. Demographic characteristics included age, educational level, gender, health care facility, marital status, employment status, and monthly household income. Health status characteristics included presence of a medical

condition, number and type of medical conditions, self-reported health status, past six months hospitalization, and past six months emergency department visit. For the measurement scales, consult Table 5.

Table 5

Demographic and Health Status Characteristics

Variable Name	Variable Type	Definition
Demographic Characteristics		
Health Care Facility	Categorical	Central Region Eastern Region Western Region
Age	Continuous	Years
Gender	Dichotomous	Male/Female
Marital status	Dichotomous	Married Single
Education level	Categorical	< High school High school University
Employment status	Categorical	Employed Retired Student Unemployed
Monthly income	Categorical	<5,000 SAR ($1,333)/month 5,000-9,999 SAR ($1,333-$2666)/month ≥ 10,000 SAR ($2666)/month
Health Status Characteristics		
Medical condition	Dichotomous	Yes/No
Number of medical conditions	Categorical	None One ≥ Two
Type of medical condition	Categorical	Diabetes Hypertension Asthma or COPD Other
Health status	Categorical	Excellent Very good Good Fair Poor
Hospitalized within the last 6 months	Dichotomous	Yes/No
Visited the emergency department within the last 6 months	Dichotomous	Yes/No

Data analysis. Descriptive statistics and hierarchical multiple regression were conducted using the SPSS Version 26.0 (IBM Corporation, 2017). While structural equation modeling is a more robust statistical methodology for testing a theoretical model and allows for single-item measures, it was not used due to concerns the model would not yield good results since all constructs were a single item (Hair, Risher, Sarstedt, & Ringle, 2019). Several preliminary analyses were conducted to ensure the quality and reliability of the data that includes checking for normality, linearity, homoscedasticity, and absence of multicollinearity. First, the normality of the data was checked using skewness and kurtosis and found to be within the required threshold of ±1.96 (George & Mallery, 2010). Independence of observations was tested using the Durbin-Watson test which showed a coefficient of 1.905. As a rule of thumb, values between 1.5 and 2.5 are considered normal (Field, 2009). Linearity was confirmed by the appearance of a linear representation of standardized residuals. Most of the values lie along the linear line (Figure 5). Multicollinearity was checked by examining correlations and variance inflation factors (VIF) between the variables. A VIF above 10 is an indicator of multicollinearity (Field, 2013). No VIF was greater than 10, indicating a lack of multicollinearity.

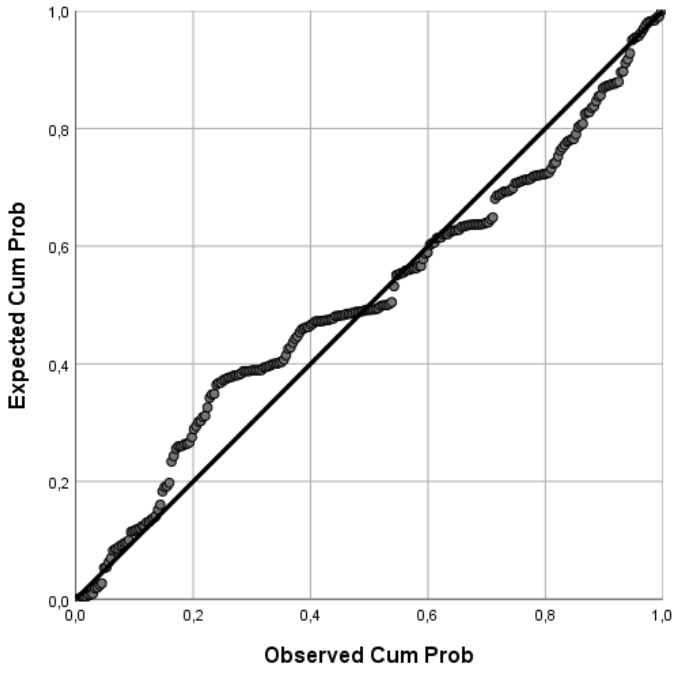

Figure 5. Normal P-P plot of regression standard residuals for intention to use MNGHA Care.

With all assumptions of regression met and outliers removed, the independent variables were entered into the regression model in three sequential blocks. Table 6 shows the descriptive statistics and the statistics fulfilling assumptions for multivariate analysis. A three-stage hierarchical multiple regression was conducted with behavioral intention as the dependent variable. The first block included the five independent variables of performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude. The second block contained the moderator variables of age, gender, experience, and health status along with the independent variables. Experience was a categorical variable with 0 representing people with no experience using health applications, and 1 representing people with experience using health applications. To test the moderating effects of gender, age, experience, and health status on the relationship of independent variables (performance expectancy, effort expectancy, social influence, facilitating conditions and attitude) and behavioral intention to use the PHR,

interaction terms were added to the regression model in block 3. For each block, the standardized regression coefficient (β) and the R^2 were examined.

Table 6

Descriptive Statistics for Main Study Variables and Correlation Matrix

	1	2	3	4	5	6
Performance Expectancy (1)						
Effect Expectancy (2)	0.42					
Social Influence (3)	0.42	0.44				
Facilitating Conditions (4)	0.36	0.43	0.60			
Attitude (5)	0.54	0.45	0.41	0.43		
Intention to Use MNGHA Care (6)	0.54	0.51	0.39	0.40	0.51	
Mean	4.10	4.18	3.90	3.79	4.15	4.16
SD	0.60	0.55	0.87	0.89	0.62	0.54
Range	1-5	1-5	1-5	1-5	1-5	1-5
Skewness	-0.04	0.06	-0.37	-0.37	-0.12	0.12
Kurtosis	-0.28	-0.08	-0.55	-0.55	-0.51	-0.41
VIF	1.567	1.476	1.758	1.728	1.637	

Results

Demographic and health status characteristics. There were 324 participants who answered the questions related to MNGHA Care. After outliers were removed, there was a final sample of 261 patients. Table 7 summarizes the demographic and health status characteristics of the respondents. The mean age was 35.07 years (± 9.61). Most users were from the Central region (n=110, 42.1%), male (n=132, 50.6%), married (n=208, 79.7%), had a higher educational level (university graduate: n=118, 45.2%) and monthly income (> $2666/month: n=95, 36.4%). For health status, the majority (n=178, 68.2%) had a medical condition with the following chronic conditions most common: asthma or COPD (n=46, 17.6%), diabetes (n=38, 14.6%), and hypertension (n=32, 12.3%).

Table 7

Demographic and Health Status Characteristics

Demographic Information	
	Mean(SD)
Age	35.07 (9.61)
	n (%)
Region of the country	
Eastern	81(31.0)
Central	110 (42.1)
Western	70 (26.8)
Gender	
Male	132 (50.6)
Female	129 (49.4)
Marital status	
Married	208 (79.7)
Single	53 (20.3)
Educational level	
Elementary school or less	14 (5.4)
Middle school	17 (6.5)
High school	91 (34.9)
University	118 (45.2)
Postgraduate	20 (7.7)
Employment status	
Employed	142 (54.4)
Retired	16 (6.1)
Student	17 (6.5)
Unemployed	84 (32.2)
Monthly household income	
< 5,000 SAR ($1333)/month	69 (26.4)
5000-9,999 SAR ($1333-$2666)	84 (32.2)
> 10,000 SAR ($2666)/ month	95 (36.4)
Health Status Characteristics	
Medical condition	
Yes	178 (68.2)
Number of medical conditions	
None	83 (31.8)
One	139 (53.3)
Two or more	39 (14.9)
Type of medical condition	

Diabetes	38 (14.6)
Hypertension	32 (12.3)
Asthma or COPD	46 (17.6)
Heart failure	9 (3.4)
Cancer	11 (4.2)
Sickle cell disease	7 (2.7)
Psychiatric condition	4 (1.5)
Other	78 (29.9)
Self-reported health status	
Excellent	121 (46.4)
Very good	95 (36.4)
Good	33 (12.6)
Fair	8 (3.1)
Poor	4 (1.5)
Hospitalized within the last 6 months	
Yes	54 (20.7)
Visited the emergency department within the last 6 months	
Yes	124 (47.5)

Hypothesized relationships. The results of the hierarchical multiple regression analysis are presented in Table 8. The first stage of the model revealed that performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude contributed significantly to the regression model, F (5, 255) = 38.874 ($p < .001$) and accounted for 43.3% of the explained variance in patients' intention to use MNGHA Care. Performance expectancy, effort expectancy and attitude were almost equally important predictors with standardized regression coefficients of .286, .249 and .198, respectively.

In the second stage of the model, the variables age, gender, experience with health applications, and health status were entered along with the independent variables. These variables did not significantly contribute to the regression model with additional explained variance of 0.8% in the R^2, F (4, 251) = .950, p =.435. The R^2 was not significant.

In the third stage, the full model included the independent variables, moderating variables (age, gender, experience with health applications, and health status), and interaction terms. Adding the interaction terms to the model explained an additional 4.8% of variance and was not significant, $F(20, 231) = 1.075$, $p = .377$. Figure 6 reflects the moderating effect of app experience on social influence in behavioral intention to use the PHR (β= -.236, t= -2.036, p =0.043).

Table 8

Summary of Hierarchical Regression Analysis

Predicting Behavioral Intention Behavioral intention to use MNGHA Care		
Variables	ΔR^2	β
Step 1	.433**	
Performance expectancy(PE)		.286*
Effort expectancy (EE)		.249*
Social influence (SI)		.017
Facilitating conditions (FC)		.100
Attitude (ATT)		.198*
Step 2	.008	
Gender		-.007
Age		.023
Experience		.095
Health Status		-.004
Step 3	.048	
PE x Gender		.143
PE x Age		.052
PE x Experience		.116
PE x Health Status		.034
EE x Gender		-.099
EE x Age		-.053
EE x Experience		.022
EE x Health Status		.001
SI x Gender		.071
SI x Age		-.066
SI x Experience		-.236*
SI x Health Status		-.107
FC x Gender		.020
FC x Age		-.038
FC x Experience		.096
FC x Health Status		.003

Predicting Behavioral Intention	Behavioral intention to use MNGHA Care
ATT x Gender	-.098
ATT x Age	-.080
ATT x Experience	-.206
ATT x Health Status	.035
Total R^2	.489
N	261

Note. $^{+}$ $*p < .05$. $**p < .001$.

As depicted in Figure 6, higher social influence led to higher behavioral intention to use MNGHA Care in patients without previous experience using health applications. On the contrary, among patients who had experience using health applications, social influence had a slightly negative effect on behavioral intention to use. There was a greater impact of experience with low social influence than with high social influence. However, this result should be interpreted cautiously since the overall model was not significant.

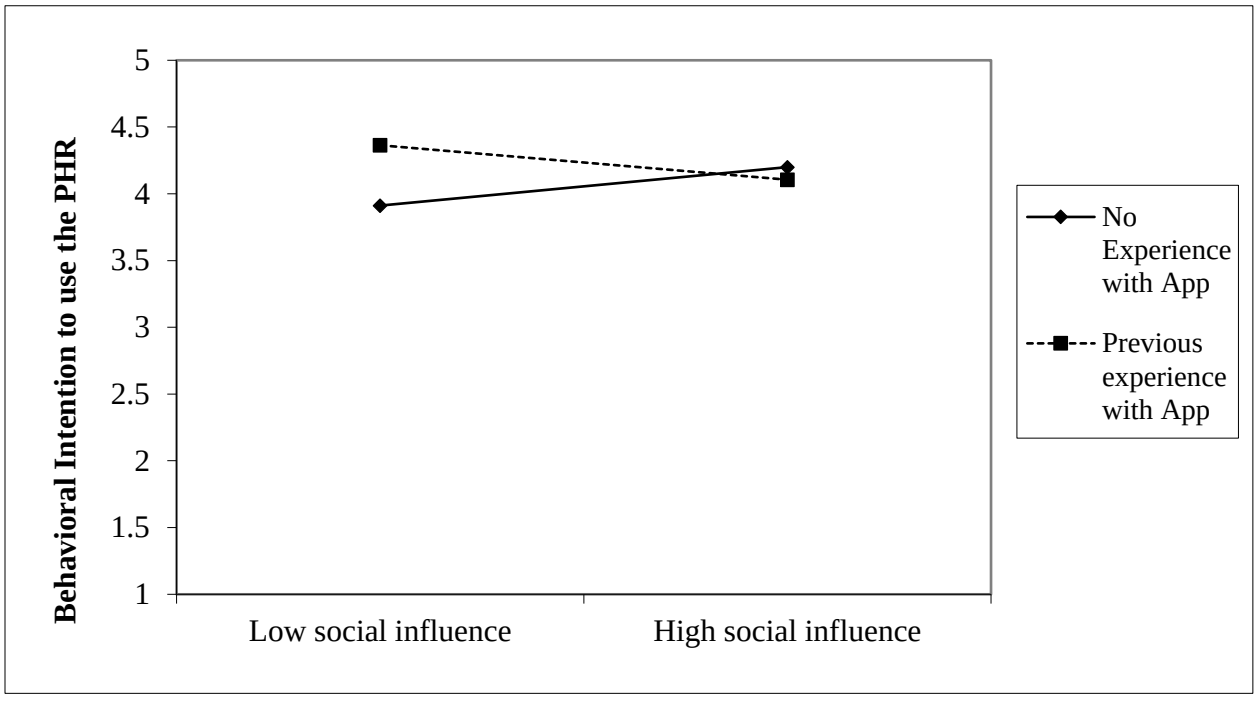

Figure 6. Interaction of social influence and experience on behavioral intention *($p < .05$).*

Discussion

This study attempted to identify predictors in the adoption of the MNGHA Care PHR among patients from a single health care organization in the Kingdom of Saudi Arabia using an adapted UTAUT model. The structural model used in this study explained 48.9% of the variance in behavioral intention to use MNGHA Care. Performance expectancy, effort expectancy, and attitude were positive predictors of behavioral intention, confirming the construct that attitude has a significant impact on PHR adoption. The individual characteristics of age, gender, experience with health applications, and health status did not have a significant impact on behavioral intention.

Other studies have also shown performance expectancy and effort expectancy to be significantly and positively associated with PHR adoption (Abd-Alrazaq et al., 2019; Alsahafi et al., 2020; Chung, Ho, & Wen, 2016; Dontje, Corser, & Holzman, 2014; Emani et al., 2012; Hoogenbosch et al., 2018; Hsieh, Kuo, Wang, Chuang, & Tsai, 2016; Tavares & Oliveira, 2016). This study supports the evidence that patients are more likely to use PHRs when they perceive them as useful and easy to use.

In this study, social influence was not associated with behavioral intention. This aligns with the findings of Tavares and Oliveira (2016). Although social influences such as interactions with health care providers have been identified as important in patient adoption of PHRs, our findings did not find a significant impact (Abd-Alrazaq et al., 2019; Vreugdenhil, Ranke, de Man, Haan, & Kool, 2019; Zhao et al., 2017). Nonetheless, Yousef et al. (2020) found health care providers (47.9%) or hospital staff (10.8%) were mainly responsible for recommending use of MNGHA Care.

Facilitating conditions likely did not have a significant impact as users found the organizational resources and technical help adequate. This finding also aligns with the results of the study by Tavares and Oliveira (2016). However, Abd-Alrazaq et al. (2019) found a positive relationship between facilitating conditions and patient use of the PHR. Venkatesh et al. (2003) found facilitating conditions had an insignificant effect on behavioral intention when the constructs of performance expectancy and effort expectancy are present, which might explain our findings.

Finally, a positive attitude towards the PHR was found to have a significant impact on behavioral intention. Attitude is strong predictor of behavioral intention to use various types of technology and is the direct precedent of intention (Davis et al., 1989). This is aligned with the findings of other research on PHRs (Chung et al., 2016; Khaneghah et al., 2016). Since attitudes may be influenced by various factors (e.g., peers, health care providers, other health care staff), promoting the PHR can encourage positive attitudes which ultimately can lead to PHR adoption.

Implications for Theory

This research contributes to the existing literature on PHRs and provides several implications for theory. First, it provides an understanding of the predictors of PHR adoption in general and, more specifically, within the context of the Middle East and the Kingdom of Saudi Arabia. PHRs have not been widely adopted, and there is limited data on predictors of PHR adoption in this region (Alanazi & Al Anazi, 2019; Alsahafi et al., 2020)

Second, it extends UTAUT with the construct of attitude and the moderators experience with health applications and health status in a health care setting. The results of this study provided further support for the constructs of performance expectancy, effort expectancy, and attitude to have significant and positive effects on PHR adoption, which is consistent with the

literature. Alsahafi, Gay, and Khwaji's (2020) study was the first to empirically examine predictors of PHR acceptance in the Kingdom of Saudi Arabia. In their study of the general Saudi adult population, they conducted a cross-sectional study and extended UTAUT with the construct of e-Health literacy. Similar to the findings of Alsahafi, Gay, and Khwaji (2020), this study found performance expectancy and effort expectancy were positive predictors of behavioral intention. Contrary to our findings, social influence was found to be a positive predictor for behavioral intention in women to use a PHR. While gender, age, and internet experience were used as moderators, gender was the only variable with a significant moderating role, whereas our study found experience with health applications to be the only significant moderator, even though the moderating effect was small and accounted for 4.8% of the explained variance.

In the health care context, the integration of constructs from health behavior theories, such as perceived health threat and self-perception, may be useful (Alaiad, Alsharo, & Alnsour, 2019; Tavares & Oliveira, 2016). Alsahafi et al (2020) found eHealth literacy to be a predictor of PHR acceptance among Saudi citizens. Though UTAUT was developed to be a comprehensive framework to study technology acceptance, contextual considerations are required to best explain PHR adoption behavior.

Implications for Practice

The Kingdom of Saudi Arabia has prioritized the use of eHealth technologies such as PHRs in health care delivery (Alanazi & Al Anazi, 2019; Alharbi, 2018; Alsahafi et al., 2020; Alshahrani et al., 2019; Alsulame, Khalifa, & Househ, 2016). In order to meet the goals of the National Transformation Program, health care organizations around the country will increasingly be called upon to leverage PHRs to efficiently deliver person- and patient-centered care. This

research can help organizations to better understand patient perceptions of the PHR and lead them to identify strategies to engage patients with the PHR in a way that they will better manage their health and well-being. Therefore, MNGHA should involve patients in evaluating the features and functions of the PHR.

This study found performance expectancy, effort expectancy, and attitude to have a significant impact on the adoption of PHRs. Tailored marketing strategies have been used to promote the advantages of PHRs and are a way for patients to see the benefits of using a PHR to manage their health (Zhao et al., 2017). The design and functionalities of the PHR can play an important role in patients' intention to use them (Zhao et al., 2017). Designing a PHR with an easy-to-use, attractive interface with simple language will improve patients' perceptions of the ease in use and help to prevent furthering health disparities (Hoque & Sorwar, 2017). Attitude has been identified as a barrier to use of PHRs in a number of studies (Zhao et al., 2017). Patients may have negative attitudes towards a PHR for a number of reasons, and this can contribute to their refusal to use PHRs. When health care providers educate and train patients on the features, functionalities, and benefits of the PHR, a positive attitude will develop and facilitate acceptance. However, for health care providers to play this role, they must be knowledgeable about the benefits and purpose of a PHR.

Limitations

There are several limitations to this study. First, this was a secondary analysis, and all constructs for the independent variables were single-item measures. This could have affected the reliability and validity of our findings. Most conceptual constructs are complex and multifaceted and, therefore, a single item may not be an "accurate, comprehensive, and reliable measurement" (Hassard, 2013). However, as described, this was necessary to avoid respondent burden. Second,

common method bias may be present since the independent variable and dependent variable were measured at a single point in time with only one data collection instrument. Finally, the generalizability may have been affected due to the study being limited to one organization in the country.

Recommendations for Future Research

Because this study was subject to common method bias, future researchers should examine the independent and dependent variables at different time points and with at least two different instruments. We were unable to secure access to either the system logs or patient records, but a future study may incorporate these types of data to minimize this type of bias.

Examining theories in new contexts advances theories and increases the external validity (Dwivedi et al., 2019; Venkatesh et al., 2011). Selecting constructs that explain the behavioral intention relationship should be contextual based. In this study, the model tested explained 48.9% of the variance in behavioral intention, suggesting the inclusion of attitude was relevant and reasonable. However, other predictors may have improved the model. Future studies may consider adding other constructs shown to be influential in PHR adoption or, more broadly, eHealth adoption. Alaiad, Alsharo, and Alnsour (2019) recommended including constructs recognized as inhibitors of technology adoption as well as adding constructs related to health-related behavior.

The construct of privacy and security is one that should be investigated. Studies have shown privacy and security concerns to have a significantly negative effect on behavioral intention to use a PHR (Abd-Alrazaq et al., 2019; Elsafty, Elbouseery, & Shaarawy, 2020; Niazkhani, Toni, Cheshmekaboodi, Georgiou, & Pirnejad, 2020; Showell, 2017; Zhao et al., 2017). As opposed to a technology such as e-banking, PHRs may be accessible to a wide range

of health care personnel (Pushpangadan & Seckman, 2015) as well as family members. Patients have raised concerns surrounding identity theft and the possibility of their leaked health information limiting employment opportunities (Pushpangadan & Seckman, 2015) This is an area that deserves further studies in this population.

This study is one of the few to evaluate the moderating effect of variables on the relationship between the independent variables and behavioral intention to use a PHR (Abd-Alrazaq et al., 2020; Abd-Alrazaq, Bewick, Farragher, & Gardner, 2019; Alsahafi et al., 2020; Tavares & Oliveira, 2016). Most PHR research has not assessed moderating or mediating effects (Abd-Alrazaq et al., 2019). The only significant moderating effect seen was experience with health apps on the relationship between social influence and behavioral intention. Other variables acting as either mediators or moderators may help to enrich our understanding of PHR adoption within this context.

For the moderator of health status, a single self-reported health status item was used due to its simplicity and to reduce respondent burden. It has been found to be a valid and reliable measure of health status in high-income countries (Cullati, Mukhopadhyay, Sieber, Chakraborty, & Burton-Jeangros, 2018). However, operationalizing health status in another way may have provided alternative findings. Future researchers should measure health status by another method.

Abd-Alrazaq et al. (2020) developed an adapted UTAUT model, the Abd-Alrazaq Model, to examine mediating, moderating, and moderated mediating effects on patients' behavioral intention and actual use of a PHR in England. Privacy, effort expectancy, social influence, and facilitating conditions were hypothesized to have direct effects on behavioral intention. Facilitating conditions and behavioral intention were hypothesized to have direct effects on

actual use. Performance expectancy was evaluated as a mediator between perceived privacy, effort expectancy, social influence, and facilitating conditions and behavioral intention. Moderating effects of age, education, income, internet access, and sex were assessed on the direct and mediating effects. Performance expectancy was found to have significant mediating effects between privacy and behavioral intention ($p < .001$); effort expectancy and behavioral intention ($p < .001$); and social influence and behavioral intention ($p < .001$). There were statistically significant moderating effects on several of the mediated relationships involving the moderators of gender, education, and internet access. Future studies may evaluate this model in other contexts with the same variables or through the addition of new variables.

Next, future researchers should consider more mixed-methods research. In the systematic review of PHR use by Abd-alrazaq et al. (2019), 88% of the studies were quantitative. Mixed-methods research is suitable to develop multiple perspectives and a comprehensive understanding of PHR adoption. A qualitative approach alongside quantitative methods will provide deeper insight into the patient's perspective.

Finally, more studies should evaluate the HCP's perspective of PHR adoption. The focus on a more engaged patient has been a paradigm shift in medicine (Shah & Liebovitz, 2017). Therefore, understanding HCP perspectives is fundamental to the successful implementation, adoption, and continued use of a PHR (Nazi, 2013; Shah & Liebovitz, 2017). Negative or indifferent attitudes among HCPs have been identified as a barrier to patient adoption (Zhao et al., 2017). Fears of increased workload, threats to autonomy, or upsetting patients are some concerns (Nazi, 2013). Addressing these concerns can lead to HCP endorsement and subsequent patient adoption.

Conclusion

The use of PHRs in KSA is relatively new and use will continue to grow in line with Vision 2030 and MNGHA's aim to be a center of excellence through the effective use of technology in health care delivery. This study extended UTAUT by adding the construct of attitude along with the use of age, gender, experience, and health status as moderators. Our findings show the UTAUT constructs of performance expectancy and effort expectancy had significant positive effects on behavioral intention. This study provides evidence that the construct of attitude had a significant positive effect on behavioral intention to use a PHR. Additionally, the impact of experience with health apps as a moderator of social influence was supported in our study. These results can further help the organization to encourage and support patients in the adoption of PHRs.

Chapter 3: "Health Care Providers' Acceptance of a Personal Health Record: An Application of UTAUT"

Abstract

Background

Personal health records (PHRs) are eHealth tools designed to support patient engagement and patient- and person-centered care. As health care organizations in the Kingdom of Saudi Arabia begin to adopt PHRs, understanding the health care provider's (HCP's) perspective can contribute to patient adoption. Endorsement of a PHR by HCPs has been found to facilitate patient acceptance. However, no studies have evaluated HCPs' acceptance of PHRs in the Kingdom of Saudi Arabia.

Objective

The aim of this study was to identify predictors of HCPs' behavioral intention to recommend patient use of an organization's PHR using an adapted model of the unified theory of acceptance and use of technology (UTAUT). An additional aim was to identify barriers to PHR adoption.

Methods

This cross-sectional study utilized a survey developed based on UTAUT to measure HCPs' behavioral intention to support patient use of the MNGHA Care PHR. The main theory constructs of performance expectancy, effort expectancy, social influence, facilitating conditions, and positive attitude toward using the PHR were collected as independent variables. Age, years of experience, and professional role were tested as moderators between the main theory

constructs and behavioral intention using partial least squares structural equation modeling. Barriers to PHR use were solicited through two items, one open-ended question and a checklist.

Results

Of the 291 respondents, there were 246 completed questionnaires for the analysis. Behavioral intention to support PHR use was significantly influenced by performance expectancy (β=0.17, p =.03) and attitude (β=0.61, $p < .01$). No moderating effects were present. HCPs selected the top three barriers to PHR use as lack of patient awareness, literacy of the patients, and patient resistance to new technologies. The three themes identified from the open-ended comments were perceived usefulness, education/training, and technology.

Conclusions

This study identified the predictors of HCPs' recommending patients use a PHR in the Kingdom of Saudi Arabia. In order to encourage HCPs to endorse PHRs, health care organizations should involve HCPs in the implementation and provide training on the features available as well as expected benefits. Campaigns should be organized for patients and HCPs to raise awareness and for educational purposes. Future studies should be conducted in other contexts and include other potential predictors.

Health Care Providers' Acceptance of a Personal Health Record: An Application of UTAUT

A wide range of eHealth technologies has become available over the past two decades as countries have introduced eHealth initiatives to support the goals for patient and person-centered care (Petrovskaya, Lau, & Antonio, 2019). Personal health records (PHRs) are an eHealth tool to increase patient engagement and empowerment by allowing individuals to keep track of their personal health information. Legislation has been adopted around the world to ensure patients have electronic access to their health information through PHRs (Gagnon et al., 2016). Person-centered care and patient engagement are now considered pillars of any high-functioning health care system, and PHRs can contribute to both (Berwick, Snair, & Nishtar, 2018; Shah & Liebovitz, 2017). However, multiple studies have shown low adoption rates (Abd-Alrazaq et al., 2019; Fraccaro, Balatsoukas, & Peek, 2017; Zhao et al., 2017). To increase PHR adoption, a holistic approach, involving multiple stakeholders, is necessary for successful uptake. Ultimately, the goal is to contribute to better patient and health care systems outcomes (Huba & Zhang, 2012; Scandurra, Jansson, Forsberg-Fransson, & Ålander, 2017; Schreiweis et al., 2019).

As a first step, relevant stakeholders must perceive the value in PHRs before they can be expected to promote or adopt their use. Although health care providers (HCPs) are not the primary beneficiaries of PHR use and, thus, may not see the value, they should be oriented towards the goals and objectives of health care organizations' efforts to increase PHR adoption. Research has shown that HCP attitudes are a major contributing factor in patients' adoption of PHRs (Agarwal et al., 2013; Assadi & Hassanein, 2017; Liu et al., 2015). HCPs play a key role in supporting and engaging patients through their attitudes, behavior, and endorsement of services (Kujala et al., 2018).

Even though studies have shown a high level of patient interest in PHRs, there has been discordance between interest and uptake because some HCPs have been reticent to accept and promote their use (Kaelber et al., 2008; Nazi, 2013; Shah & Liebovitz, 2017). Nazi explored the experiences and perspectives of United States health care professionals (physicians, nurses, and pharmacists) related to patient use of the My HealtheVet PHR and found many had a limited familiarity with the PHR features, contributing to its underutilization. Table 9 shows key strategies associated with PHR adoption by HCPs (Nazi, 2013).

Table 9

Key Strategies to Support Providers in PHR Adoption

Key Factor	Strategies
Perceived relevance	Promotional efforts to target patients and health care professionals
	Continuous reinforcement of the use of PHRs to achieve patient-centered care
Perceived value	Focus on unique services offered
Education and training	Offer systematic training to health care professionals
	Provide ongoing opportunities to interact with other users
Integration with existing technology	Integration of secure messaging interactions saved as a clinical progress note in the EHR
	Alerts and notifications should be well integrated into the EHR
Alignment with workflow	Simulation exercises can be conducted to identify how a feature can work most effectively
Incentives	Financial and nonfinancial incentives provided to individuals
Access to information	Patients share self-reported information with health care team to prevent face-to-face visits
Communication	Bidirectional communication to support interaction between patients and health care professionals

In Finland, Kujala et al. (2018) identified the concern that technical innovation can change professionals' roles and threaten professional autonomy in HCPs surveyed from a broad range of backgrounds (e.g., nurse, social worker, dentist, physician, physical therapists). Threat to professional autonomy was negatively associated with support for the portal. Moreover, most respondents believed they had not received enough information about the portal (87%).

Territorialism and threats to autonomy were previously noted in Canada (Wiljer et al., 2008). Historically, there has been information asymmetry with HCPs, especially physicians, having more information and having significant authority over patients (Bergen & Stivers, 2013). Since the shift in perspectives to provide patients with information to improve self-management and support empowerment, some HCPs feel patient assertiveness threatens their position as health authorities. Therefore, Wiljer et al. supported institutional strategies for change, including "continuous organizational reassurance" and a physician champion.

Gagnon et al. (2016) evaluated multiple stakeholders' perceptions of PHRs in Canada. The main adoption themes identified were knowledge about PHRs, user capacities and attitudes, environmental factors, and legal and ethical issues. Support from HCPs was also recognized as an important factor in PHR acceptance. Physician support of PHRs was deemed necessary to ensure sustainability.

Vreugdenhil et al. (2019) examined patients' and HCPs' perceptions of a recently introduced patient portal in an academic medical center in the Netherlands. In this mixed-methods study, they included 17 hospital staff (seven physicians) in a focus group. One physician described the changes in the doctor and patient role as "a little uncomfortable" and feeling "as if you lose your autonomy as a doctor" (p. 8). In general, HCPs described a loss of control over the health care process.

Moll and Cajander (2019) surveyed oncology nurses and physicians in Sweden where the majority believed there were advantages from PHRs, such as contributing to patients feeling more in control of their own care; however, few believed that patients accessing their PHRs resulted in patients taking better care of themselves. In another study conducted in Sweden, Wass and Vimarlund (2019) compared HCPs' perception of patients having access to their PHRs in primary care units and outpatient clinics. Compared to HCPs in primary units, those in outpatient clinics had more concerns about "patients becoming upset, worried or misunderstanding information" (Wass & Vimarlund, 2019, p. 1543). On the other hand, more HCPs in primary care units believed sharing information with patients was beneficial.

Despite the benefits of PHRs, many organizations have seen limited uptake by patients. Although PHRs are patient-facing and consumer-oriented tools, the role of HCPs in endorsing the adoption and continued use is an important one that is too often neglected. Patient engagement through PHRs is a reciprocal process and requires attention to the needs of patients and providers (Nazi, 2013; Shah & Liebovitz, 2017). Several concerns have been raised to explain the lack of support for PHRs by HCPs: confused patients, changed documentation practices, increased workload, and loss of autonomy (Kaelber et al., 2008; Kujala et al., 2018; Moll & Cajander, 2020; Nazi, 2013; Shah & Liebovitz, 2017). In order to support patient engagement, HCPs must first be educated about the relevance and value of the PHR and the features of the PHR should be integrated within the workflow.

HCPs must be actively involved from the pre-implementation stage to communicate the benefits of a PHR to patients. If providers are unaware of the PHR or lack information on the benefits and objectives, they will be unable to positively influence patients to adopt the innovation.

HCP Acceptance of PHRs in the Kingdom of Saudi Arabia

Enhancing patient-centered care through patient involvement with technology is an aim of The National Transformation Program, a component of Vision 2030—a roadmap for economic growth and national development in the Kingdom of Saudi Arabia. The Ministry of National Guard Health Affairs (MNGHA) implemented the MNGHA Care PHR in 2018. No studies have evaluated HCP acceptance of PHRs in the country. Two studies that evaluated the challenges in implementing PHRs in the country identified HCP resistance as a barrier (Al Sahan & Saddik, 2016; Alanazi & Al Anazi, 2019). The aim of this study was to identify a set of determinants in the behavioral intention to recommend use of MNGHA Care PHR using a conceptual model. To promote patient engagement and patient-centered care, a better understanding of how HCPs perceive PHRs is needed.

Theoretical Foundation

As technology is increasingly used in health care, studies to better understand factors that drive the acceptance by end-users have been undertaken. The technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) are widely used models to understand technology acceptance in health care, although they were developed outside of health care (Ammenwerth, 2019). TAM, developed in 1989 by Fred D. Davis, was based on the theory of reasoned action; he hypothesized that two constructs—perceived usefulness and perceived ease of use—affect attitude, which then influences behavioral intention to use the technology (Ajibade, 2018; Ammenwerth, 2018). Despite the high predictive power of TAM, it has several limitations, including parsimony and simplicity. It is unable to explain intention to use across a wide range of technologies, environments, and end-users (Bagozzi, 2007). Researchers also point to the fact that individual differences, such as age and education,

can be important drivers of the acceptance and willingness to use technology but are not included in TAM (Ajibade, 2018).

Venkatesh et al. (2003) developed UTAUT to provide a comprehensive framework to explain acceptance, intention, and usage of information technology in organizations. It is an integration of eight theories—theory of reasoned action, TAM, motivational model, theory of planned behavior (TPB), combined TAM-TPB, model of personal computer utilization, diffusion of innovation theory, and social cognitive theory (Venkatesh et al., 2003). The core constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions directly act on behavioral intention and, ultimately, predict use behavior. Gender, age, voluntariness, and experience are moderators in the framework. UTAUT was tested and validated with field studies conducted at four organizations where new technology was being introduced and cross-validated with new data from two other organizations. It explained approximately 77% of the variance in behavioral intention and 52% of the variance in technology use (Venkatesh et al., 2003).

UTAUT2

An expanded version of UTAUT was proposed for technology acceptance and use in the consumer context (Venkatesh et al., 2012). Venkatesh et al. (2011)proposed that specific situations or contexts may require extension of the original UTAUT model with new constructs, moderators, or relationships. While in organizational contexts, performance expectancy drives employees' technology acceptance and use behavior, other factors were hypothesized to be primary motivators for consumers. Therefore, three additional constructs expected to be important drivers were added to UTAUT2—hedonic motivation, price value, and habit. Voluntariness of use was dropped as a moderator because use of technology is not mandatory for consumers. Hedonic motivation is "the fun or pleasure derived from using a technology" and

predicts the behavioral intention to use technology" (Venkatesh et al., 2012, p. 161). Price value is the tradeoff between the perceived benefits and cost for using a technology and is a predictor of behavioral intention. The final construct added was habit, the "extent to which people tend to perform behaviors automatically," and is a predictor of behavior intention (Venkatesh, Sykes, & Zhang, 2011, p. 161). The revised model was shown to explain 74% of the variance of behavior intention and 52% of the variance in technology use in consumers, which is similar to what was seen in the original UTAUT framework (Venkatesh et al., 2012).

Research Model

Most studies have not examined the full UTAUT or UTAUT2 models with the moderation effects but rather the main effects alone, in combination with a subset of the moderators, or with new constructs or mechanisms (Venkatesh et al., 2016). Venkatesh et al (2016) proposed that future research should use UTAUT or UTAUT2 as the baseline model to transform the theory from static to dynamic (Venkatesh et al., 2016). New endogenous mechanisms or new moderation mechanisms are the most common types of extensions (Venkatesh et al., 2016). While UTAUT includes the technological dimension (performance expectancy and effort expectancy) and organizational/environmental dimension (social influence and facilitating conditions), the individual dimension is not included. Nonetheless, individual traits (attitude, personal innovativeness, computer self-efficacy) may be significant predictors of the acceptance of technology (Dwivedi et al., 2019; Rosen, 2004; Venkatesh et al., 2012). Constructs representing individual traits are frequently used as endogenous mechanisms to extend UTAUT.

Figure 7 shows the research model for this study. Figure 8 shows the original UTAUT model for reference. This study used the four core constructs of UTAUT—performance

expectancy, effort expectancy, social influence, and facilitating conditions. The construct of attitude was added as an individual characteristic. Attitude has been defined as positive or negative feelings related to performing a specific behavior (Davis et al., 1989). The five constructs will directly act on the behavioral intention to recommend the PHR. Behavioral intention is ultimately expected to lead to the actual recommendation to use the PHR. Age, years of experience, and professional role will moderate the relationship between the five main constructs and behavioral intention to recommend the PHR.

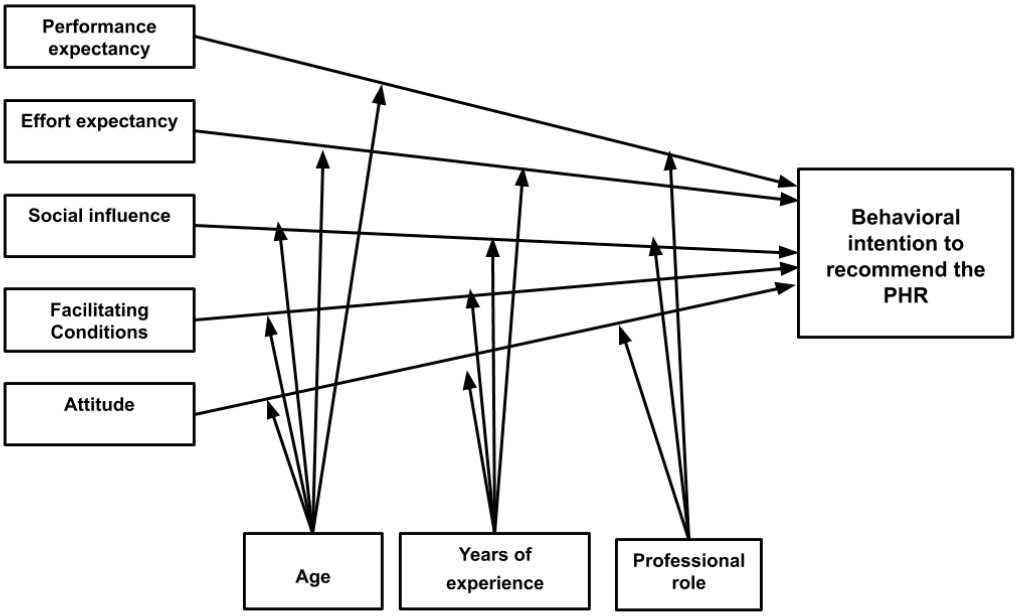

Figure 7. Adapted UTAUT model.

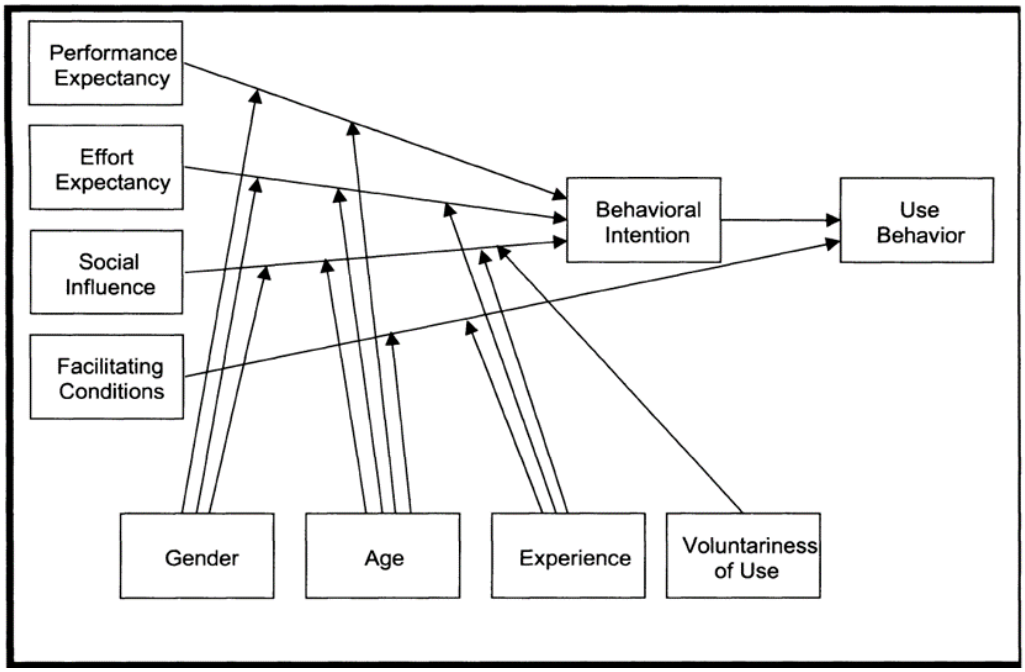

Figure 8. Original UTAUT (Venkatesh et al., 2003).

Proposed differences between this model and the original UTAUT model are shown in Table 10. The moderators chosen for this study were age, years of experience, and professional role. Li et al (2013b) analyzed eHealth adoption factors in HCPs. HCP provider characteristics such as age have been found to predict eHealth adoption. Electronic medical record use was inversely associated with physician age. Venkatesh et al (2003) found younger technology users are motivated to use a technology because the relationship between performance expectancy and behavioral intention is stronger since they give greater weight to perceived usefulness. For all other relationships between the main constructs and behavioral intention, age will act as a moderator with a stronger effect expected for older HCPs. Older users are believed to be more influenced by experience when initially using a technology and ease of use are believed to be more important (Venkatesh et al., 2003).

Years of experience was chosen as a moderator because years in practice has been associated with acceptance of eHealth (Li et al., 2013b). One study found that as the number of

years since medical school graduation increased, the less likely physicians were to accept eHealth technologies (Li et al., 2013b). Limited experience causes initial difficulties with technology use. Once experience is gained, other issues may affect the decision to continue using the technology (Venkatesh et al., 2011). Years of experience will moderate the relationships between behavioral intention and effort expectancy, social influence, facilitating conditions, and attitude.

Lastly, professional role will moderate the relationships between performance expectancy, social influence, attitude and behavioral intention. Variations in acceptance of eHealth technologies have been seen between physicians and other HCPs as well between specialists and non-specialists (Li et al., 2013b).

Table 10

Original UTAUT Versus Adapted UTAUT for Health Care Providers

	Original UTAUT Moderators				Adapted UTAUT Moderators		
	Gender	Age	Experience	Voluntariness	Age	Years of experience	Professional role
PE→BI	✓	✓			✓		✓
EE→BI	✓	✓	✓		✓	✓	
SI→BI	✓	✓	✓	✓	✓	✓	✓
BI→Use							
FC→Use		✓	✓				
FC→BI					✓	✓	
ATT→BI					✓	✓	✓

Note. PE=performance expectancy; EE= effort expectancy; SI= social influence; BI= behavioral intention; FC=facilitating conditions; ATT= attitude; Use= actual usage.

The research questions for this study were: (a) Does an adapted UTAUT model predict HCPs' behavioral intention to recommend the PHR? and (b) What barriers do health care providers' believe prevent patient use of the PHR? The hypotheses were: (a) performance expectancy, effort expectancy, facilitating conditions, social influence, and attitude have a

positive relationship with HCPs' behavioral intention to recommend MNGHA Care; and (b) age, years of experience, and professional role moderate the relationship between the main constructs and behavioral intention to recommend the use MNGHA Care.

Methods

Study design. A cross-sectional, descriptive multicenter study was conducted at the Ministry of National Guard Health Affairs (MNGHA). Data were collected using an anonymous self-administered online survey of HCPs from April 18, 2021 to May 2, 2021. The research protocol was approved by the institutional review boards at Virginia Commonwealth University and King Abdullah International Medical Center.

Setting and participants. MNGHA is a large, integrated healthcare system that provides high quality health care to the National Guard's soldiers and their dependents in all regions across the Kingdom of Saudi Arabia (KSA). It was established in 1983 and is a leader in health care services in the Middle East. Primary health care clinics and secondary and tertiary hospitals from across the organization were included. The target population was all HCPs working in MNGHA. The definition of HCP was taken from the Saudi Commission for Health Specialties: "those who have genuine qualifications and experiences for safe practice in the healthcare sector" (Saudi Commission for Health Specialties, 2015, p.9). Licensing requirements for all HCPs are established by the Saudi Commission for Health Specialties. A snowball sampling strategy was chosen to reach HCPs from across the organization.

Two approaches were used for conducting a power analysis. First, using the 10 times rule of thumb, the minimum sample size for partial least squares structural equation modeling should be the larger of (a) 10 times the largest number of formative indicators used to measure one construct, or (b) ten times the largest number of inner model paths directed at a particular

construct in the inner model (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). The largest number of indicators for one construct is four so four x 10 is 40. There are five inner model paths directed at behavioral intention so five x 10 is 50. Therefore, using the 10 times rule, 50 is larger and was the minimum sample size.

The second approach was using the power table shown in Table 11 that outlines sample size recommendations for partial least squares (Kock & Hadaya, 2018). At a statistical power of 80% and a significance level of 5%, a minimum sample size of 45 was required for an R^2 of 0.50, and a maximum number of arrows pointing at a construct as five. Using the higher estimate of the two approaches, a minimum of 50 health care providers was required to test the proposed research model. However, Kline (2015) asserted that 200 is a fair sample size, and 300 is good for statistical analysis with structural equation modeling. Therefore, a target sample size of at least 200 was chosen.

Table 11

Sample Size Recommendation in Partial Least Squares at a Power of 80%

Maximum number of arrows pointing at a construct	Minimum R^2			
	.10	.25	.50	.75
2	110	52	33	26
3	124	59	38	30
4	137	65	42	33
5	147	70	45	36
6	157	75	48	39
7	166	80	51	41
8	174	84	54	44
9	181	88	57	46
10	189	91	59	48

Participant recruitment. HCPs were recruited through the hospital's email list in combination with WhatsApp since it is a widely used social media platform for professional communication. An invitation email and follow-up reminders were sent out through HCP colleagues working in each region. An email or WhatsApp message with a link to the online survey available through QuestionPro® was shared. Prior to participating in the study, HCPs were provided with information on the purpose of the study and time required, and they were assured that participation was voluntary and responses would remain confidential (Appendix E). Follow up messages (Appendices F, G, H, and I) were sent up to three times to encourage a higher response rate. As an incentive, participants were given the choice to be entered into a drawing for a 37.5 Saudi Arabian Riyal (SAR, $10) gift card from Amazon.

Instrument Development

In this research, the steps outlined by Czaja and Blair (2005) were used in the development of the survey instrument since no validated survey to examine PHR acceptance in HCPs is available. The first step was to examine the literature to identify surveys, items from

published research, and adapted items from previously validated scales. The technology acceptance literature in health care was reviewed to identify scales. Modifications were made to existing scales with items adjusted to reflect the acceptance of PHRs in the given context. Appendix B is the preliminary survey developed for use in this study. All questions included in the instrument are modifications of previously published technology acceptance surveys used in health care and were adapted to fit PHRs (Chung et al., 2016; Hennemann, Beutel, & Zwerenz, 2017; Hoogenbosch et al., 2018; Tavares & Oliveira, 2016; Venkatesh et al., 2003). To ensure the face validity of this scale, experts familiar with the context and area of the current research reviewed the initial list of items. They were asked to suggest content areas that might have been omitted and to ensure the items were accurate, grammatically correct, and met acceptable standards for item construction (DeVellis, 2016).

Once the experts' suggestions were incorporated, institutional review board approval was sought for pilot testing in HCPs from MNGHA. Perneger et al. (2014) recommended pretesting surveys to "detect misunderstandings, ambiguities, or other difficulties participants may encounter with instrument items" (p. 147). The QuestionPro® survey link with cover letter (Appendix C) explaining the purpose of the study was emailed to seven HCPs working within MNGHA. They were asked to provide feedback on the survey length, clarity, and ease of use of the questionnaire. After incorporating their feedback and the experts' approval of the final survey outline, the survey was administered.

Measures. ***Dependent variable measurement: Behavioral intention to recommend the PHR.*** Behavioral intention is a measure of the strength of an individual's intention to perform a specific behavior (Davis et al., 1989). This measure was assessed through a single-item scale using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

(1) I will probably recommend patients use MNGHA Care in the future.

Dependent variable measurement: Barriers to MNGHA Care use. HCPs were asked to select the three main challenges that prevent patients from using MNGHA Care from a list. One open-ended question was also included: What additional comments do you have about MNGHA Care? Harland and Holey (2011) described how open-ended questions provide complementarity, initiation, and expansion to quantitative research. Complementarity clarifies while initiation can stimulate new research questions and expansion adds richness.

Independent variable measurements. The independent variables were performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude. All items were adopted from technology acceptance surveys from the literature with minor modifications. A five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used for the independent variables.

Performance expectancy (PE) is the degree to which an individual believes using a technology will help in the attainment of significant rewards. A four-item scale was used to assess this measure.

PE1 - MNGHA Care is a useful tool to help patients feel more involved in their care.

PE2 - I believe MNGHA Care helps patients to better manage their health.

PE3 - MNGHA Care will increase patient satisfaction with their health care.

PE4 - MNGHA Care can improve the quality of patient care.

Effort expectancy (EE) is the degree of ease associated with use of a technology (Venkatesh et al., 2003). This measure is operationalized as the degree of ease associated with using the PHR. This measure was assessed with a three-item scale.

EE1 - Information in MNGHA Care should be easy for our patients to understand.

EE2 - I believe most patients have the skills needed to use MNGHA Care.

EE3 - I think it is not difficult to learn to use MNGHA Care.

Social influence (SI) is the degree to which an individual perceives important people in their social circle are using a technology (Venkatesh et al., 2003). The measure was assessed by a two-item scale.

SI1-I believe our patients support the use of MNGHA Care.

SI2-In general, the organization has supported the use of MNGHA Care.

Facilitating conditions (FC) is the degree to which an individual believes that an organizational and technical infrastructure support the use of a technology (Venkatesh et al., 2003). The measure was assessed by responses to a three-item scale.

FC1 - I have enough information about MNGHA Care.

FC2 - There is technical help for patients who use MNGHA Care.

FC3 - I know the goals of MNGHA Care.

Attitude (ATT) is the degree of positive or negative feelings associated with use of a technology (Davis et al., 1989). It was operationalized as a positive feeling associated with the use of the PHR. The construct was measured by a four-item scale.

ATT1 - MNGHA Care is a valuable tool.

ATT2 - It is a good idea for patients to use MNGHA Care.

ATT3 - MNGHA Care is a positive advancement in this digital age.

ATT4 - I believe MNGHA Care will be used by many patients.

Demographic and professional characteristics. Demographic and professional characteristics were collected, including region, facility type, gender, age, and nationality, personal MNGHA Care account, and past endorsement of MNGHA Care. The professional characteristics included profession, number of years in profession, and specialty area for physicians. Table 12 shows the variables and their measurement.

Moderator measurement. The moderators for the model were age, professional role, and years of experience. All variables were categorical and are shown in Table 12.

Table 12

Variables and Measurement

Variable	Data Type
Demographics	
Region	Categorical
Facility type	Categorical
Gender	Dichotomous
Age	Categorical
Professional role	Categorical
Specialty area	Categorical
Years in profession	Categorical
Nationality	Dichotomous
Contextual	
Personal MNGHA Care account	Dichotomous
Recommended PHR to patients in the past	Dichotomous
Predictors	
Performance expectancy	Continuous
Effort expectancy	Continuous
Social influence	Continuous
Facilitating conditions	Continuous
Attitude	Continuous
Outcome	
Behavioral intention to recommend the PHR	Continuous
Barriers to PHR	Categorical

Data Analysis. *Data screening and preliminary analysis.* The analyses were conducted with SPSS Version 26.0 (IBM Corporation, 2017) and SmartPLS 3 (Ringle, Wende, & Becker, 2014). Data were downloaded from QuestionPro® in an SPSS format and were screened prior to statistical analyses by assessing and dealing with missing data (Tabachnick & Fidell, 2013). Normality of data was assessed by examining the skewness and kurtosis. All items except for the first three items of the attitude construct were normally distributed. Since SmartPLS was used for model testing, normality of data was not one of the prerequisites (Hair, Risher, Sarstedt, & Ringle, 2019).

Partial least squares. Structural equation modeling is an advanced statistical technique used to test a theory and requires prior knowledge of potential relationships among variables (Tabachnick & Fidell, 2013).There are two types of structural equation modeling—traditional covariance-based and partial least squares. The advantage of the partial least squares method is the ability to estimate complex research models without distributional assumptions (Hair, Risher, Sarstedt, & Ringle, 2019). Compared to traditional structural equation modeling, partial least squares has greater statistical power, which means there is a higher likelihood of identifying significant relationships if they are actually present in the population (Hair et al., 2019). Furthermore, partial least squares has been widely used in empirical studies of technology acceptance including with UTAUT (Venkatesh et al., 2003, 2011, 2012) and with PHR acceptance (Tavares & Oliveira, 2016, 2017)

Partial least squares was used for hypothesis testing for three main reasons. First, smaller sample sizes can produce stable parameter estimates in comparison to traditional structural equation modeling which requires 10-20 cases per parameter (Weston & Gore, 2006; Willaby, Costa, Burns, MacCann, & Roberts, 2015). Using traditional structural equation modeling, a

minimum sample size of 780 participants would be required based on the rule of 10 and 78 parameters. Researchers have typically found low response rates in HCPs, especially physicians (Brtnikova et al., 2018; Cho, Johnson, & VanGeest, 2013). Second, Hair et al. (2019) suggest using the partial least square method when the objective is to explore theoretical extensions of established theories. Finally, Hair et al. (2019) recommended this type of analysis when using a theoretical framework for prediction.

The initial step was assessment of the measurement model. Indicator loadings above .708 are recommended for acceptable item reliability; however, outer loadings as low as 0.6 have been considered acceptable for exploratory research (Avkiran, 2018; Hair et al., 2019). Internal consistency was measured with composite reliability (CR). For exploratory research, a CR of 0.6 is acceptable. Convergent validity, defined as "the degree to which scores on the focal measure are correlated with scores on measures of constructs with which there is a hypothesized relationship," was measured with average variance extracted (AVE) with greater than 0.5 considered preferable (Polit & Beck, 2017, p. 317). Finally, discriminant validity, whether one construct is distinct from another construct, was evaluated with the Fornell-Larcker criterion—the square root of the AVE is 0.522 and more than the construct correlations. Collinearity was assessed with a variance inflation factor (VIF). If an indicator had a variance inflation factor more than five, it was removed. The weight, or the relative contribution, and the loading, or absolute contribution, were assessed for each indicator, and insignificant indicators were removed from the model.

After evaluation of the measurement model, the structural model was assessed. Predictive accuracy was determined with the coefficient of determination (R^2), indicating the extent the exogenous constructs (performance expectancy, effort expectancy, social influence,

facilitating conditions, and attitude) explained the endogenous construct (behavioral intention). In addition, effect sizes (f^2) were measured. An effect size of 0.02 is considered small, 0.15 as medium and 0.35 as large (Hair et al., 2019). Finally, the significance of the path coefficients was examined.

Two items were used to assess barriers to the use of the PHR. The checklist came from barriers to PHR use identified from the literature (Miklin, Vangara, Delamater, & Goodman, 2019; Thompson, Reilly, & Valdez, 2016; Zhao et al., 2017). Frequencies of the barriers were assessed by HCP subgroups. For the open-ended question, thematic analysis was used. Braun and Clarke (2006) outlined six phases of thematic analysis: (a) getting familiar with the data, (b) developing initial codes, (c) grouping codes and searching for themes, (d) reviewing themes, (e) defining themes, and (e) preparing a report. The data were downloaded as an Excel sheet. The comments were read and reread before generating initial codes. Common concepts were grouped into existing broad themes. Subthemes were then generated. The analysis was carried out by the first author and the validity of the codes, and themes was checked by another author. Agreement was reached for all codes and themes. A table with the themes, sub-themes, and an illustrative example were prepared. Finally, frequencies and proportions of each theme and subtheme were calculated.

Results

Participants' characteristics. The participants' characteristics are shown in Table 13. There were 291 participants who participated in the survey. The majority of them were hospital-based (265/284, 93.3%), female (180/289, 62.3%), had greater than 10 years' experience (190/289, 65.7%), had greater than 10 years at MNGHA (149/289, 51.6%), and were non-Saudi

(150/288, 52.1%). Most HCPs were 40-49 years old (106/290, 36.6%), and nurses made up the largest HCP group (118/291, 40.5%).

Table 13

Participants' Characteristics (N=291)

Variables	Respondents, n (%)
Health care facility	
Dammam	53 (18.2)
Madinah	46 (15.8)
Al Ahsa	57 (19.6)
Jeddah	41 (14.1)
Riyadh	94 (32.3)
Type of facility	
Hospital	265 (93.3)
Primary health care clinic	19 (6.7)
Gender	
Male	109 (37.7)
Female	180 (62.3)
Age	
20-29 years	44 (15.2)
30-39 years	93 (32.1)
40-49 years	106 (36.6)
50 years and above	47 (16.2)
Health care provider	
Physician	50 (17.2)
Pharmacist	67 (23.0)
Nurse	118 (40.5)
Technician	45 (15.5)
Other	11 (3.8)
Years in profession	
Less than 5 years	41 (14.2)
5-10 years	58 (20.1)
Greater than 10 years	190 (65.7)
Years working at MNGHA	
< 1 year	23 (8.0)
1-4 years	43 (14.9)
5-10 years	74 (25.6)
> 10 years	149 (51.6)

Variables	Respondents, n (%)
Nationality	
Saudi	138 (47.9)
Non-Saudi	150 (52.1)
Have you heard of MNGHA Care?	
Yes	229 (91.6)
No	21 (8.4)
Do you have an MNGHA Care account?	
Yes	217 (87.9)
No	30 (12.1)
Have you used MNGHA Care?	
Yes	206 (82.4)
No	44 (17.6)
Have you recommended patients use MNGHA Care?	
Yes	202 (80.8)
No	48 (19.2)

Measurement model. The measurement model testing results are shown in Table 14. After removing the records having missing data points, a usable sample of 246 was used for structural equation modeling. The VIF of all items was below the threshold of 5.00 showing no evidence of multi-collinearity. Item loadings were in the range of 0.70-0.93, and CR was above the threshold. Moreover, the AVE of the constructs was in the range of 0.55 – 0.81.

Table 14

Measurement Model Statistics

Construct	Items	Mean	SD	VIF	Loadings	CR	AVE
Performance expectancy (PE)		4.09	0.73			0.95	0.81
	PE1			2.526	0.87		
	PE2			3.792	0.92		
	PE3			3.711	0.92		
	PE4			3.462	0.90		

Construct	Items	Mean	SD	VIF	Loadings	CR	AVE
Effort expectancy (EE)		3.75	0.67			0.79	0.55
	EE1			1.099	0.81		
	EE2			1.473	0.70		
	EE3			1.465	0.72		
Facilitating conditions (FC)		3.60	0.78			0.88	0.71
	FC1			1.756	0.85		
	FC2			1.547	0.77		
	FC3			2.023	0.90		
Social influence (SI)		3.82	0.69			0.85	0.74
	SI1			1.3	0.84		
	SI2			1.3	0.88		
Attitude (ATT)		4.08	0.63			0.94	0.80
	ATT1			4.171	0.93		
	ATT2			3.603	0.92		
	ATT3			3.486	0.91		
	ATT4			2.029	0.83		
Behavioral intention (BI)	BI	4.18	0.68		1	1	1

Discriminant validity was tested using the Fornell-Larcker criterion. The results are shown in Table 15. The square roots of the corresponding AVE are shown in bold.

Table 15 *Discriminant Validity of the Constructs*

	1	2	3	4	5
1. Attitude	**0.896**				
2. Effort Expectancy	0.697	**0.742**			
3. Facilitating Conditions	0.596	0.570	**0.843**		
4. Performance Expectancy	0.742	0.708	0.527	**0.901**	
5. Social Influence	0.646	0.671	0.645	0.602	**0.860**

Results in Table 14 and 15 provide evidence of validity and reliability of the constructs used in the model.

Structural model. After ensuring sufficient validity and reliability of the constructs, the proposed model was tested. The structural model test results for the main constructs are shown in Table 16. The nonsignificant relationships are shown in italics. Out of the five independent variables, only performance expectancy (β = 0.17, p =.03) and attitude (β = 0.61, p < .01) had a significant relationship with the intention to recommend. Attitude had a large effect size compared to performance expectancy. As shown in Figure 9, the two independent variables, performance expectancy and attitude, accounted for 70% of variance in the intention to recommend the PHR among HCPs.

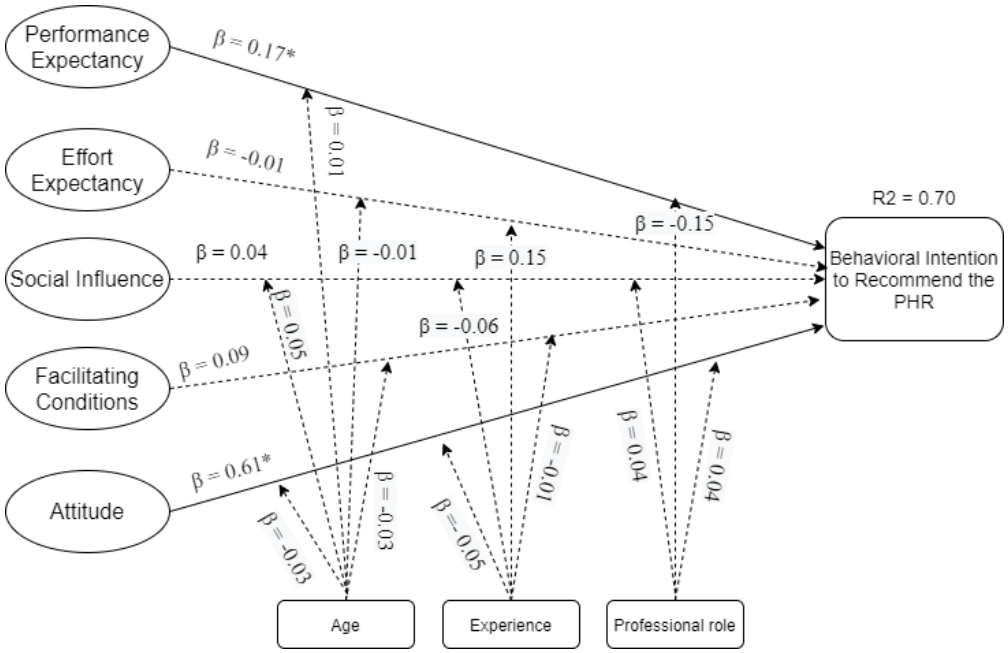

Figure 9. Structural model with β values (p < .05).

Table 16

Structural Model Results

	β	t-statistics	*p*	f^2
PE → BI	0.17	2.132	.03	0.035
EE → BI	-0.01	0.166	.87	0
SI → BI	0.04	0.473	.63	0.002
FC → BI	0.09	1.241	.21	0.013
ATT → BI	0.61	6.385	< .01	0.369

Note. PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating conditions, ATT = Attitude, BI = Intention to Recommend PHR.

The moderating effect of age, experience, and professional role was also examined. Table 17 shows the results of moderation testing. There were no moderation effects between the independent variables (performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude) and intention to recommend the PHR.

Table 17

Moderation Analysis Results

	β	t-statistics	*p*	f^2
Moderation of Age				
PE x AGE → BI	0.01	0.118	.906	0
EE x AGE → BI	-0.01	0.159	.873	0
FC x AGE → BI	-0.03	0.360	.719	0.001
SI x AGE → BI	0.05	0.633	.527	0.003
ATT x AGE → BI	-0.03	0.307	.759	0.001
Moderation of Experience				
EE x EXP → BI	0.15	1.688	.092	0.016
SI x EXP → BI	-0.06	0.609	.543	0.003
FC x EXP → BI	-0.01	0.205	.838	0
ATT x EXP → BI	-0.05	0.597	.55	0.003
Moderation of Profession				
PE x HCP → BI	-0.15	1.598	.11	0.023
SI x HCP → BI	0.04	0.620	.536	0.003
ATT x HCP → BI	0.04	0.441	.659	0.002

Note. AGE = age, EXP = experience, HCP = Profession, PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating conditions, ATT = Attitude, BI = Intention to Recommend PHR.

Barriers to acceptance of MNGHA Care. Table 18 shows the frequencies and percentages of each HCP group selecting each barrier from a checklist. Figure 10 depicts the top three barriers selected by HCPs. The top three barriers identified were lack of patient awareness, literacy of the patients, and patient resistance to new technologies.

Table 18

Barriers to MNGHA Care

Barrier	Physician n (%)	Pharmacist n (%)	Nurse n (%)	Technician n (%)	Other n (%)	Total
Lack of patient awareness	22 (14.4)	45 (29.4)	60 (39.2)	19 (12.4)	7 (4.6)	153
Lack of health care provider awareness	8 (16.7)	11 (22.9)	16 (33.3)	10 (20.8)	3 (6.3)	48
Patient resistance to new technologies	12 (12.1)	26 (26.3)	45 (45.5)	13 (13.1)	3 (3.0)	99
Literacy of the patients	21 (15)	28 (20)	71 (50.7)	14 (10)	6 (4.3)	140
Confidentiality and privacy concerns	2 (11.1)	1 (5.6)	13 (72.2)	2 (11.1)	0	18
Patient lack of experience with the use of computers	16 (20.8)	11 (14.3)	32 (41.6)	14 (18.2)	4 (5.2)	77
Patient lack of experience with the use of mobile phone applications for health	11 (12.4)	21 (23.6)	38 (42.7)	12 (13.5)	7 (7.9)	89
Security concerns	3 (17.6)	1 (5.9)	11 (64.7)	2 (11.8)	0	17
Inadequate technical support	8 (17)	11 (23.4)	19 (40.4)	7 (14.9)	2 (4.3)	47
Lack of training for patients	18 (19.8)	25 (27.5)	34 (37.4)	11 (12.1)	3 (3.3)	91
Health care provider resistance	1 (25)	0	2 (50)	0	1 (25)	4
Other barrier	2 (33.3)	1 (16.7)	2 (33.3)	1 (16.7)	0	6

For other barriers, there were six comments provided. HCPs mentioned the following concerns: a) “no internet access”; b) “application guidance”; c) “lack of patient understanding of the results displayed”; d) “fin[an]cial reason”; e) “need [to] follow up theie[*sic*] sick leave and

medical report, so they need to come to hospital"; and f) "patient will make booking for multiple clinic".

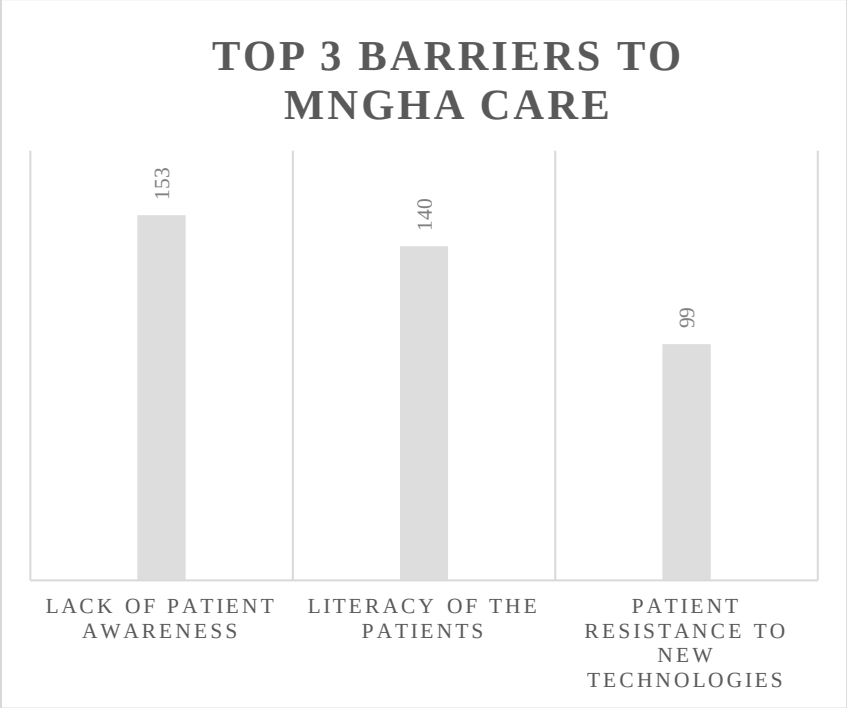

Figure 10. Top 3 barriers to MNGHA Care.

There were 36 participants who responded to the open-ended question. From these responses, there were 44 data extracts or individually coded chunks of data. The question asked was: What additional comments do you have about MNGHA Care? The characteristics of the participants are shown in Table 19. Most of the participants were female (63.4%), nurses (41.7%), had greater than 10 years' experience (63.9%), had greater than 10 years at MNGHA (47.2%), and were non-Saudi (63.9%).

Table 19

Characteristics of HCPs Who Responded to Open-ended Question (N=36)

Variables	Respondents, n (%)
Health care facility	
Dammam	7 (19.4)
Madinah	3 (8.3)
Al Ahsa	5 (13.9)

Variables	Respondents, n (%)
Jeddah	7 (19.4)
Riyadh	14 (38.9)
Type of facility	
Hospital	34 (94.4)
Primary health care clinic	2 (5.6)
Gender	
Male	13 (36.1)
Female	23 (63.4%)
Age	
20-29 years	6 (16.7)
30-39 years	9 (25.0)
40-49 years	13 (36.1)
50 years and above	8 (22.2)
Health care provider	
Physician	6 (16.7)
Pharmacist	8 (22.2)
Nurse	15 (41.7)
Other	7 (19.4)
Years in profession	
Less than 5 years	2 (5.6)
5-10 years	11 (20.6)
Greater than 10 years	23 (63.9)
Years working at MNGHA	
1-4 years	7 (19.4)
5-10 years	12 (33.3)
> 10 years	17 (47.2)
Nationality	
Saudi	13 (36.1)
Non-Saudi	23 (63.9)

There were three major themes identified: (a) perceived usefulness, (b) technology, and (c) education/training. The subthemes identified for technology were interface, technical support, security, and compatibility. Table 20 highlights themes along with illustrative quotes.

Table 20

Major Themes in Open-ended Responses Regarding MNGHA Care

Themes	Sub-themes	Illustrative quotes
Perceived usefulness	N/A	MNGHA Care is a valuable tool for everyone working in the hospital and could be useful too for every patients
Technology	Interface	The application is not user friendly, the interface is very cold and not intuitive, it serves only basic functions, and there is major areas of improvement.
Technology	Technical support	I have the application in my phone but I can't open it, I tried asking help but to no avail.
Technology	Security	Features like security questions to retrieve forgotten information or to change number just like with most social media app would be beneficial.
Technology	Compatibility	I hope you consider our elderly and illiterate population more.
Education/training	N/A	It would be a good idea to exert more effort on training patients to use this magnificent application to improve patients' health and to reduce the frequency of patients' physical meetings.

Theme 1: Technology. The most common theme identified was technology (Figure 11). Technical support was the major subtheme (Figure 12). As shown in Figure 13, six nurses reported technical difficulties with using MNGHA Care. Nurse 14 said, "The system keeps hanging although I have fast internet." Other HCP 9 said, "It needs massive bug fixes."

Physician 3 suggested overhauling the interface: "The application is not user friendly, the interface is very cold and not intuitive, it serves only basic functions and there is major areas of improvement."

Other HCPs were concerned about the compatibility. Advanced age and low levels of literacy may prevent some patients from benefiting. "I hope you consider our elderly and illiterate population more" (Physician 26). "Our aged patients, how will their best interest be communicated, because they are our vulnerable population" (Nurse 29).

Finally, a HCP mentioned having appropriate security measures in place. "Features like security questions to retrieve forgotten information or to change number just like with most social media app would be beneficial" (Nurse 18).

Theme 2: Perceived usefulness. The second most common theme focused on perceived usefulness (Figure 11). A number of responses revealed HCPs believe MNGHA Care to be a useful addition to patient care. Out of 44 extracts, 14 (32%) mentioned the perceived usefulness of MNGHA Care. The "other HCP" group reported perceived usefulness more than other HCP groups. Some of the comments were more general: "Appreciate the new approach in health care" (Nurse 22). "[…] it's a great app" (Pharmacist 27). "[…] continue the goal about MNGHA care in our hospital" (Other HCP 7). "MNGHA Care is a valuable tool for everyone working in the hospital and could be useful too for every patients" (Other HCP15). "Excellent tool" (Physician 5).

There were also references to HCPs' perceptions of specific benefits associated with using MNGHA Care. Improved efficiency and better communication between patients and HCPs were some benefits mentioned. "[…] the app is an awesome digital way to give efficient access to their health records" (Nurse 18). "[…] very nice and helpful application that will improve the health care process and facilitate patient-health care provider communication" (Pharmacist 13). "It's a valuable tool to manage your appointments, have access to your results and your personalised healthcare record is always with you" (Physician 35).

Another HCP recognized the power of MNGHA Care as a tool of patient empowerment: “I believe in the power of preventive medicine which I think MNGHA Care would be a great tool to empower and raise awareness about” (Other HCP 9).

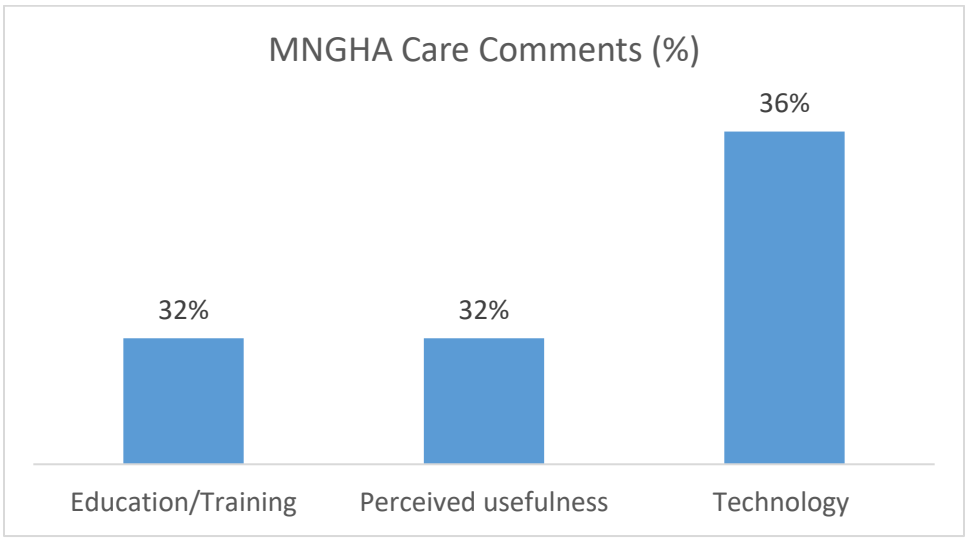

Figure 11. MNGHA Care comments (%).

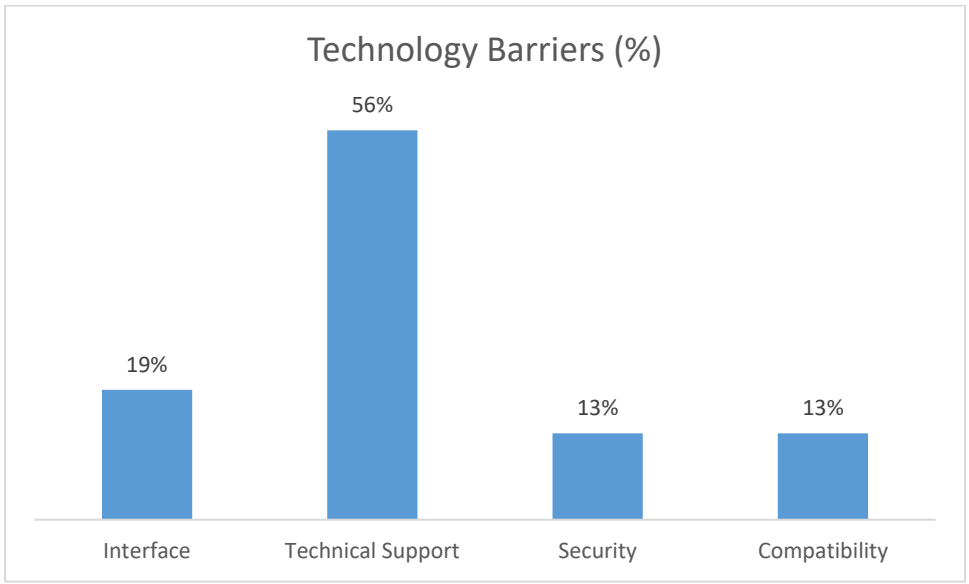

Figure 12. Technology barriers (%).

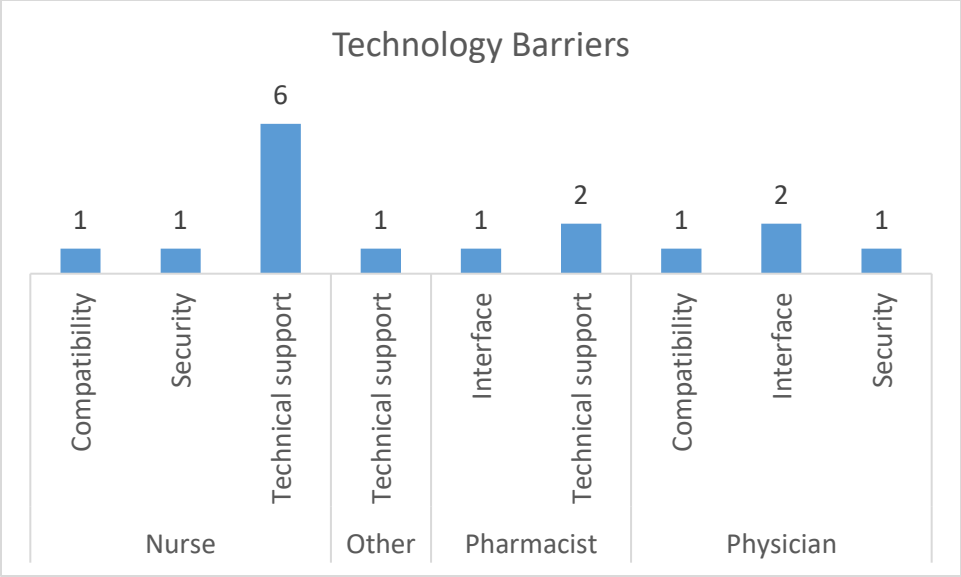

Figure 13. Technology barriers by HCP group.

Theme 3: Education/training. While many HCPs mentioned the usefulness of the PHR, it was clear that many believed there is a significant need for education and training. The third theme relates to the need to train staff and patients about the features and benefits of MNGHA Care. Nurses recognized this need more than other HCP groups.

> Well, we have to be sure that all concerned staffs - all staffs actually, are properly educated and informed on how to use this one. There should be a training on how to use per department. This way, the staffs can also help educate the patients. (Other HCP 1)

Pharmacist 23 said that they "need to have awareness campaigns for patients." In addition to staff and patients, there were concerns about caregivers also being trained. "To educate patient as well as relatives regarding the use of the application and must focus on the benefits they can get from the apps" (Nurse 21).

Discussion

This is the first study, to our knowledge, to examine factors that influence HCPs to recommend the PHR in the Kingdom of Saudi Arabia. Although HCPs are not primary users of

PHRs, their endorsement of PHRs can stimulate patient engagement in their health management through this technology (Thompson et al., 2016). Predictors of patient adoption of PHRs may differ from those that affect HCPs to endorse a PHR (Abd-Alrazaq, Bewick, Farragher, & Gardner, 2019; Thompson, Reilly, & Valdez, 2016). Since PHR research involving HCPs is rare, this study contributes to the literature on the HCP perspective (Macintosh, 2017).

The proposed theoretical model of this study explained 70% of the variance in HCPs' behavioral intention to recommend the PHR. Performance expectancy and attitude were significantly associated with behavioral intention to recommend the PHR. Much of the literature has shown performance expectancy to be the strongest predictor of intention to use a technology among HCPs (Chung et al., 2016; Ifinedo, 2012; Kim, Lee, Hwang, & Yoo, 2016). In patient and consumer studies of PHRs, performance expectancy has also been shown to be a positive predictor (Abd-Alrazaq, Bewick, Farragher, & Gardner, 2019; Abd-Alrazaq et al., 2020; Hsieh et al., 2016; Tavares & Oliveira, 2016).

The inclusion of the construct of positive attitude was a relevant and valuable contribution in understanding HCPs' perspectives towards patient use of the PHR. Attitude was the strongest predictor of behavioral intention. This finding is aligned with other studies on PHR adoption (Chung et al., 2016; Khaneghah et al., 2016). Chung et al. studied PHR acceptance among nurses and also found attitude to have the greatest effects on their intention to use the PHR.

Our findings did not support the hypothesis that age, years of experience, or HCP role moderate behavioral intention. Several studies have shown that older and more experienced HCPs are more resistant to HIT and are less comfortable with using technology (Ibrahim, Donelle, Regan, & Sidani, 2019). Physicians also have been found to be less enthusiastic about

the introduction of eHealth services (Hossain, Quaresma, & Rahman, 2019). There was no evidence that older, more experienced, nonphysicians had a stronger behavioral intention to recommend the PHR to patients. In fact, this population of older, experienced HCPs appeared to be very accepting of the idea.

From the open-ended question, a large number of comments were associated with the positive benefits and perceived usefulness of MNGHA Care. HCPs did not indicate resistance to patients using a PHR. The top three barriers to PHR use were believed to be patient-related—lack of patient awareness, literacy of the patients, and patient resistance to new technologies. Most of the barriers identified through the open-ended comments related to the need for training and PHR functionality which directly tied in to the top three barriers. Alanazi and Al Anazi (2019) conducted interviews in 35 key executives and health informatics project managers from government and private hospitals in the Kingdom of Saudi Arabia to explore challenges to PHR adoption. Even though they perceived the PHR would be an effective tool for managing health, 60% of the respondents believed patients were not ready for PHRs. Some of the barriers identified were computer literacy, physicians' resistance, and privacy and security issues. Two years prior to the implementation of MNGHA Care, Al Sahan and Saddik (2016) found technical personnel were concerned about lack of patient awareness and resistance to change from HCPs and patients.

Implications for Theory

This research adds to the literature on HCP PHR acceptance using an adapted UTAUT model. To our knowledge, this is the first study to extend the UTAUT with the construct of attitude in the context of HCP PHR acceptance. Few studies on HCP acceptance of PHRs have

used theory (Macintosh, 2017). The results of this study revealed the adapted UTAUT model to be a good predictive model of HCPs' behavioral intention to recommend a PHR.

Although the model explained 70% of the variance in behavioral intention and provided support for the proposed theoretical model, other factors may be important to HCP PHR acceptance. In the health care setting, UTAUT has been criticized for its focus on general technology acceptance factors and the inability to completely explain HIT adoption (Alaiad et al., 2019). Therefore, it has been suggested to adapt UTAUT to fit the health care context by incorporating health behavior theories, privacy and security issues, and negative factors that inhibit technology adoption (Alaiad et al., 2019).

Implications for Practice

HCP endorsement of a PHR to patients has been identified as an important factor in patients' choosing to use PHRs (Gagnon et al., 2016; Nazi, 2013; Ryan et al., 2016; Vreugdenhil et al., 2019; Wiljer et al., 2008). This study supports the need to focus on strategies to support performance expectancy and attitude. If HCPs are aware of the benefits to their patients, health care system, and care process, they will be more likely to endorse the PHR. HCPs should be trained on the features available on the PHR. Hennemann et al. (2017) suggested providing short educational sessions on eHealth interventions to facilitate acceptance among health professionals. These training sessions could be conducted by each department. Campaigns could also be directed at promoting HCP awareness. This, in turn, will increase perceived usefulness and promote a positive attitude in HCPS. Through their interactions with HCPs, patients will perceive PHRs as useful and then will be more likely to have the behavioral intention to use a PHR (Abd-Alrazaq et al., 2020).

Limitations

There are several limitations to this study. While cross-sectional studies are useful for examining associations, a causal relationship cannot be established (Hulley, 2007). Snowball sampling was used to select participants which can limit generalizability; however, participants from multiple sites were selected in order to attain good representation from across MNGHA. Self-administered online surveys are associated with various biases, including social desirability response bias and sampling bias (Polit & Beck, 2017). To minimize social desirability response bias, participants had the option not to answer any question that made them uncomfortable. HCPs were contacted multiple times and were offered an incentive to encourage a high response rate and to minimize sampling bias.

Recommendations for Future Research

Future studies should evaluate this proposed model in other contexts. This study involved one large integrated health care organization in the Kingdom of Saudi Arabia. Research in other organizations within the country and in this part of the world will increase the generalizability of our findings. Research should be also conducted in individual HCP groups. Differences in PHR acceptance have been seen based on a variety of characteristics, including age, gender, professional role, and practice setting. This study did not specifically set out to evaluate these variations; however, future researchers should examine these issues and focus on HCP group-specific interventions.

Conclusion

This study is the first to characterize the predictors of HCPs' acceptance of the PHR in the Kingdom of Saudi Arabia. Performance expectancy and attitude were found to be significant predictors of HCP's behavioral intention to support PHR use. Several barriers to behavioral

intention to recommend the PHR were identified. This research provides guidance for health care organizations on strategies to improve HCP support and decrease barriers to patient use of PHRs. Future research should explore other predictors in order to develop successful interventions to encourage the adoption and continued use of the PHR among patients.

Chapter 4: "Health Care Providers' Perceptions towards Adding a Secure Messaging Feature to a PHR"

Abstract

Background

To achieve patient- and person-centered care, patient-centered communication is necessary. Personal health records (PHRs) can facilitate patient-centered communication through the secure messaging feature. The health care team is able to communicate with patients and their caregivers to promote positive outcomes for the individuals and health care systems. As health care organizations in the Kingdom of Saudi Arabia implement PHRs and add the secure messaging feature, studies are needed to evaluate health care providers' perspectives on a secure messaging feature.

Objective

The aim of this study was to identify predictors of health care providers' behavioral intention to support the addition of a secure messaging feature using an adapted model of the unified theory of acceptance and use of technology (UTAUT) as the theoretical foundation. Another aim was to identify barriers to support a secure messaging feature.

Methods

This cross-sectional study utilized a survey developed based on the UTAUT to measure health care providers' behavioral intention to support a secure messaging feature among health care providers. The main theory constructs of performance expectancy, effort expectancy, social influence, facilitating conditions, and positive attitude toward using the PHR were collected as independent variables. Age, years of experience, and professional role were tested as moderators between the main theory constructs and behavioral intention using partial least squares structural

equation modeling. Barriers were solicited through two items, an open-ended question and a checklist.

Results

There were 224 completed questionnaires for analysis. Behavioral intention to support PHR use was significantly influenced by performance expectancy (β=0.21, p =.01) and attitude (β=0.50, $p < .01$). No moderating effects were present. The top three barriers to acceptance of a secure messaging feature were: lack of training for patients, patient lack of experience with the use of mobile phone applications for health, literacy of the patients, and patient resistance to new technologies. The three themes identified from the open-ended comments were perceived usefulness, education/training, and technology.

Conclusions

As new features such as secure messaging are added to the PHR, health care organizations may face significant challenges. Along with planning for the technical aspects of implementation, HCPs should be prepared. This study identified the predictors of HCPs' behavioral intention to accept a secure messaging feature to a PHR in the Kingdom of Saudi Arabia. HCP resistance was not evident; however, the major concerns were related to patients' ability to use this technology. Adequate training and support are necessary for patients, their caregivers, and HCPs before introducing this feature. This research provides a better understanding of HCPs' acceptance of secure messaging within this context.

Health Care Providers' Perceptions towards Adding a Secure Messaging Feature to a PHR

With the turn of the century, there was a global strategy to create stronger health care systems to meet three aims—affordable, accessible, and high quality care (Berwick, Nolan, & Whittington, 2008). In response to the patient safety concerns raised by the Institute of Medicine (IOM) report, *To Err is Human*, the IOM commissioned the Committee on Quality of Health Care in America to develop policies to improve quality of care (Berwick, 2002). The committee released the report *Crossing the Quality Chasm: A New Health Care System for the 21st Century*, which called for the patient's role to evolve from a passive recipient of care to competent and informed partner in their care. The IOM proposed "patients should have unfettered access to their own medical information" and outlined six qualities for health care—safe, effective, patient-centered, timely, efficient, and equitable ("Crossing the quality chasm," 2001, p. 14).

Health information technology (HIT) has been promoted to support the delivery of patient-centered care. Patient-centered care was defined by the IOM as "providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions" ("Crossing the quality chasm," 2001, p. 6). Finney Rutten et al. (2014) suggested HIT applications deliver patient-centered care through patient-centered communication. The six functions of patient-centered communication are to: (a) foster healing relationships, (b) exchange information, (c) respond to emotions, (d) manage uncertainty, (e) make decisions, and (f) enable self-management (Finney Rutten et al., 2014; Rathert, Mittler, Banerjee, & McDaniel, 2017). Through understanding patients' needs, values, and preferences, the relationship between patients and health care providers can be strengthened and improvements in health outcomes may be achieved (Hogan et al., 2018; Street, 2013).

Personal Health Records and Patient-Centered Communication

The IOM endorsed the use of electronic communication to replace some face-to-face visits to improve the efficiency and accessibility of health care (Wolfe, 2001). Electronic communication bridges the gap between patients and health care providers and enables patients to have continuous access to care (Alpert, Markham, Bjarnadottir, & Bylund, 2019; Chen et al., 2017; Hogan, Wakefield, Nazi, Houston, & Weaver, 2011). The majority of chronic disease care occurs away from the health care provider (HCP) and clinical environment. However, communication is frequently needed by either the patient or health care provider. Patients may need clarification, prescription refills, or questions answered (Chen et al., 2017). HCPs may need to contact patients to discuss lab results, to modify medical orders, or to change the care plan (Chen et al., 2017). Personal health records (PHRs) are a patient-centered HIT application that allows electronic communication between patients and clinicians through secure messaging. Secure messaging is defined as "any electronic communication between a provider and patient that ensures only those parties can access the communication" (Centers for Medicare and Medicaid Services., 2012, p. 54042).

The Markle Foundation provided one of the earliest definitions of the PHR as "an internet-based set of tools that allows people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it" (Markle Foundation, 2003, p. 3). There are three types of PHRs—standalone, tethered, integrated—and various features available (Alsahafi & Gay, 2018; Detmer et al., 2008). The tethered PHR, which is connected to an organization's electronic health record (EHR), will be the focus of this research. Secure messaging is a feature of some PHRs and may improve the exchange of information between patients and health care providers (Keplinger et al., 2013).

Secure messaging has been associated with positive health outcomes and better patient-provider relationships (Chen et al., 2017). Researchers have found associations between secure messaging and positive patient outcomes in diabetes (Chung, Panattoni, Chi, & Palaniappan, 2017). In a systematic review of the impact of secure messaging on diabetes outcomes, the authors found significant improvement in hemoglobin A1c with secure messaging (Kuo & Dang, 2016). However, studies have not identified a consistent effect on reducing health care utilization or outcomes such as blood pressure or cholesterol control (Heisey-Grove & DeShazo, 2020; Kuo & Dang, 2016). Compared to in-person visits, the use of secure messaging has been estimated to save over $5 billion with patients able to avoid unnecessary emergency department visits (Alpert et al., 2019).

The number of health care organizations offering the secure messaging functionality with their PHR has increased, but studies have shown that providers are reluctant to use the feature due to concerns related to threats to autonomy, workload, amount of time required, and lack of reimbursement (Alpert et al., 2019; Crotty, Mostaghimi, & Landon, 2013; Nazi, 2013; Vreugdenhil et al., 2019). Nazi et al. recognized proper training and reinforcement for patients and health care providers to be important facilitators in the success of a PHR. As health care organizations increasingly shift to virtual care, secure messaging will play a more important role in supporting continuity of care.

Secure Messaging and the Kingdom of Saudi Arabia

Previous studies in the Kingdom of Saudi Arabia have found patients are interested in a secure messaging feature in PHRs. Alhammad (2017) found 66.4% of participants would like to send emails to the doctor/clinic and 60.9% would like to receive reminders for preventive health

services. Al Sahan and Saddik (2016) reported 74.1% of participants would like to communicate with the physician.

The MNGHA Care PHR application was implemented in 2018 by the Ministry of National Guard Health Affairs (MNGHA). Some of the features available in MNHGA Care are: checking laboratory results, scheduling appointments, requesting medical reports, viewing radiology reports, providing vaccination reminders, and requesting prescription refills ("MNG-HA Care," 2020). It does not include the secure messaging functionality. The aim of this study was to investigate predictors of HCP support for secure messaging as a future feature of MNGHA Care and potential barriers.

Theoretical Foundation

The unified theory of acceptance and use of technology (UTAUT) was developed by Venkatesh et al. (2003) as a unified technology acceptance model, integrating eight theoretical models with a basis in information systems, psychology, and sociology. It was empirically tested in longitudinal studies at four organization where a new technology was introduced. The four core constructs of performance expectancy, effort expectancy, social influence, and facilitating conditions were direct determinants of user acceptance and usage behaviors. Behavioral intention precedes the use of technology. Performance expectancy and effort expectancy represent technology attributes. Social influence and facilitating conditions are contextual factors. Gender, age, experience, and voluntariness were moderators of the relationships between the core constructs and behavioral intention and use behavior. The model was found to have a high predictive power of behavioral intention and use behavior.

Since its development, UTAUT has been used extensively and in a wide range of contexts to explain technology adoption (Dwivedi et al., 2019; Venkatesh et al., 2016; Williams et al.,

2015). It has been modified and tested in various ways with many researchers not using the complete UTAUT model (Dwivedi et al., 2019). Dwivedi et al. (2019) found that 75% of studies using the UTAUT model included constructs other than those found in the original model. Furthermore, few studies have used the four moderators used in the original model, and most have used no moderator in the technology adoption and use context (Dwivedi et al., 2019).

Research model. Venkatesh et al. (2016) proposed future research should use UTAUT as the baseline model to transform the theory from static to dynamic. Venkatesh et al. (2012) described the three types of UTAUT extensions and integrations as (a) examining UTAUT in a new context, (b) adding a new construct, or (c) adding an exogenous predictor of the UTAUT variables. Despite the high predictive power of the original model, researchers have criticized the lack of a construct to reflect individual behavior (Dwivedi et al., 2019). Therefore, UTAUT has been extended by adding a construct for individual behavior. Some of the individual characteristics found in the literature include attitude, personal innovativeness, and computer self-efficacy (Dwivedi et al., 2019).

Figure 14 shows the research model for this study. The four core constructs of UTAUT—performance expectancy, effort expectancy, social influence, and facilitating conditions—will be used. The construct of attitude will be added as an individual characteristic and an endogenous mechanism to extend UTAUT. Attitude has been defined as positive or negative feelings related to performing a specific behavior (Davis et al., 1989). The five constructs will directly act on the behavioral intention to recommend the PHR, ultimately leading to the behavioral intention to support secure messaging. The hypotheses are: (a) performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude will have a positive relationship with HCP intention to support secure messaging; and (b) age, years of experience, and professional role

will moderate the relationship between the five main constructs and behavioral intention to support secure messaging. Figure 15 shows the original UTAUT for comparison.

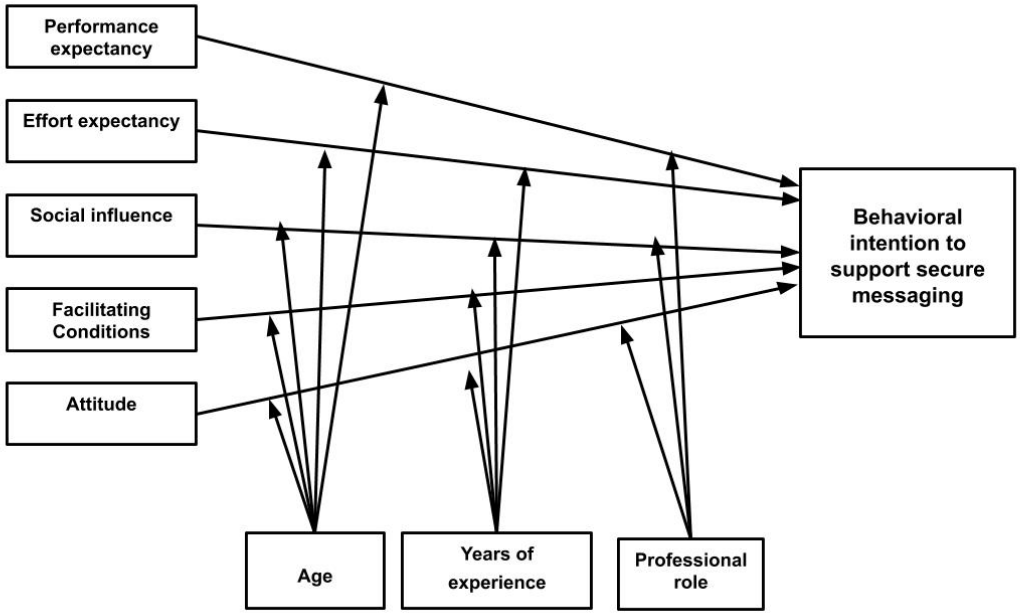

Figure 14. Adapted UTAUT model for HCP acceptance of secure messaging.

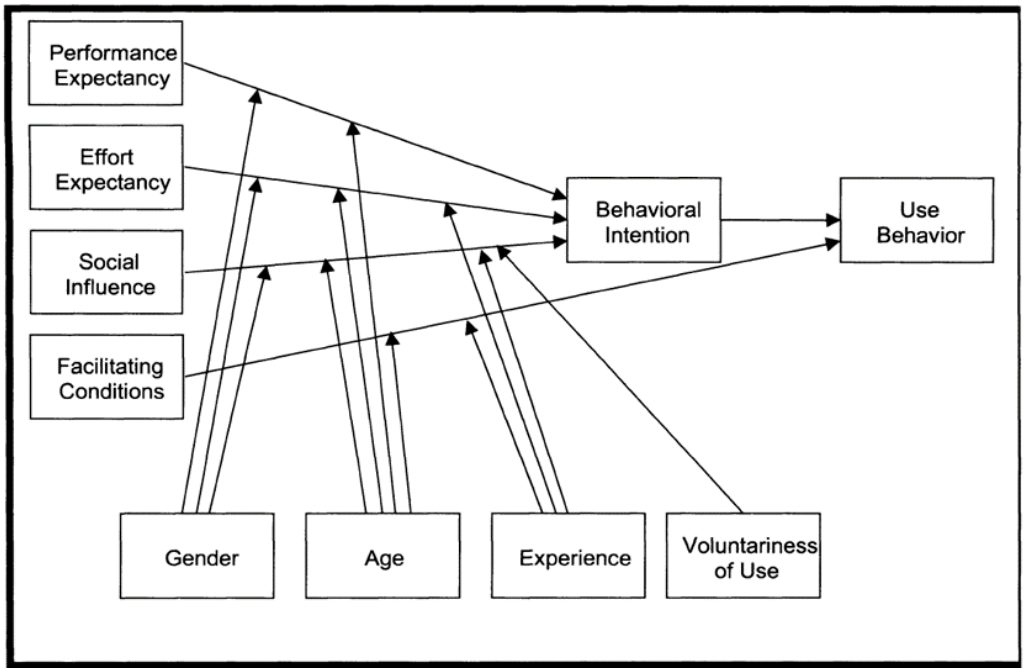

Figure 15. Original UTAUT (Venkatesh et al., 2003).

Proposed differences between this model and the original UTAUT model are shown in Table 21. Moderators should be selected based on a theoretical basis. For this paper, age, years of experience and professional role were tested as moderators. The moderating effect of age has been studied in other technology acceptance studies (Abd-Alrazaq et al., 2019; Alsahafi et al., 2020; Tavares & Oliveira, 2016; Venkatesh et al., 2003). Venkatesh et al (2003) found the relationship between performance expectancy and behavioral intention was stronger for younger employees because they give greater weight to perceived usefulness. Similarly, this research will use age with the expectation that the influence of performance expectancy will be moderated by age so the effect will be stronger for younger HCPs since older works are less adaptable and willing to use new technology (Tripathi, 2018). For all other relationships between the main constructs and behavioral intention, age will act as moderated with a stronger effect expected for older HCPs.

An indirect relationship has been seen between the number of years since graduating medical school and support for HIT use among physicians (Carlton, Holsinger, & Anunobi, 2016). As the number of years out of medical school increases, support for HIT decreases. Problems using technology that are evident when experience is limited diminish over time and process issues drive use at later stages (Venkatesh et al., 2011). Years of experience will moderate the relationships between behavioral intention and effort expectancy, social influence, facilitating conditions, and attitude.

Finally, professional role is expected to moderate the relationships between performance expectancy, social influence, attitude and behavioral intention. Li et al (2013b) found variations in acceptance of eHealth technologies between physicians and other HCPs as well between

specialists and non-specialists. The threat of loss of autonomy weakens physicians' behavioral intention to support the use of the PHR as compared to other HCPs.

Table 21

Original UTAUT Versus Adapted UTAUT for Health Care Providers

	Original UTAUT Moderators				Adapted UTAUT Moderators		
	Gender	Age	Experience	Voluntariness	Age	Years of experience	Professional role
PE→BI	✓	✓			✓		✓
EE→BI	✓	✓	✓		✓	✓	
SI→BI	✓	✓	✓	✓	✓	✓	✓
BI→Use							
FC→Use		✓	✓				
FC→BI					✓	✓	
ATT→BI					✓	✓	✓

Note. PE= performance expectancy; EE=effort expectancy; SI= social influence; BI= behavioral intention; FC= facilitating conditions; ATT= attitude; Use= actual usage.

The research questions for this study were: (a) Does an adapted UTAUT model predict health care providers' behavioral intention to support a secure messaging feature be added to the existing PHR? and (b) What are barriers to HCPs supporting the addition of secure messaging? The hypotheses are: (a) performance expectance, effort expectancy, facilitating conditions, social influence, and attitude have a positive relationship with HCPs' behavioral intention to support a secure messaging feature be added to MNGHA Care; and (b) age, years of experience, and professional role moderate the relationship between the main constructs and behavioral intention to support secure messaging.

Methods

Study design. A cross-sectional multicenter study was conducted across MNGHA to assess predictors of secure messaging acceptance among various HCP groups using a self-administered survey. The research protocol was submitted for institutional review board approval at Virginia Commonwealth University and King Abdullah International Medical Center.

Setting and participants. MNGHA is a large healthcare system established in 1983 to provide state of the art medical care to the National Guard's soldiers and their dependents in all regions across the Kingdom of Saudi Arabia (KSA). Primary health care clinics and secondary and tertiary hospitals across the organization were included to have the broadest scope.

This study used a snowball sampling method to reach the population of HCPs working in MNGHA. The Saudi Commission for Health Specialties establishes licensing requirements for all HCPs, including physicians, pharmacists, nurses, dentists, applied medical science specialists (e.g., physical therapists and dietitians), and technicians. The Saudi Commission defines a health care practitioner as "those who have genuine qualifications and experiences for safe practice in the healthcare sector" (Saudi Commission for Health Specialties, 2015, p.9).

The rule of 10 is a commonly applied rule of thumb in partial least squares structural equation modeling (Avkiran, 2018; Hair et al., 2019; Kock & Hadaya, 2018). Using this rule, the minimum sample size should be the larger of either (a) ten times the largest number of inner model paths directed at a particular construct in the inner model, or (b) ten times the largest number of formative indicators used to measure one construct (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). With five inner model paths directed at behavioral intention, the minimum sample size was five x 10 or 50. The largest number of indicators for one construct is four so the minimum sample size was four x 10 or 40. Since 50 was the larger number, it was the required minimum sample size. However, a target sample size of at least 200 was chosen because Kline (2015) asserted that 200 is a fair sample size, and 300 is good for statistical analysis with structural equation modeling.

Participant recruitment. Colleagues from each facility assisted in the data collection using their email list and professional contacts in WhatsApp. WhatsApp is a widely used social

media platform for communication. The same message was used for both modes of communication. An invitation email and/or WhatsApp message with a link to the online survey available through QuestionPro® were sent out through HCP colleagues working in each region. HCPs were provided with information on the purpose of the study and the time required and were assured that participation was voluntary and responses would remain confidential (Appendix E). To maximize the response rate, follow up messages (Appendices F, G, H, and I) were sent up to three times. As an incentive, participants were given the choice to be entered into a drawing for a 37.5 Saudi Arabian Riyal (SAR, $10) gift card from Amazon.

Instrument development. Czaja and Blair (2005) outlined the stages in survey development. In the first stage, preliminary planning, requires the researcher to specify the research question and goals of the survey. A review of the literature can identify surveys, adapted items from previously validated scales, and items from published research. To draft the preliminary survey for this study, modifications were made to existing scales with items adjusted to reflect the acceptance of PHRs in the given context. Appendix B is the preliminary survey developed for use in this study. All questions included in the instrument are modifications of previously published technology acceptance surveys used in health care and were adapted to fit PHRs (Chung et al., 2016; Hennemann et al., 2017; Hoogenbosch et al., 2018; Tavares & Oliveira, 2016; Venkatesh et al., 2003). In the second stage, to ensure the face validity of this scale, experts familiar with the context and area of current research reviewed the initial list of items in the light of construct definitions. They ensured the items were accurate, grammatically correct, and met acceptable standards for item construction (DeVellis, 2016).

Once the experts' suggestions were incorporated, institutional review board approval was sought for pilot testing. Perneger et al. (2014) recommended pretesting surveys to "detect

misunderstandings, ambiguities, or other difficulties participants may encounter with instrument items" (p. 147). The QuestionPro® survey link with cover letter (Appendix C) explaining the purpose of the survey pilot test was emailed to seven HCPs working in MNGHA. They were asked to provide feedback on the survey length, clarity, and ease of use using the Pilot Testing Tool (Appendix D).

Stage three was the final survey design and planning. Pilot data were used to examine the clarity and time necessary for completion. Feedback from these results was used to improve the final survey. Necessary revisions were made.

Stage four was data collection. The link to the final survey through QuestionPro® was distributed to HCPs across MNGHA using the hospital's email list and WhatsApp.

Measures. ***Dependent variable measurement: Behavioral intention to support secure messaging.*** Behavioral intention is the strength of an individual's intention to perform a specific behavior (Davis et al., 1989). This measure was assessed through a single-item scale using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

(1) I would endorse secure messaging between patients and health care providers.

Dependent variable measurement: Barriers to secure messaging. HCPs were asked to select the three main challenges to adding a secure messaging feature to MNGHA Care. One open-ended question was included: What concerns do you have about adding a secure messaging feature to MNGHA Care? Open-ended questions increase the depth of quantitative research through complementarity, initiation, and expansion (Harland & Holey, 2011).

Independent variable measurements. The independent variables were performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude. All items

were adapted from UTAUT surveys in the literature with minor modifications. A five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used for all independent variables.

Performance expectancy (PE) is the degree to which an individual believes using a technology will help in the attainment of significant rewards. A four-item scale was used to assess this measure.

PE1 - Adding secure messaging to MNGHA Care can likely enhance the efficiency in health care.

PE2 - I believe secure messaging will promote positive health outcomes.

PE3 - Secure messaging will help patients to better manage their health.

PE4 - I think secure messaging will be a useful extension to existing treatment.

Effort expectancy (EE) is the degree of ease associated with use of a technology (Venkatesh et al., 2003). A three-item scale was used to assess this measure.

EE1 - I think secure messaging would be easy to use.

EE2 - I believe most patients could easily learn to use secure messaging.

EE3 - Learning to use secure messaging will be easy for me.

Social influence (SI) is the degree to which an individual perceives important people in their social circle are using a technology (Venkatesh et al., 2003). A two-item scale was used to assess this measure.

SI1 - I believe our patients will use secure messaging.

SI2 - The organization would support the use of secure messaging.

Facilitating conditions is the degree to which an individual believes that an organizational and technical infrastructure support the use of a technology (Venkatesh et al., 2003). The measure was assessed by responses to a three-item scale.

FC1 - The organization has the resources to support the use of secure messaging.

FC2 - Technical help would be available to assist health care providers and patients with using secure messaging.

FC3 - I think secure messaging fits well with the mission of the organization.

Attitude (ATT) is the degree of positive or negative feelings associated with use of a technology (Davis et al., 1989). A four-item scale was used to assess this measure.

ATT1 - Secure messaging is a valuable tool.

ATT2 - It is a good idea for patients to use secure messaging.

ATT3 - Secure messaging is a positive advancement in this digital age.

ATT4 - I believe secure messaging will be used by many patients.

Demographic, professional, and contextual characteristics. The demographic and professional characteristics were collected to describe the study sample. The demographic characteristics included region, facility, gender, age, and nationality. The professional characteristics included profession, years in profession, years at MNH-HA, and specialty area for physicians. The contextual characteristics were personal MNGHA Care account and whether the PHR has been recommended to patients in the past. All variables and their measurement are shown in Table 22.

Table 22

Variables and Their Measurement

Variable	Data Type
Demographics	
Region	Categorical
Facility type	Dichotomous
Gender	Dichotomous
Age	Categorical
Professional role	Categorical
Specialty area	Categorical
Years in profession	Categorical

Years at MNGHA	Categorical
Nationality	Dichotomous
Contextual	
Personal MNGHA Care account	Dichotomous
Recommended PHR to patients in the past	Dichotomous
Predictors	
Performance expectancy	Continuous
Effort expectancy	Continuous
Social influence	Continuous
Facilitating conditions	Continuous
Outcome	
Behavioral intention to support secure messaging	Continuous
Barriers to PHR	Categorical

Data analysis. *Data screening and preliminary analysis.* The analyses were conducted with SPSS Version 26.0 (IBM Corporation, 2017) and SmartPLS 3 (Ringle et al., 2014). Before conducting any statistical test, data were screened for missing data and outliers. The mean and standard deviation was calculated for each item of the constructs of performance expectancy, effort expectancy, social influence, facilitating conditions, attitude, and behavioral intention to support secure messaging.

Partial least squares. Partial least squares structural equation modeling was used to test the theoretical model using SmartPLS. There are two types of structural equation modeling—traditional covariance based and partial least squares. Hair et al. (2019) identified several instances when partial least squares should be chosen over traditional structural equation modeling. Relevant to this research, it was chosen because it would test the predictive capacity of a theoretical framework. Next, this research sought to extend an established theory. Finally, it is preferred with smaller sample sizes and is not restricted by a lack of normality. Research has shown low response rates in HCPs (Brtnikova et al., 2018; Cho et al., 2013). Partial least

squares path modeling has been widely used in empirical studies of technology acceptance including with UTAUT (Venkatesh et al., 2003, 2011, 2012) and with PHR acceptance (Tavares & Oliveira, 2016, 2017).

The first step in the process was to evaluate the measurement model by examining the estimates of internal consistency for each block of indicators. The initial step was assessing the measurement model. Indicator loadings above .708 are recommended for acceptable item reliability (Avkiran, 2018; Hair et al., 2019). Composite reliability (CR) was used to measure internal consistency with 0.6 considered as acceptable. Convergent and discriminant validity were assessed using the average variance extracted (AVE). Indicators were removed if the variance inflation factor was more than five, indicating collinearity, or if the weight and the loading were insignificant.

The structural model was assessed after evaluation of the measurement model. Predictive accuracy was determined with the coefficient of determination (R^2), indicating the extent the exogenous constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude) explained the endogenous construct (behavioral intention). The effect sizes (f^2) were measured and determined to be small (0.02), moderate (0.15), or large (0.35). Path coefficients were interpreted as regression coefficients with the t statistic calculated using bootstrapping, a nonparametric technique for estimating the precision of the partial least squares estimates. Finally, the significance of the path coefficients was examined.

Two items were included to assess barriers to the addition of secure messaging. The checklist consisted of factors identified from the literature (Bishop, Press, Mendelsohn, & Casalino, 2013; Miklin et al., 2019; Popeski et al., 2015). The top three barriers were assessed overall. The frequencies and percentages of each barrier were calculated by HCP group. The

open-ended question was analyzed using the six phases of thematic analysis as described by Braun and Clarke (2006). After the data were downloaded as an Excel spreadsheet, each comment was read several times before initial codes were generated. Broad themes were used to group common concepts. The codes were then reviewed again to determine whether subthemes were necessary. The first author conducted the thematic analysis, and another author checked the validity of the codes and themes. Agreement was reached for all codes and themes. A table was developed with themes, subthemes, and quotes to illustrate the meaning of each theme and subtheme. Frequencies and proportions of each theme and subtheme were calculated overall and by HCP group.

Results

Participants' characteristics. The characteristics of the respondents are shown in Table 23. The majority of the HCPs were non-Saudi (126/224, 56.5%), hospital-based (213/224, 95.1%), female (149/224, 66.5%), had greater than 10 years' experience (154/224, 68.8%), and had greater than 10 years at MNGHA (117/224, 52.2%). Most participants were 40-49 years of age (89/224, 39.9%), and nurses represented the largest group of HCPs (101/224, 45.1%).

Table 23

Participants' Characteristics (N=224)

Variables	Respondents, n (%)
Health care facility	
Dammam	40 (17.9)
Madinah	30 (13.4)
Al Ahsa	46 (20.5)
Jeddah	29 (12.9)
Riyadh	79 (32.3)
Type of facility	
Hospital	213 (95.1)
Primary health care clinic	9 (4.0)
Gender	

Variables	Respondents, n (%)
Male	75 (33.5)
Female	149 (66.5)
Age	
20-29 years	31 (13.9)
30-39 years	70 (31.4)
40-49 years	89 (39.9)
50 years and above	33 (14.8)
Health care provider	
Physician	35 (15.6)
Pharmacist	50 (22.3)
Nurse	101 (45.1)
Technician	29 (12.9)
Other	9 (4.0)
Years in profession	
Less than 5 years	27 (12.1)
5-10 years	43 (19.2)
Greater than 10 years	154 (68.8)
Years working at MNGHA	
< 1 year	12 (5.4)
1-4 years	34 (15.2)
5-10 years	61 (27.2)
> 10 years	117 (52.2)
Nationality	
Saudi	97 (43.5)
Non-Saudi	126 (56.5)
Have you heard of MNGHA Care?	
Yes	208 (92.9)
No	16 (7.1)
Do you have an MNGHA Care account?	
Yes	195 (88.2)
No	26 (11.8)
Have you used MNGHA Care?	
Yes	186 (83.0)
No	38 (17.0)
Have you recommended patients use MNGHA Care?	

Variables	Respondents, n (%)
Yes	179 (79.9)
No	45 (20.1)

Measurement model. The measurement model testing results are shown in Table 24. Item loadings of all the items were in the range of 0.83-0.95, and CR was above the threshold. The AVE of the constructs was in the range of 0.74 – 0.87. However, one item from performance expectancy (PE2) had a VIF value higher than 5, indicating multicollinearity. This item was removed from further analysis.

Table 24

Measurement Model Statistics

Construct	Items	Mean	SD	VIF	Loadings	CR	AVE
Performance expectancy (PE)		3.99	0.71			0.95	0.87
	PE1			3.518	0.92		
	PE2			*6.198*	*0.95*		
	PE3			4.737	0.95		
	PE4			3.417	0.93		
Effort expectancy (EE)		3.85	0.64			0.89	0.74
	EE1			2.452	0.91		
	EE2			1.862	0.83		
	EE3			1.753	0.84		
Facilitating conditions (FC)		3.87	0.73			0.93	0.86
	FC1			2.104	0.91		
	FC2			2.104	0.94		
Social influence (SI)		3.81	0.69			0.89	0.81
	SI1			1.602	0.90		
	SI2			1.602	0.90		

Attitude (ATT)		3.93	0.69			0.95	0.82
	ATT1			4.522	0.93		
	ATT2			4.65	0.94		
	ATT3			4.587	0.94		
	ATT4			2.192	0.83		
Behavioral intention (BI)	BI	3.95	0.78		1	1	1

The discriminant validity was tested using the Fornell-Larcker criterion. The results are shown in Table 25. The square root of the corresponding AVE is shown in bold.

Table 25

Discriminant Validity of the Constructs

	1	2	3	4	5
1. Attitude	**0.907**				
2. Effort Expectancy	0.809	**0.860**			
3. Facilitating Conditions	0.873	0.794	**0.928**		
4. Performance Expectancy	0.834	0.792	0.783	**0.935**	
5. Social Influence	0.82	0.815	0.822	0.742	**0.898**

Results in Tables 24 and 25 provide evidence of validity and reliability of the constructs used in the model.

Structural model. After ensuring sufficient validity and reliability of the constructs, the proposed model was tested. The nonsignificant relationships are shown in italics in Figure 16. Out of the five independent variables, only performance expectancy ($\beta = 0.21$, $p = .01$) and attitude ($\beta = 0.50$, $p < .01$) had a significant relationship with the intention to endorse secure messaging in PHR (Table 26). Attitude had a medium effect size, whereas performance expectancy had a small effect size. The other three variables did not predict the intention to endorse secure messaging in PHR among the HCP. The two independent variables—

performance expectancy and attitude—accounted for 73% of variance in the intention to support secure messaging service in PHR among HCPs.

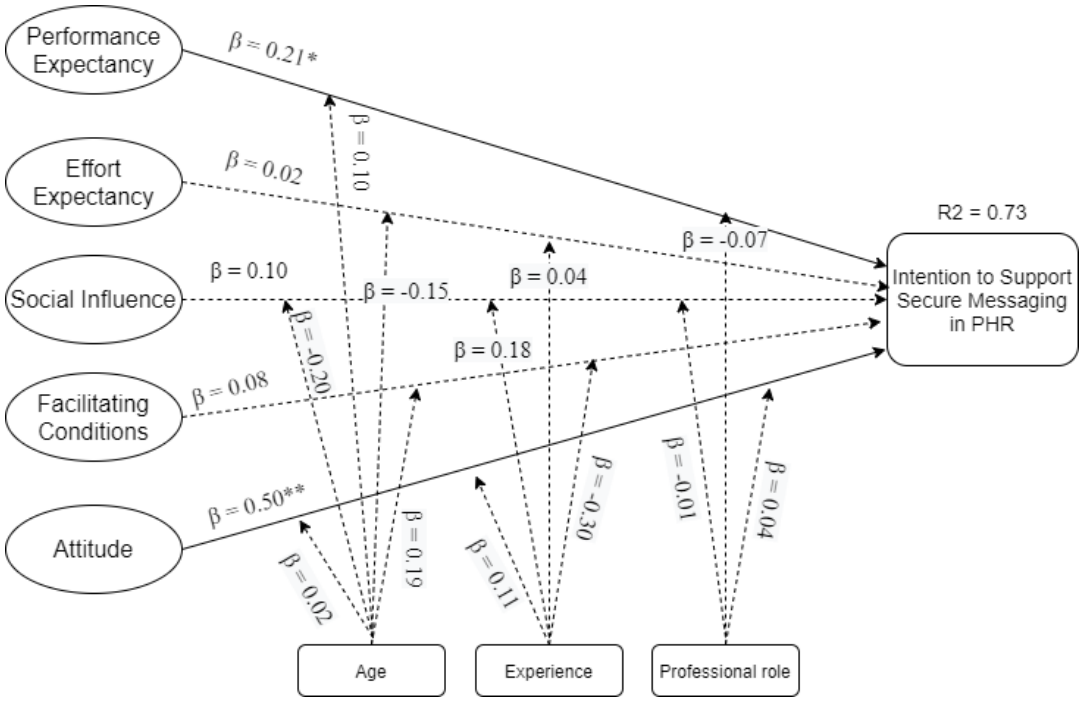

Figure 16. Structural model.

Table 26

Structural Model Results

	β	t-statistics	*p*	f^2
PE → BI	0.21	2.486	.01	0.04
EE → BI	0.02	0.218	.83	0
SI → BI	0.10	0.902	.37	0.009
FC → BI	0.08	0.585	.56	0.005
ATT → BI	0.50	3.551	< .01	0.144

Note. PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating conditions, ATT = Attitude, BI = Intention to Support Secure Messaging.

In addition to main variables, the moderating effect of age, experience, and type of profession was also examined. Table 27 shows the results of moderation testing. None of the proposed moderators—age, experience, and professional role—moderated the suggested

relationships between the independent variables (performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude) and intention to endorse secure messaging in PHR.

Table 27

Moderation Analysis Results

	β	t-statistics	*p*	f^2
Moderation of Age				
PE x AGE → BI	0.10	1.194	.233	0.01
EE x AGE → BI	-0.15	0.998	.319	0.01
SI x AGE → BI	-0.20	1.19	.235	0.02
FC x AGE → BI	0.19	1.056	.291	0.014
ATT x AGE → BI	0.02	0.162	.871	0
Moderation of Experience				
EE x EXP → BI	0.04	0.277	.782	0.001
SI x EXP → BI	0.18	0.966	.335	0.014
FC x EXP → BI	-0.30	1.580	.115	0.026
ATT x EXP → BI	0.11	0.492	.623	0.003
Moderation of Profession				
PE x HCP → BI	-0.07	0.732	.465	0.006
SI x HCP → BI	-0.01	0.021	.983	0
ATT x HCP → BI	0.04	0.330	.741	0.002

Note. AGE = age, EXP = experience, HCP = Profession, PE = Performance Expectancy, EE = Effort Expectancy, SI = Social Influence, FC = Facilitating conditions, ATT = Attitude, BI = Intention to Support Secure Messaging.

Barriers to secure messaging. Barriers to secure messaging were examined through a checklist and an open-ended question. Table 28 shows the frequencies and percentages of barriers reported by HCP subgroups. Figure 17 shows the top three barriers were: lack of training for patients, patient lack of experience with the use of mobile phone applications for health, patient resistance to new technologies, and literacy of the patients.

Table 28

Barriers to Secure Messaging by HCP

Barriers	Physician n (%)	Pharmacist n (%)	Nurse n (%)	Technician n (%)	Other n (%)	Total
Patient resistance to new technologies	13 (11.3)	30 (26.1)	50 (43.5)	18 (15.7)	4 (3.5)	115
Literacy of the patients (i.e., reading, writing, health)	19 (13.3)	28 (19.6)	71 (49.7)	21 (14.7)	4 (2.8)	143
Confidentiality and privacy concerns	5 (9.6)	10 (19.2)	24 (46.2)	10 (19.2)	3 (5.8)	52
Patient lack of experience with the use of computers	15 (22.1)	11 (16.2)	27 (39.7)	13 (19.1)	2 (2.9)	68
Patient lack of experience with the use of mobile phone applications for health	13 (13.5)	22 (22.9)	42 (43.8)	13 (13.5)	6 (6.3)	96
Inadequate technical support	11 (16.2)	12 (17.6)	35 (51.5)	8 (11.8)	2 (2.9)	68
Security concerns	4 (17.4)	6 (26.1)	7 (30.4)	4 (17.4)	2 (8.7)	23
Lack of training for patients	13 (13.5)	28 (29.2)	41 (42.7)	11 (11.5)	3 (3.1)	96
Health care provider resistance	4 (22.2)	6 (33.3)	5 (27.8)	3 (16.7)	0	18
Other barrier	0	2 (66.7)	1 (33.3)	0	0	3

There were three other barriers identified by HCPs. They were “cost of data”, manpower to answer the question”, and “no internet access”.

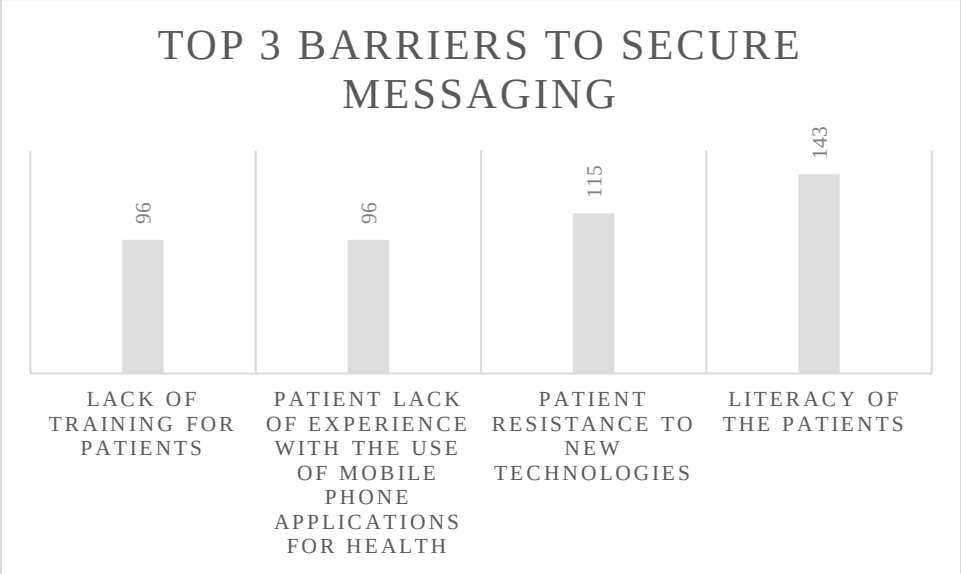

Figure 17. Top 3 barriers to secure messaging.

There were 21 participants who responded to the open-ended question. From these responses, there were 23 data extracts, or individually coded chunks of data. The question asked was: What concerns do you have about adding a secure messaging feature to MNGHA Care? The characteristics of the participants who answered this question are shown in Table 29. Most of the participants were non-Saudi (66.7%), female (76.2%), nurses (42.9%), more than 10 years’ professional experience (61.9%), and more than 10 years at MNGHA (42.9%).

Table 29

Characteristics of Respondents to Open-ended Question (N=21)

Variables	Respondents, n (%)
Health care facility	
Dammam	6 (28.6)
Madinah	3 (14.3)
Al Ahsa	2 (9.5)
Jeddah	3 (14.3)
Riyadh	7 (33.3)
Type of facility	
Hospital	20 (95.2)

Variables	Respondents, n (%)
Primary health care clinic	1 (4.8)
Gender	
Male	5 (23.8)
Female	16 (76.2)
Age	
20-29 years	4 (19.0)
30-39 years	6 (28.6)
40-49 years	5 (23.8)
50 years and above	6 (28.6)
Health care provider	
Physician	3 (14.3)
Pharmacist	5 (23.8)
Nurse	9 (42.9)
Other	4 (19.0)
Years in profession	
Less than 5 years	2 (9.5)
5-10 years	6 (28.6)
Greater than 10 years	13 (61.9)
Years working at MNGHA	
1-4 years	5 (23.8)
5-10 years	7 (33.3)
> 10 years	9 (42.9)
Nationality	
Saudi	7 (33.3)
Non-Saudi	14 (66.7)

Three major themes were identified: (a) technology, (b) education/training, and (c) perceived usefulness. Table 30 outlines the major themes, subthemes, and illustrative quotes.

Table 30

Major Themes from Open-ended Comments

Themes	Subthemes	Illustrative quotes
Technology	Technical support	To customize the use of the electronic options takes looooooong [*sic*] time BESTCare enhancements [is a] current live example
Technology	Security	Confidentially [*sic*] might be the concern but I believe If secure messaging would have use of OTP sent to the patient s cell phone to open messages it will be secured
Technology	Compatibility	My concerns relate to patients literacy, education level and culture.
Education/training	N/A	Most patients might not find it easy to use as long as someone will educate them.
Perceived usefulness	N/A	Its [*sic*] a great idea that will enhance the communication between the patient and health care providers.

Theme 1: Technology. The most commonly reported theme was related to technology as shown in Figure 18. The subthemes of technology (Figure 19) were compatibility (50%), security (38%), and technical support (13%). Figure 20 shows nurses reported technology as barriers more than the other HCP groups. Most of the comments were related to concerns about compatibility with patient-related barriers such as age, education, literacy, and language barriers. All HCP groups mentioned compatibility concerns as depicted in Figure 21.

"If we experience misunderstanding from a family member sending us text, chat, or voice message, how much more with this app?" (Other HCP 2). "…if referring to the messaging between the patient and their physician I think it would be appropriate for younger generation" (Other HCP 5).

The second most common subtheme was related to security concerns. "Confidentially [*sic*] might be the concern but I believe if secure messaging would have use of OTP sent to the

patients cell phone to open messages it will be secured" (Nurse 11). "...privacy and confidentiality issue if anyone else has access to patient's phone" (Physician 22). "…with so many apps I value my personal information" (Nurse 18).

Finally, several HCPs mentioned current difficulties using MNGHA Care and the need for more technical support. "There was no tech help available when I used the app, other problems you might face will be the network which might be not accessible or available to all patient and their personal" (Nurse 8).

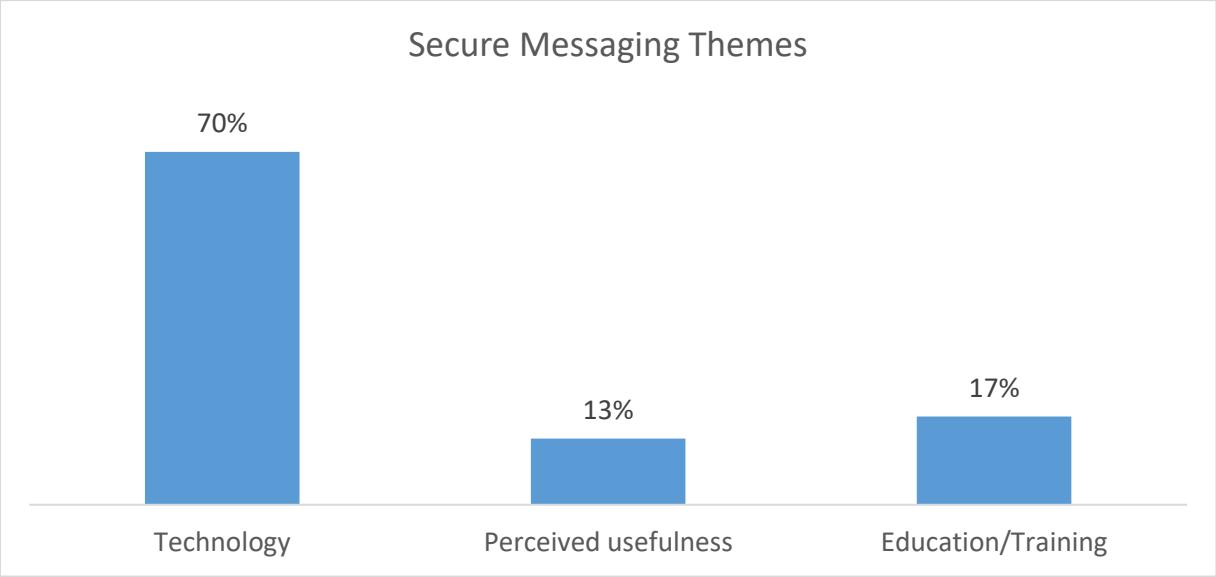

Figure 18. Secure messaging themes.

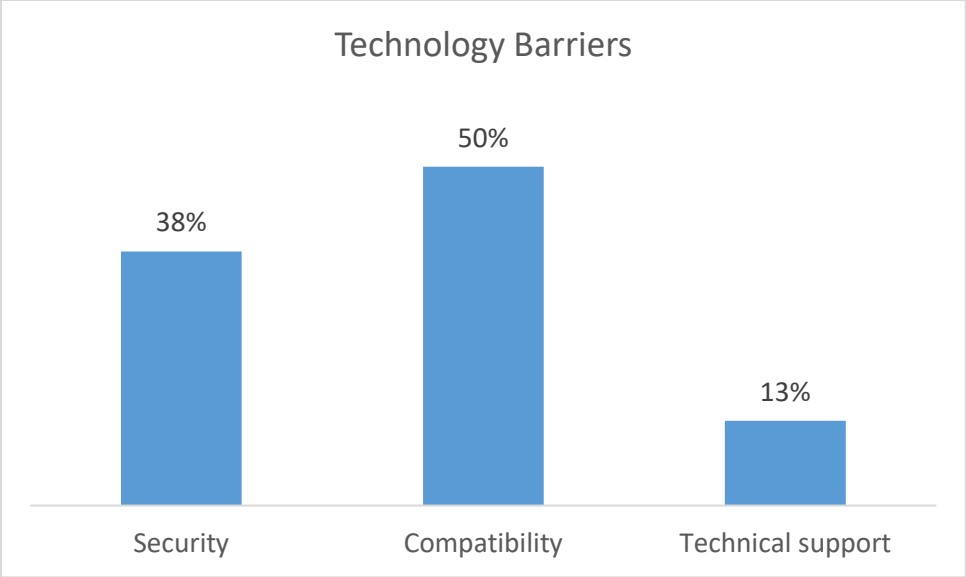

Figure 19. Technology barriers.

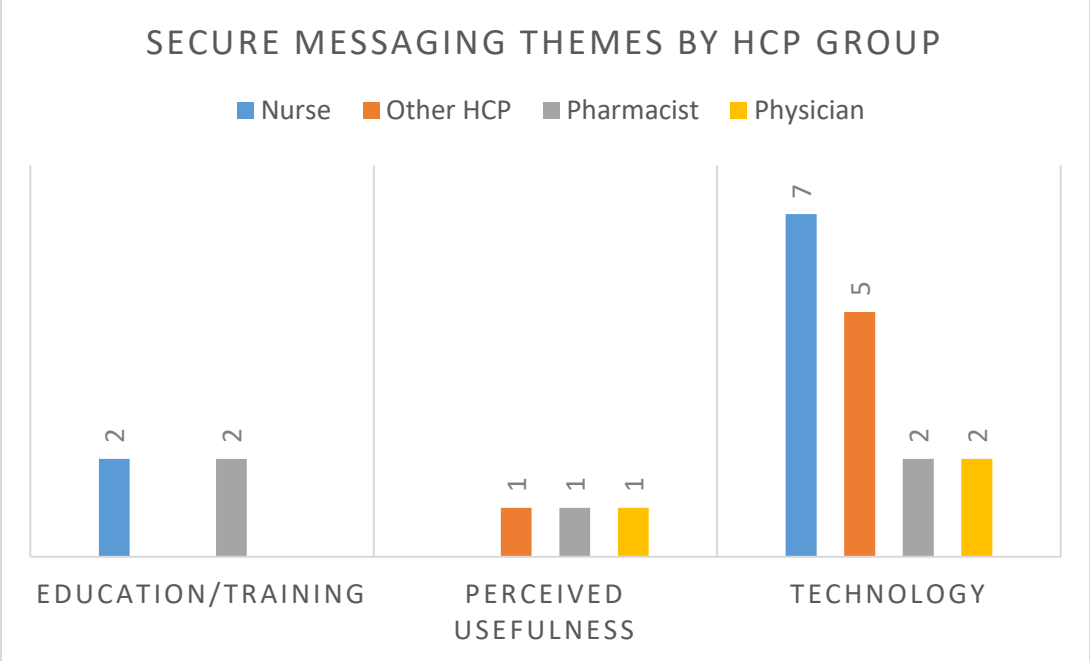

Figure 20. Secure messaging themes by HCP group.

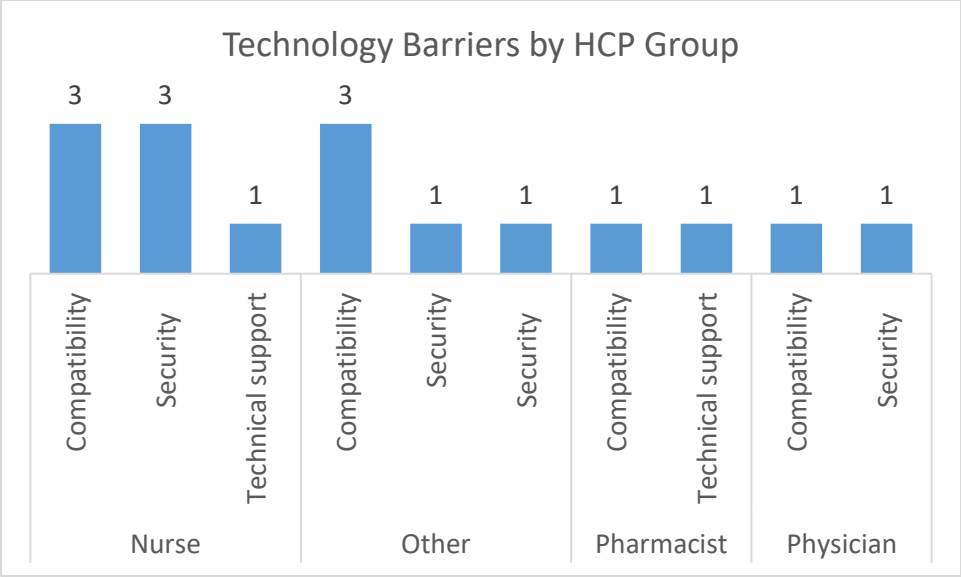

Figure 21. Technology functions and features by HCP group.

Theme 2: Education/training. The second theme identified was the need for education and training. HCPs recognized education and training are needed to maximize the benefits. "Its [*sic*] a great idea that will enhance the communication between the patient and health care providers." (Pharmacist 6). "Proper orientation for the benefits and use of the apps is very important to both patients and relatives" (Nurse 12). "If secure messaging to be implemented - will it be from patient to a specific doctor or any doctor in the subspecialty? Will messaging be 24/7 or during specific times. [*sic*] need to have clear guidance on that" (Pharmacist 20).

Theme 3: Perceived usefulness. The final theme identified was perceived usefulness. Even though secure messaging has not been implemented, a few HCPs recognized the positive role it can play in health care. "It is an excellent idea" (Physician 2). "Using messaging to explain complains. M[a]y be for follow ups only" (Other HCP 4).

Discussion

The MNGHA Care PHR was implemented in 2018, and a secure messaging feature has not been added. However, as eHealth technologies such as secure messaging become more important to the health care delivery process to improve patient-centered-communication, HCPs will be expected to play a crucial role in the use and endorsement. In this study, an adapted UTAUT model was used to predict the acceptance of a secure messaging feature among HCPs. Predictors of HCPs' behavioral intention to support the addition of the secure messaging feature acceptance were performance expectancy and attitude. Our results did not show moderating effects of age, years of experience, or professional role. This study is one of the first to use a theoretical framework to evaluate the acceptance of secure messaging pre-implementation.

The results of this study showed that performance expectancy was positively associated with HCPs' behavioral intention to accept secure messaging. The findings are aligned with other eHealth studies where perceived usefulness was found to have the strong impact on HCPs' behavioral intention (Li, Talaei-Khoei, Seale, Ray, & MacIntyre, 2013a). HCPs are more likely to intend to support a secure messaging feature if they perceive it as useful and see the benefits. Health care organizations should engage HCPs and inform them of the benefits of secure messaging to strengthen support. Initiating dialogue with HCPs in the planning and pre-implementation phases will increase their behavioral intention and promote utilization by patients and the health care team. Other studies have identified the importance of good communication and achieving buy-in from HCPs in the early phases as the key to successful implementation of health information technology (Gagnon et al., 2016; Kujala et al., 2018; Lluch, 2011).

This study also found attitude to be positively associated with HCPs' behavioral intention to accept secure messaging. It had the strongest impact on behavioral intention. Other researchers have found attitude to be an important individual factor in HCPs accepting eHealth technologies (Bennani, Belalia, & Oumlil, 2008; Djamasbi, Fruhling, & Loiacono, 2009; Li et al., 2013b). As HCPs learn about the value of secure messaging for themselves and their patients, they will develop positive attitudes about this feature as described by Nazi (2013). This study provides evidence that attitudes are crucial for the behavioral intention of HCPs to accept the secure messaging feature.

In an examination of the barriers, the top three most reported barriers were: lack of training for patients, patient lack of experience with the use of mobile phone applications for health, patient resistance to new technologies, and literacy of the patients. HCPs showed no resistance to the idea but rather voiced concerns for the patients. Responses to the open-ended question also mirrored the top three barriers identified with compatibility issues mentioned frequently.

Implications for Theory

This is the first theory-based study, to our knowledge, to examine predictors of HCPs' behavioral intention to accept the secure messaging feature. Overall, the model accounted for 73% of the variance in behavioral intention. Even though the model had a high predictive power, further extending UTAUT in this context with privacy and security constructs and other specific facilitating or inhibiting factors (e.g., time cost, eHealth and business process alignment, professional autonomy) may be enlightening. While age, professional role, and years of experience did not moderate the relationships between the independent variables and behavioral intention, there may be direct or mediating effects.

Implications for Practice

HCPs are a driving force behind eHealth initiatives such as this (Li et al., 2013b). Introducing a secure messaging feature requires much consideration prior to implementation (Wakefield et al., 2010). Since acceptance factors may be context sensitive, studies should be conducted in the health care settings where the technology will be implemented (Li et al., 2013b). Understanding the factors that affect HCPs' behavioral intention to accept the secure messaging feature will reduce barriers and facilitate the uptake of this innovation. Therefore, in the early phases of planning and implementation of a secure messaging feature, HCPs should be included in the discussions to ensure they perceive the system as useful and have a favorable attitude towards it. Training sessions would be useful in teaching HCPs about the secure messaging feature with a focus on benefits and integration into the workflow.

Limitations

There are several limitations to this study. First, the cross-sectional design allows for the detection of association but not causal relationships. Next, the results may not be generalizable as a nonprobability sampling method was used, and the study was limited to only HCPs working within MNGHA. Furthermore, self-reported online surveys have several disadvantages (Polit & Beck, 2017). Response rates tend to be low (i.e., less than 50%), which can introduce selection bias. Even though the instrument was piloted in HCPs, there is the possibility that misinterpreted questions were not recognized. Questionnaires also do not allow in-depth investigation of a phenomenon. However, to add some depth, open-ended questions were included.

Future Research

Future research should focus on strategies to prepare HCPs and patients for secure messaging in the Kingdom of Saudi Arabia. There should be adequate knowledge and

familiarity by both. Another area of future research is identifying ways to optimally use secure messaging in the organization by selecting specific categories of patients and focusing on achieving positive health outcomes.

Conclusion

This study is the first to characterize the predictors of HCPs' acceptance of secure messaging in the Kingdom of Saudi Arabia. It provides a baseline understanding of behavioral intention to support a secure messaging feature among various HCPs. Performance expectancy and attitude were significant predictors that influence health care providers' intention to support the addition of secure messaging. Future research should explore other predictors in order to develop successful interventions to implement secure messaging.

Chapter 5: Conclusion

Three related, independent studies were conducted in partial fulfillment of a Doctorate of Philosophy in the health-related sciences program at Virginia Commonwealth University. This chapter includes a brief summary of the study findings, study limitations, implications for theory and practice, and possible future research.

Summary of Findings

This study examined the predictors of patients' behavioral intention to use a PHR, HCPs' behavioral intention to support the use of a PHR, and HCPs' behavioral intention to support the addition of a secure messaging feature. The aim was to observe the alignment between the two perspectives and identify barriers to HCPs' support of the PHR and the addition of a secure messaging feature. The study findings are summarized along the five main objectives as follows:

1. Examine the behavioral intention of patients to use the PHR

Research question: Does an adapted UTAUT model predict patients' behavioral intention to use a PHR?

A total of 261 patients were included in this secondary analysis. The majority of the participants were male (50.6%), married (79.7%), from the central region (42.1%), had a high school diploma (34.9%) or university (52.9%) education, and were employed (54.4%). In terms of health status, the majority had one chronic medical condition (53.3%) and rated their health as excellent (46.4%) or very good (36.4%).

The adapted UTAUT model used in this study included the independent variables of performance expectancy, effort expectancy, social influence, facilitating conditions, and attitude. The moderators for the model were age, gender, experience with health applications, and health status. Hierarchical multiple regression was used for hypothesis testing. Overall, the adapted

UTAUT model explained 48.9% of the variance in behavioral intention to use the MNGHA Care PHR ($p > .05$). Performance expectancy, effort expectancy, and attitude were significant predictors of PHR use. Experience with health apps moderated the relationship between social influence and behavioral intention ($p = .043$).

2. Examine the behavioral intention of HCPs to recommend the PHR

Research question: Does an adapted UTAUT model predict HCPs' behavioral intention to recommend the PHR?

There were 291 HCPs who participated in this study on HCPs' behavioral intention to recommend use of the PHR. The majority were hospital-based (n=265, 93.3%), female (n=180, 62.3%), age 40 years and above (n=153, 52.8%), had greater than 10 years in their profession (n=190, 65.7%), had greater than 10 years working at MNGHA (n=149 (51.6%), and were non-Saudi (n=150, 52.1%). Nurses made up the largest percentage of HCPs (n=118, 40.5%). The majority of HCPs (n=202, 80.8%) reported previously recommending patients use the PHR.

Partial least squares structural equation modeling was used to investigate the hypothesis that an adapted UTAUT model predicts HCPs' behavioral intention to recommend the PHR. For the analysis, 246 responses met the requirements for the statistical analysis. The structural model explained 70% of the variance in behavioral intention ($p < .05$). Behavioral intention to support PHR use was significantly influenced by performance expectancy ($\beta=0.17$, $p = .03$) and attitude ($\beta=0.61$, $p < .01$). No moderating effects were present.

3. Assess HCP reported barriers to PHR use

Research question: What barriers do HCPs believe prevent patient use of the PHR?

HCPs selected the top three barriers to PHR use as lack of patient awareness, literacy of the patients, and patient resistance to new technologies. The three themes identified from the

open-ended comments were perceived usefulness, education/training, and technology. The subthemes for technology were interface, technical support, security, and compatibility.

4. Examine the behavioral intention of HCPs to support the addition of a secure messaging feature to the existing PHR.

Research question: Does an adapted UTAUT model predict HCPs' behavioral intention to support a secure messaging feature be added to the existing PHR?

There were 224 HCPs included in the analysis of HCPs' behavioral intention to accept a secure messaging feature. The majority were hospital-based (n=213, 95.1%), female (n=149, 66.5%), had greater than 10 years in their profession (n=154, 68.8%), had greater than 10 years working at MNGHA (n=117, 52.2%), and non-Saudi (n=126, 56.5%). Nurses made up the largest percentage of HCPs (n=101, 45.1%). Most of the HCPs were age 40 years and above (n=89, 39.9%).

Partial least squares structural equation modeling was used to investigate the hypothesis that an adapted UTAUT model predicted HCPs' behavioral intention to accept a secure messaging feature. The structural model explained 73% of the variance in behavioral intention ($p < .05$). Behavioral intention to accept secure messaging was significantly influenced by performance expectancy ($\beta=0.21$, $p = .01$) and attitude ($\beta=0.50$, $p < .01$). No moderating effects were present.

5. Assess HCP reported barriers to adding a secure messaging feature

Research question: What are barriers to HCPs supporting the addition of secure messaging?

HCPs selected the top three barriers to acceptance of secure messaging as lack of training for patients, patient lack of experience with the use of mobile phone applications for health,

literacy of the patients, and patient resistance to new technologies. The three themes identified from the thematic analysis of the open-ended comments were perceived usefulness, education/training, and technology. The subthemes for technology were technical support, security, and compatibility.

Limitations

There are several limitations to this study. To examine predictors of patient adoption of the PHR, secondary data were utilized. While secondary analysis is a fast and economical way to investigate research questions, it has limitations. For this research, the primary limitation is the use of a single-item measure for most constructs. Multi-item measures provide a more reliable measurement since you are able to statistically examine the internal reliability (Robinson, 2018).

The cross-sectional design allows for examining associations, but causality cannot be inferred (Hulley, 2007). Furthermore, the study was conducted in a single organization which possibly limits generalizability; however, multiple sites and HCP types from across the country increased the representation, and by extension, the generalizability.

Although self-administered online surveys have the advantages of low cost and speed, there are specific limitations to this type of data collection (Dillman, 2014). Nonresponse bias is common. During the pilot test, questions identified as confusing or redundant were removed. Next, the hospital email list and personal contacts in WhatsApp were used to reach HCPs. Reminders were sent through email and/or WhatsApp to increase the response rate. Even with these steps, online data collection alone may have resulted in a lower response rate as a result of HCPs quitting the survey, perceptions of the survey as junk mail, or for other reasons (Aday & Cornelius, 2006). There also was the potential for self-selection bias. The patients and HCPs

who participated may have differed in important ways from those who did not agree to participate. Variation in PHR acceptance by patients and HCPs may have been a reflection of initial group differences rather than the effects of the independent variables selected (Polit & Beck, 2017).

Next, the use of self-reported patient data has limitations. Social desirability bias is common with self-reporting. Participants may provide answers in line with what they believe to be a more socially acceptable view (Althubaiti, 2016). To minimize this bias, participants were informed that their answers would be anonymous, and they were allowed to skip any question that made them uncomfortable.

The use of snowball sampling, a nonprobability sampling strategy, is less likely to produce a representative sample (Polit & Beck, 2017). For the HCP study, several HCPs, or seeds, were selected from each of the main hospitals and asked to send an email and/or WhatsApp message to colleagues in their network. This made it easier to reach HCPs from across MNGHA that would have otherwise been difficult to contact. However, it increases the likelihood that the sample is not representative of the population as the initial HCPs were most likely to refer to others who have similar characteristics, leading to a homogeneous sample.

Common method bias is also a possibility with this study. When the independent variable and dependent variable are measured at the same time and with the same instrument, common method bias may occur (Bhattacherjee, 2012). Inflated estimates of the dependent variable occur as a result of measurement artifacts and can result in misleading conclusions (Bhattacherjee, 2012; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Implications

This research contributes to the existing literature on PHR adoption and acceptance in patients and HCPs both broadly and within the context of the Kingdom of Saudi Arabia. Only 24% of hospitals offer PHRs (Alanazi & Al Anazi, 2019). Yousef et al. (2020) was the first study of patient acceptance of a PHR post-implementation. This study is novel in its attempt to align the patient and HCP viewpoints of the PHR. Much of the PHR research centers on patients since they are the primary users of the PHR.

However, various researchers have noted the key role HCPs play in patient adoption and use of PHRs. This study showed the predictors of behavioral intention to adopt the PHR in patients were performance expectancy, effort expectancy, and attitude. In HCPs performance expectancy and attitude were the predictors of behavioral intention to support the PHR as well as the addition of a secure messaging feature. Strategies that focus on developing a positive attitude and perceived usefulness of the PHR and secure messaging are likely to be successful in patients and HCPs. HCPs should be provided education and training on the features and functions of the PHR along with information on the expected benefits (Nazi, 2013; Vydra et al., 2015). For secure messaging, HCPs should be involved pre-implementation and introduced to the benefits in order to facilitate support. With adequate knowledge, HCPs are in a good position to endorse use of the PHR and its associated features to patients. Wynia, Torres, and Lemieux (2011) encouraged patients and physicians to use PHRs together to achieve optimal outcomes. Additionally, education and training targeted to patients and their caregivers should be in place. Awareness campaigns could be held throughout the year to encourage adoption.

PHR design considerations are important to HCPs and patients. HCPs believed the major barriers to PHR use were related to patients. HCPs work closely with their patients on a daily

basis. With 80% of HCPs having MNGHA Care, using it, and recommending it to their patients, they are familiar with the PHR and have likely engaged in dialogue with patients about the PHR. Therefore, they have a good understanding of barriers as users and from their interactions with patients.

In the thematic analysis of the open-ended questions, technology barriers were a concern for acceptance of the PHR and the addition of a secure messaging feature. HCPs related concerns that the PHR may not be compatible with older adults or patients with literacy issues. In patients effort expectancy was a predictor of use. Niazkhani et al. (2020) identified difficulty understanding and navigating a PHR to be a common barrier. In order to promote the usability, a wide range of patients should be involved in piloting the PHR features, and PHR redesigns should occur as issues are identified by patients and HCPs to promote effective use.

Future Research

Future research should take a qualitative or mixed methods approach to gain a more granular view of perspectives of HCPs and patients. While quantitative studies provide valid information using statistical analyses, a qualitative or mixed methods approach allows a more holistic view (Polit & Beck, 2017). Adding a qualitative component gives a critical look behind the scenes and enables one to better recognize reasons behind failures and emphasize successful practices. Mixed methods is particularly useful to answer research questions requiring real-life contextual understanding and to identify cultural influences (Creswell & Clark, 2017).

This study did not examine differences between HCP groups. Other studies have found physicians to be more resistant to the implementation of eHealth technologies (Li et al., 2013b). Physicians comprised less than 20% of the HCP sample. Other differences have been seen in HCP PHR acceptance by physician specialty and practice setting (Kujala et al., 2018; Moll &

Cajander, 2020). Future researchers should focus on specific HCP groups and practice settings within the Kingdom of Saudi Arabia to pinpoint their concerns.

Literacy concerns are a well-recognized barrier. More studies within this context should evaluate the effects of literacy on PHR use. Alanazi and Al Anazi (2019) recognized computer and health literacy to be barriers to PHR adoption in the Saudi population. Al-Mifgai et al. (2020) found eHealth literacy and health numeracy to be significant predictors of the ability to successfully perform harder health-management tasks in a simulation of a PHR designed and tailored to the population of the Kingdom of Saudi Arabia. In a recent study by Alsahafi et al. (2020), eHealth literacy was a predictor of acceptance of an integrated PHR in the Saudi population.

Future research should examine UTAUT using additional constructs, such as privacy and security, facilitating and inhibitory factors, and new relationships. As proposed by Abd-Alrazaq et al. (2020), UTAUT can be further extended by adding new direct, moderating, mediating, and moderated mediating effects. In the systematic review of factors affecting patient use of PHRs by Abd-Alrazaq et al. (2019), more than 150 different factors were evaluated from the studies. Their review found only18 factors that definitively influence patient PHR use. Li et al. (2013b) evaluated HCP acceptance of eHealth and identified 40 factors that are influential in HCP acceptance of eHealth. As more research on PHRs is conducted in the Kingdom of Saudi Arabia, studies should examine these factors in patients and HCPs.

This study did not address objective use. In fact, most of the studies on PHR adoption have used behavioral intention as a proxy for actual use (Abd-Alrazaq, 2018). Although intention is considered a direct antecedent of actual use, some researchers have argued that intentions to perform a behavior do not necessarily translate into actual use (Bagozzi, 2007; Wu

& Du, 2012). Intention can be dynamic and may change when limitations arise that prevent actual use or when an individual simply decides against engaging in a behavior. Therefore, researchers should study actual use using systems log data.

Finally, health outcomes associated with PHR must be studied. The primary goal of PHR use is to improve access to care and patient self-management in order to optimize health outcomes. Research on benefits of PHR use in this population are necessary. Many PHR studies have evaluated outcomes in patients with chronic medical conditions with better outcomes in diabetes associated with secure messaging (Sun et al., 2018). In a quality improvement study conducted by Belcher et al. (2019) in the Kingdom of Saudi Arabia, patients with diabetes who received messages twice weekly through a portal over 12 weeks had a mean hemoglobin A1c reduction from 11% to 9%.

Conclusion

This study provides a baseline for understanding patients' and HCPs' acceptance of a PHR in the Kingdom of Saudi Arabia. The theoretical basis for the study was an adapted UTAUT model. Performance expectancy, effort expectancy, and attitude were predictors of patients' behavioral intention. In HCPs performance expectancy and attitude were predictors. These findings are in line with the eHealth literature. The open-ended comments from the HCPs added to the insight and reflected a generally positive view towards the use of the PHR and the addition of a secure messaging feature.

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Appendix A: Patient Questionnaires – Arabic and English

DAM-19-037800-183797

RD19/002/D

إستبيان عن العصر الرقمي

إذا كانت الإجابة على هذه الأسئلة تسبب لك الإحراج، فلك الحق بعدم الأشتراك دون أدنى مسؤولية.

معلومات عامة: تستخدم هذه المعلومات للغرض البحثي فقط، ولن يتم الكشف عن هويتك.

1- ما هي منشأة الرعاية الصحية التي تزورها اليوم؟

- مستشفى الملك فهد للحرس الوطني (الرياض)
- مستشفى الملك عبدالله التخصصي للأطفال (الرياض)
- عيادة الرعاية الصحية الأولية (الرياض)
- مستشفى الملك خالد للحرس الوطني (جدة)
- مستشفى الأمير محمد بن عبد العزيز (المدينة)
- مستشفى الملك عبد العزيز (الأحساء)
- مستشفى الإمام عبدالرحمن بن فيصل (الدمام)
- عيادة الرعاية الصحية الأولية (القصيم)

2- أين تعيش في السعودية؟

- المنطقة الوسطى
- المنطقة الشرقية
- المنطقة الشمالية
- المنطقة الجنوبية
- المنطقة الغربية

3- ماهو سبب زيارتك هذا اليوم؟

- مريض
- مرافق مع المريض
- أخرى ...

4- كم عمرك؟

5- ما هو جنسك؟

- ذكر
- أنثى

6- ما هي حالتك الاجتماعية ؟

- متزوج/متزوجة
- اعزب /عزباء
- مطلق/مطلقة
- ارمل/ ارملة

7- ما هو اعلى مستوى تعليمي حصلت عليه ؟

- المرحلة الابتدائية أو أقل
- المرحلة المتوسطة
- المرحلة الثانوية
- المرحلة الجامعية
- مرحلة الدراسات العليا

8- ما هي حالتك الوظيفية؟

- متقاعد
- عاطل عن العمل
- موظف
- طالب
- اعمال حره

9- ما هو دخلك الشهري؟

- أقل من 5,000 ريال سعودي / شهري
- 5,000 – 9,999 ريال سعودي / شهري
- 10,000 - 19,999-ريال سعودي / شهري
- 20,000 – 49,999 ريال سعودي / شهري
- أكثر من 50,000 ريال سعودي /شهري

المعلومات الصحية

1- هل تشكو من أي حالة مرضية؟

- نعم
- لا

2- هل تعاني من أحد هذه الامراض التالية؟ (يمكن الاشارة على اكثر من مرض)

- السكري
- الربو أو مرض في الجهاز التنفسي
- ارتفاع ضغط الدم
- فشل عضلات القلب
- السرطان
- مرض فقر الدم المنجلي
- امراض نفسية
- أمراض أخرى، حدد.....

3- كيف تقيم حالتك الصحية؟

- ممتازه
- جيد جدا
- جيده
- معتدله /مقبولة

- ضعيف

4- هل خضعت للتنويم بالمستشفى خلال الـ 6 أشهر الماضية؟

- نعم
- لا

5- هل زرت قسم الطوارئ خلال الـ 6 أشهر الماضية؟

- نعم
- لا

الرضي عن الرعاية الصحية المقدمة

هل انت راضي عن الرعاية الصحية المقدمة لك من قبل الشؤون الصحية للحرس الوطني؟

- راضي جداً
- راضي
- مستاء
- مستاء جداً

الثقافة الصحية

1. هل تحتاج إلى المساعدة من اي شخص عند قراءة التعليمات أو الكتيبات أوغيرها من المواد المكتوبة من طبيبك أو الصيدلية؟

- **اطلاقاً**
- **نادرا**
- **احياناً**
- **غالباً**
- **دائما**

استعمال الانترنت و الهواتف الذكية

1- هل تستخدم أحد الهواتف الذكية؟

- **نعم**
- **لا**

2- ما هو معدل إستخدامك للإنترنت ؟

- عدة مرات في اليوم
- مرة واحدة يوميا
- عدة مرات في الأسبوع
- عدة مرات في الشهر
- نادرا أم لا على الإطلاق

المعلومات المتعلقة بسلوك البحث الصحي عبر الإنترنت

1- هل تستخدم الإنترنت للبحث عن المعلومات الطبية؟

- نعم
- لا

2- هل أنت عضو في مجتمع او منتدى صحي عبر الإنترنت؟

- نعم
- لا

3- هل تناقش القضايا الصحية على وسائل التواصل الاجتماعي (مثل: فيس بوك او تويتر) ؟

- نعم
- لا

4- هل تستخدم التطبيقات الصحية على هاتفك الذكي؟

- نعم
- لا
- غير متوفر

تطبيق خدمات المرضى بالشؤون الصحية بالحرس الوطني

1- هل سمعت عن تطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني للهواتف المحمولة ؟

- نعم
- لا

2- هل تستخدم تطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني؟

- نعم
- لا

3- من الذي نصحك بتطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني ؟

- الأسرة
- الأصدقاء
- مقدم الرعاية الصحية بالشؤون الصحية للحرس الوطني
- موظف آخر داخل المستشفى
- لا أحد

4- منذ متى وأنت تستخدم تطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني ؟

- أقل من 6 أشهر
- 6- 12 شهر
- أكثر من سنة
- لا ينطبق

5- ما معدل استخدامك لتطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني؟

- كل يوم
- عدة مرات في الأسبوع
- عدة مرات في الشهر
- نادرا
- اطلاقاً

6- يرجى التحقق من جميع الطرق التي تستخدم في تطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني.

- ادارة معلوماتي الصحية
- جدولة المواعيد
- تحقق من نتائج المختبر الخاص
- طلب اعادة صرف الادوية

7- يرجى الإشارة إلى مدى موافقتك للعبارات التالية بما يتعلق بسهولة الاستخدام والرضا عن تطبيق خدمات المرضى بالشؤون الصحية للحرس الوطني

	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
سهولة تسجيل الدخول إلى التطبيق					
المعلومات في التطبيق سهلة الفهم					
الناس من حولي يستخدمون التطبيق					
أخصائيوا الرعاية الصحية يشجعون على استخدام التطبيق					
تتوفر المساعدة عندما لا أعرف كيفية استخدام التطبيق					
تطبيق الحرس الوطني للشؤون الصحية يتوافق مع التكنلوجيا التي أستخدمها					
باستخدام التطبيق أشعر بمزيد من المشاركة في رعايتي الصحية					
باستخدام التطبيق أشعر أن لدي معرفة أكثر على صحتي					
ربما سأستخدم التطبيق في المستقبل					
أنوي استخدام التطبيق بانتظام					
يوفر التطبيق قيمة معلوماتية جيدة					
أصبح استخدام التطبيق عادة بالنسبة لي					
سوف أخبر وأنصح أصدقائي وعائلتي باستخدام التطبيق					
استخدام التطبيق ممتع					

شكرا جزيلا لاستكمال هذا الاستبيان!

RD19/002/D

DAM-19-037800-183797

Digital Age Survey

If you feel uncomfortable with answering any of the questions, you do not have to answer and will not be penalized in any way.

Demographics: This information will only be used in summary form, and your identity will not be revealed.

1. Which health care facility are you attending today?
   - King Fahad National Guard Hospital (Riyadh)
   - King Abdullah Specialized Children's Hospital (Riyadh)
   - Primary Health Clinic (Riyadh)
   - King Khaled National Guard Hospital (Jeddah)
   - Prince Mohammed Bin Abdulaziz Hospital (Al Madinah)
   - King Abdulaziz Hospital (Al Ahsa)
   - Imam Abdulrahman Bin Faisal Hospital (Dammam)
   - Primary Health Clinic (Qassim)
2. Where do you live in Saudi Arabia?
   - Central Region
   - Eastern Region
   - Northern Region
   - Southern Region
   - Western Region
3. Why are you visiting the facility?
   - Patient
   - Caregiver
   - Other, please specify
4. What is your age?
5. What is your gender?
   - Male
   - Female
6. What is your marital status?
   - Married
   - Single
   - Divorced
   - Widowed
7. What is the highest grade or level of school you have completed?
   - Elementary school or less
   - Middle school
   - High school
   - University

- Postgraduate

8. What is your employment status?
    - Retired
    - Unemployed
    - Employed
    - Student
9. What is the estimated monthly income for your household?
    - < 5,000 SAR/month
    - 5,000-9,999 SAR/month
    - 10,000-19,999 SAR/month
    - 20,000-49,999 SAR/month
    - > 50,000 SAR/month

Health-status

1. Do you have any medical condition?
    - Yes
    - No
2. Check all medical conditions that you have.
    - Diabetes
    - Asthma or COPD
    - Hypertension
    - Heart failure
    - Cancer
    - Sickle cell disease
    - Psychiatric condition
    - Other, please specify_____
3. How do you rate your health?
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor
4. Have you been hospitalized within the last 6 months?
    - Yes
    - No
5. Have you visited the Emergency Department within the last 6 months?
    - Yes
    - No

Satisfaction with Health Care

1. How do you feel about the care you or your family member receives from MNGHA?
    - Very satisfied
    - Satisfied
    - Dissatisfied
    - Very dissatisfied

Health Literacy

1. How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Always

Mobile Phone and Internet Usage

1. Do you use a "smart" phone?
    - Yes
    - No
2. How often do you go online and use the Internet?
    - Several times a day
    - About once daily
    - A few times per week
    - A few times per month
    - Rarely or not at all

Online Health-related Information Seeking Behavior

1. Do you use the Internet to search for medical information?
    - Yes
    - No
2. Are you a member of an online health community?
    - Yes
    - No
3. Do you discuss health issues on social media (e.g., Facebook, Twitter)?
    - Yes
    - No
4. Do you use health applications (apps) on your mobile phone?

- Yes
- No
- NA

MNGHA Care

1. Have you heard about the MNGHA Care mobile health app?
   - Yes
   - No
2. Do you use MNGHA Care?
   - Yes
   - No
3. Who recommended MNGHA Care to you?
   - Family
   - Friends
   - Healthcare provider
   - Other hospital staff
   - No one
4. For how long have you been using MNGHA Care?
   - 0-6 months
   - 7-12 months
   - > 1 year
   - Not applicable
5. How frequently do you use MNGHA Care?
   - Every day
   - A few times per week
   - A few times per month
   - Rarely
   - Never
6. Please check all of the ways that you use MNGHA Care.
   - ☐ Manage my personal health information
   - ☐ Schedule appointments
   - ☐ Check my lab results
   - ☐ Request prescription refills

7. Please indicate how strongly you agree or disagree with each statement related to the ease of use and satisfaction with MNGHA Care.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Logging into MNGHA Care is easy.					
Information in MNGHA Care is understandable.					
People around me use MNGHA Care.					
My healthcare professional encouraged me to use MNGHA Care. (social influence)					
Technical help is available when I do not know how to use MNGHA Care.					
MNGHA Care is compatible with other technologies that I use.					
By using MNGHA Care, I feel more involved in my care.					
I will probably use MNGHA Care in the future.					
I intend to use MNGHA care regularly.					
MNGHA Care is					

a valuable service.					
Using MNGHA Care has become a habit for me.					
I will tell my friends and family to use MNGHA Care.					
It is enjoyable to use MNGHA Care.					

Thank you very much for completing this survey!

Appendix B: Healthcare Provider Questionnaire

Healthcare Provider Questionnaire

Demographics

1. Region
   □ Al Imam Abdulrahman Bin Faisal Hospital-Dammam
   □ King Abdulaziz Hospital-Al Ahsa
   □ King Abdulaziz Medical City-Jeddah
   □ King Abdulaziz Medical City-Riyadh
   □ Prince Mohammed Bin Abdulaziz Hospital-Madinah
2. Facility
   □ Primary health care clinic
   □ Hospital
3. Gender (M/F)
4. Age: 20-29 years, 30-39 years, 40-49 years, 50 years and above
5. Profession
   □ Physician
   □ Pharmacist
   □ Nurse
   □ Physical Therapist
   □ Occupational Therapist
   □ Laboratory Personnel
   □ Other_____(please specify)
6. Specialty area (Physicians): (ER, ICU, Internal Medicine, Surgery, Oncology, Hematology, Ob/Gyn, Pediatrics, Family Medicine, Other_____)
7. Years in profession: < 5 years, 5-10 years, > 10 years
8. Nationality
   □ Saudi Arabia
   □ Non-Saudi_____(specify country)

PHR Vignette

MNGHA Care is a personal health record. The proposed benefits of personal health records include improved access to care, better continuity of care, and enhanced patient-provider relationships.

General PHR Questions

9. Do you have an MNGHA Care account? (Y/N)

10. Have you recommended patients use MNGHA Care?

PHR Acceptance

Please select level of agreement with each statement related to the use of MNGHA Care personal health record and patient portal.

Strongly disagree, disagree, neutral, agree, strongly agree

11. MNGHA Care is a useful tool to help patients feel more involved in their care. (PE)

12. I believe MNGHA Care helps patients to better manage their health. (PE)

13. MNGHA Care will increase patient satisfaction with their health care. (PE)

14. MNGHA Care can improve the quality of patient care. (PE)

15. Information in MNGHA Care should be easy for our patients to understand. (EE)

16. I believe most patients have the skills needed to use MNGHA Care. (EE)

17. Learning to use MNGHA Care is easy for our patients. (EE)

18. I think it is not difficult to learn to use MNGHA Care. (EE)

19. My colleagues would approve of patients using MNGHA Care. (SI)

20. Our patients support the use of MNGHA Care. (SI)

21. In general, the organization has supported the use of MNGHA Care (SI)

22. People who influence my behavior think patients should use MNGHA Care.(SI)

23. I have enough information about MNGHA Care. (FC)

24. There is technical help for patients who use MNGHA Care. (FC)

25. I know the goals of MNGHA Care. (FC)

26. Assistance is available if there are difficulties using MNGHA Care. (FC)

27. MNGHA Care is a valuable tool. (ATT)

28. It is a good idea for patients to use MNGHA Care. (ATT)

29. MNGHA Care is a positive advancement in this digital age. (ATT)

30. I believe MNGHA Care will be used by many patients. (ATT)

31. I will probably recommend patients use MNGHA Care in the future. (BI)

32. I intend to mention MNGA Care to patients in the next week. (BI)

33. I plan to suggest MNGHA Care to patients in the next month. (BI)

Secure messaging

Secure messaging vignette:

Secure messaging through personal health records improves communication between patients and their health care providers and supports patient-centered care. Adding secure messaging to MNGHA Care is an important step in strengthening the relationship between patients and providers.

Please select level of agreement with each statement related to the addition of secure messaging to MNGHA Care.

Strongly disagree, disagree, neutral, agree, strongly agree

34. Adding secure messaging to MNGHA Care can enhance the efficiency in health care. (PE)

35. I believe secure messaging will promote positive health outcomes. (PE)

36. Secure messaging will help patients to better manage their health. (PE)

37. I think secure messaging will be a useful extension to existing treatment. (PE)

38. I think secure messaging would be easy to use. (EE)

39. I believe most patients could easily learn to use secure messaging. (EE)

40. Learning to use secure messaging will be easy for me. (EE)

41. I think it would not be difficult to learn secure messaging.(EE)
42. My colleagues would approve of secure messaging. (SI)
43. I believe our patients will use secure messaging. (SI)
44. The organization would support the use of secure messaging. (SI)
45. I believe the senior management would be helpful in the use of secure messaging. (SI)
46. The organization has the resources to support the use of secure messaging. (FC)
47. Technical help would be available to assist health care providers and patients with using secure messaging. (FC)
48. I think secure messaging fits well with the mission of the organization. (FC)
49. Support would be available if I have difficulties with secure messaging. (FC)
50. Secure messaging is a valuable tool. (ATT)
51. It is a good idea for patients to use secure messaging. (ATT)
52. Secure messaging is a positive advancement in this digital age. (ATT)
53. I believe secure messaging will be used by many patients. (ATT)
54. I would endorse secure messaging between patients and health care providers. (BI)
55. I would like to use secure messaging to communicate with patients. (BI)
56. I predict I would use secure messaging for patient care. BI

PHR Barriers

57. From the following list, please select what you consider the 3 main challenges to prevent patients from using MNGHA Care.

    □ Lack of patient awareness

    □ Lack of health care provider awareness

□ Patient resistance to new technologies

□ Literacy of the patients (i.e., reading, writing, health)

□ Confidentiality and privacy concerns

□ Patient lack of experience with the use of computers

□ Patient lack of experience with the use of mobile phone applications for health

□ Security concerns

□ Inadequate technical support

□ Lack of training for patients

□ Health care provider resistance

□ Other, please specify_____

Barriers to Secure Messaging

58. From the following list, please select what you consider the 3 main barriers to adding a secure messaging feature to MNGHA Care

□ Patient resistance to new technologies

□ Literacy of the patients (i.e., reading, writing, health)

□ Confidentiality and privacy concerns

□ Patient lack of experience with the use of computers

□ Patient lack of experience with the use of mobile phone applications for health

□ Security concerns

□ Inadequate technical support

□ Lack of training for patients

□ Health care provider resistance

□ Other, please specify_____

59. What additional comments do you have about MNGHA Care?

60. What concerns do you have about adding a secure messaging feature to MNGHA Care?

Appendix C: Cover Letter for Pilot Test

Dear Health Care Provider:

You are being invited to participate in the pilot test of a survey for the dissertation titled *"Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia."* As a health care provider, you are being asked to review and evaluate the statements to ensure the items capture the concepts of interest. The purpose of this survey is to test a theoretical model to: 1) understand health care provider acceptance of personal health records; 2) identify perceived barriers to health care provider acceptance of personal health records; 3) understand health care provider acceptance of adding a secure messaging feature to the personal health record; and 4) identify barriers to health care provider acceptance of secure messaging.

After completing the survey, you will be asked to provide your responses to questions related to the comprehensibility, ease of understanding, and acceptability. The feedback you provide will guide the revision of the items in order to enhance the overall clarity, comprehension, and ease.

I would like to thank you for taking the time to review the survey and provide feedback.

Best regards,

Consuela Yousef, PharmD, MPH, PhD Candidate
Virginia Commonwealth University
College of Health Professions
Richmond, Virginia (USA)

Appendix D: Pilot Test Tool

Please answer the questions below regarding your assessment of the survey you have just completed.

1. Was the questionnaire comprehensive?
2. Was the topic adequately covered?
3. Are there any questions you expected to be asked but were not included?
4. Are there any questions you feel may be too sensitive?
5. Are there any questions that may affect our response rate that we should consider deleting?
6. Was the questionnaire too long, too short, or about right?
7. How likely or unlikely would other health care providers be to complete the survey?

Appendix E: Information Sheet

Project Title: Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia

Principal Investigators:
Consuela Yousef, PharmD, MPH, PhD (Candidate), College of Health Professions, Virginia Commonwealth University
Jonathan DeShazo, PhD, MPH, Department of Health Administration, Virginia Commonwealth University

You are being invited to participate in this research study designed to explore factors that influence the acceptance of the MNGHA Care personal health record. You are being asked to participate because you are a health care provider working in the Ministry of National Guard-Health Affairs. This research study is being conducted by Consuela Yousef, a doctoral candidate in the College of Health Professions at Virginia Commonwealth University. The project is under the supervision of Dr. Jonathan DeShazo.

The purpose of this study is to understand the factors that influence patients to use the MNGHA Care personal health record; health care providers to recommend MNGHA Care; and health care providers to support the addition of a secure messaging feature to MNGHA Care. I am inviting all health care providers to share their perspective. The findings from this study will provide useful information for decision-makers to design and implement effective strategies for the successful use of MNGHA Care.

If you agree to participate, you will complete the online survey through the link at QuestionPro. There are three sections: 1) questions about yourself; 2) questions about factors that influence your intention to recommend MNGHA Care; 3) and questions about factors that influence to intention to support a secure messaging feature be added to MNGHA Care. The time anticipated to complete this survey is 10-15 minutes. To thank you for your time and completion of the survey, you will be offered the chance to enter a drawing for a 50 SR gift card.

Participation is voluntary and responses will be confidential. You may refuse to answer any questions and may withdraw at any time without penalty. The information will only be accessible to the researchers of this study. There will be no identifiable information linked to the online survey. At the end of the survey, you will be offered the chance to enter a drawing for a gift card by entering your contact information. This information will be collected and stored separately from the survey data.

Confirmation of your consent to participate in this survey will be attained by checking the box on the online survey. If you are interested in taking part in this research study, please use the link below to access the survey.

Appendix F: First Reminder Email

Dear Health Care Provider,

Earlier this week we sent an e-mail to you asking for your participation in the study "Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia." You are being invited to participate in this research study designed to explore factors that influence the acceptance of the MNGHA Care personal health record and addition of a secure messaging feature. You are being asked to participate because you are a health care provider working in the Ministry of National Guard-Health Affairs. This research study is being conducted by Consuela Yousef, a doctoral candidate in the College of Health Professions at Virginia Commonwealth University. The project is under the supervision of Dr. Jonathan DeShazo.

To complete the survey, simply click on this link:

Your response is voluntary and we appreciate your considering our request.

Appendix G: Second Reminder Email

Dear Health Care Provider,

Recently we sent an email asking you to complete a survey about the acceptance of the MNGHA Care personal health record and addition of a secure messaging feature. If you have already completed this survey, we would like to thank you very much. We truly appreciate your help.

If you have not answered the survey yet, we would like to urge you to do so. It should only take about ten to fifteen minutes to complete. Simply clink on the link to below to begin.

This survey is important to develop the evidence on personal health record acceptance among health care providers in the Kingdom of Saudi Arabia. Your responses will be confidential. Thank you for your help.

Appendix H: Third Reminder Email

Dear Health Care Provider,

Several weeks ago we contacted you asking for your help with the survey "Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia." We are writing to you again because our ability to accurately describe the perceptions of health care providers to the MNGHA Care personal health record and addition of secure messaging depends on hearing from those who have not yet responded. We need your help to ensure our results are as precise as possible.

To fill out the questionnaire, please click on the link below.

Responses to the survey are confidential and will not be connected to your name in any reports of the data. If you have any questions about the survey, please contact the doctoral student conducting this research, Consuela Yousef at yousefco@ngha.med.sa.

Thanks for considering our request.

Appendix I: Fourth and Final Reminder Email

Dear Health Care Provider,

We are writing to follow up on the message we sent last week asking you to participate in the survey on "Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia." This assessment of health care providers is drawing to a close, and this is the last reminder we are sending about the study.

The URL below is included to provide an easy link to the survey website.

The winners of the 50 SR gift certificate will be contacted by email within the next two weeks.

Thanks again for your support.

Appendix J: Consuela Yousef's CV

CONSUELA C. YOUSEF, PHARM.D., MPH, BCPS

P.O. Box 4616
Dammam, Saudi Arabia 31412
Phone: +9660563005957
Email: consuela_73@hotmail.com

EDUCATION

Virginia Commonwealth University
Doctor of Philosophy, Health-Related Sciences
Health Administration Track
Richmond, VA (USA)
Expected: June 2021

East Tennessee State University
Master of Public Health
Epidemiology Track
Johnson City, TN (USA)
May 2018

University of Tennessee, Memphis
Doctor of Pharmacy
Memphis, TN (USA)
June 1998

University of Tennessee, Martin
Pre-pharmacy coursework
Martin, TN (USA)
May 1994

LICENSURE AND CERTIFICATIONS

Tennessee Board of Pharmacy, License # 10408, July 1998-present

Saudi Commission for Health Specialties, License #10RP0343901, July 2004-present

Board Certified Pharmacotherapy Specialist, October 2007-present

Basic Life Support, October 2004-present

Collaborative Institutional Training Initiative (CITI) Program, Basic/Refresher Course Human Subjects Research, September 2017-present

PROFESSIONAL EXPERIENCE

Clinical Pharmacist, Imam Abdulrahman Al Faisal Hospital, Dammam, Saudi Arabia, December 2012-present

- Perform daily rounds with a multi-disciplinary team of health care providers for patients admitted under Internal Medicine
- Provide medication reconciliation and therapeutic drug monitoring for patients
- Assess patient-specific drug therapy
- Precept pharmacy students
- Participate on the Pharmacy and Therapeutic Committees at the regional and corporate level
- Provide drug information to hospital staff
- Participate in research projects as either a principal investigator or a co-investigator
- Monitor adverse drug reactions as the chairman of the Adverse Drug Reaction Team
- Review department policies and procedures
- Review non-formulary drug requests
- Perform drug evaluations for drugs requested for formulary addition

Clinical Pharmacist, King Khalid National Guard Hospital**,** Jeddah, Saudi Arabia, October 2010-January 2012

- Precepted pharmacy students from colleges of pharmacy in Makkah and Jeddah
- Performed daily rounds with a multi-disciplinary team of health care providers in the Neonatal Intensive Care Unit and Obstetrics/Gynecology wards
- Collaborated with the health care teams to provide appropriate pharmacotherapy for patients
- Conducted in-services to the pharmacy staff
- Participated in the new nurse orientation session
- Recommended patient-specific pharmacotherapy while analyzing allergy information
- Performed total parenteral nutrition consultations
- Wrote orders for total parenteral nutrition
- Monitored the nutritional status and wrote progress notes for patients on total parenteral nutrition
- Participated in the Basic Medication Safety Course

Pharmacology Lecturer, College of Nursing, King Saud Bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia, Fall 2010

- Taught across a range of modules/units
- Assessed the work and progress of students
- Provided students with constructive feedback

Associate Clinical Pharmacist, King Khalid National Guard Hospital, Jeddah, Saudi Arabia, October 2007- October 2010

- Rounded with multi-disciplinary health care team in the Internal Medicine ward
- Analyzed patient profiles for drug-drug, food-drug, and drug-disease interactions and made appropriate recommendations
- Reviewed patients' drug lists to develop, revise, and implement pharmacotherapy care plan

- Participated in the Medication Safety Program
- Performed drug evaluations for the Pharmacy & Therapeutics Committee
- Participated on the local Pharmacy & Therapeutics Committee
- Supervised pharmacy interns

Pharmacist I, King Khalid National Guard Hospital, Jeddah, Saudi Arabia, July 2004- October 2007

- Performed computer entry functions for physician orders
- Analyzed pertinent patient-specific information such as drug-drug interactions, allergy, and therapeutic duplication
- Provided timely responses to drug information requests from health care providers
- Participated in meeting the goals and objectives of the department to ensure attainment of the organization's goals and objectives
- Supervised pharmacy support personnel
- Performed staffing in all pharmacy satellites, main pharmacy, and IV room
- Participation in the verification and filling of intravenous fluids, total parenteral nutrition, oral medications, and controlled substances
- Presented educational lectures for staff

Pharmacist-in-Charge, Southeast Mental Health Center, Memphis, TN (USA), October 2000-May 2004

- Performed daily management of pharmacy activities at Community Behavioral Health, a crisis stabilization unit
- Supervised all aspects of pharmacy operation
- Complied with all company policies and procedures as well as federal, state, and local regulations
- Dispensed prescriptions by following standard operating procedures
- Conducted educational lectures for the patients and staff

Staff Pharmacist, Walgreens Pharmacy, Memphis, TN (USA), June 1998-October 2000

- Counseled patients on prescription and non-prescription medications and products
- Provided advice on health issues, symptoms, and medications in response to patient enquiries.
- Supervised pharmacy staff
- Processed prescriptions and dispensed medications in compliance with federal, state, and local regulations as well as company policies and procedures
- Followed guidelines for receiving, filling, dispensing, logging, and maintaining loss prevention controls for Schedule II medications

PRESENTATIONS

Adoption of a Personal Health Record in the Digital Age (oral presentation), January 2021
1st Virtual Pharmacy Conference
Riyadh, Saudi Arabia

Literature Searching (oral presentation & workshop), April 2019 & October 2018
Introduction to Clinical Research
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Drugs and QT Prolongation (oral presentation), May 2017
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Filtering and Prioritization of Formulary Drug Requests (oral presentation), March 2017
Corporate Drug Evaluation Subcommittee
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Counseling and Medication Reconciliation (oral presentation), January 2017
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Pharmacology of Sedatives (oral presentation), throughout the year
Conscious Sedation Course
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

High Alert Drugs & Look-Alike Sound-Alike Drugs (oral presentation), throughout the year
Basic Medication Safety Course
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Tazocin Drug Use Evaluation (oral presentation), February 2016
Physician and Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Comparing Insulins (oral presentation), October 2015
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Infection in Sickle Cell Disease: A Case Presentation (oral presentation), March 2015
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Drug Induced Leukopenia: A Case Presentation (oral presentation), November 2014
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Augmentin Products & Antimicrobial Stewardship (oral presentation), February 2014
Pharmacy In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Safe Prescribing in Geriatrics (oral presentation), April 2013
Safety Awareness Week
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Renal Drug Dosing: Cockcroft-Gault vs. MDRD (oral presentation), April 2013
Physician In-service
Imam Abdulrahman Al Faisal Hospital
Dammam, Saudi Arabia

Pharmacologic Management of Type 2 Diabetes in Adults (oral presentation), January 2012
King Khalid National Guard Hospital
Endocrine Service Teaching Activity
Jeddah, Saudi Arabia

Pharmaceutical Industry: Marketing & Influence (oral presentation), December 2011
Hospital Ethics Seminar
Jeddah, Saudi Arabia

Pharmacologic Management of Type 2 Diabetes in Adults (oral presentation), November 2011
World Diabetes Day
Intercontinental Hotel
Jeddah, Saudi Arabia

Pharmaceutical Care Department Overview (oral presentation), September 2011
Residents' Day Orientation
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

International Patient Safety Goal 6 (oral presentation), July 2011
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

Therapeutic Drug Monitoring (oral presentation), May 2011
Pharmacokinetics Symposium
Intercontinental Hotel
Jeddah, Saudi Arabia

Drug Dosing in Obesity (oral presentation), May 2011
Pharmacokinetics Symposium
Intercontinental Hotel
Jeddah, Saudi Arabia

Childhood Poisoning (oral presentation), January 2011
Pharmacy In-service
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

High Alert & Look-Alike-Sound-Alike Drugs (oral presentation)
Basic Medication Safety Course
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

Medications & Falls (oral presentation)
Nursing Orientation
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

Pharmacologic Management of Type 2 DM (Workshop), November 2010
World Diabetes Day Workshop
King Khalid National Guard Hospital
Jeddah, Saudi Arabia

COMMITTEES

- Formulary Changes Subcommittee, Imam Abdulrahman Al Faisal Hospital, 2021
- Corporate Adverse Drug Reaction Team, Imam Abdulrahman Al Faisal Hospital, 2021
- Corporate Antimicrobial Stewardship Committee, Imam Abdulrahman Al Faisal Hospital, 2020
- Cost Efficiency Taskforce, Imam Abdulrahman Al Faisal Hospital, 2020
- Antimicrobial Stewardship Program, Imam Abdulrahman Al Faisal Hospital, 2015-present
- Adverse Drug Reaction Team, Imam Abdulrahman Al Faisal Hospital, 2013-present
- Imam Abdulrahman Al Faisal Pharmacy and Therapeutics Subcommittee, Imam Abdulrahman Al Faisal Hospital, 2017-present
- Corporate Drug Evaluation Subcommittee, Imam Abdulrahman Al Faisal Hospital, 2013-present
- Corporate Pharmacy and Therapeutics Committee, Imam Abdulrahman Al Faisal Hospital, 2013-present

- Sickle Cell Disease Pathway Team, Imam Abdulrahman Al Faisal Hospital, 2015
- Sedation and Analgesia Committee, Imam Abdulrahman Al Faisal Hospital, 2013-present
- Ethics Committee, King Khaled National Guard Hospital, 2011-2012
- Medication Safety Program, King Khaled National Guard Hospital, 2007-2012

CONFERENCES AND COURSES

3rd Annual International Patient Experience Symposium
Abu Dhabi, United Arab Emirates (Virtual)
February 2021

1st Virtual Pharmacy Conference
Riyadh, Saudi Arabia
January 2021

Applied Biostatistics for Healthcare Providers
Al Ahsa, Saudi Arabia
December 2017

2nd International Conference on Exploring New Horizons of Pharmacy Practice
Jeddah, Saudi Arabia
April 2017

3rd Annual GCC Pharmacy Congress
Dubai, United Arab Emirates
October 2016

ASHP Summer Meeting
Denver, Colorado
June 2015

1st International Conference on Exploring New Horizons of Pharmacy Practice
Jeddah, Saudi Arabia
April 2015

Drug Formulary Management Concept, Theory, and Practice: Beyond Drug Selection
Riyadh, Saudi Arabia
November 2014

Drug Evaluation Workshop
Riyadh, Saudi Arabia
February 2013

PUBLICATIONS

AlAzmi, A., Alasmari, Z., Yousef, C., Alenazi, A., AlOtaibi, M., AlSaedi, H., ... & Alahmari, M. (2020). Off-Label Drug Use in Pediatric Out-Patient Care: A Multi-Center Observational Study. *Hospital Pharmacy*, 0018578720942226.

Esba LCA, Almodaimegh H, Alhammad A, Ferwana M, Yousef C, Ismail S. P&T Committee Drug Prioritization Criteria: A Tool Developed by a Saudi Health Care System. *Pharmacy and Therapeutics*. 2018;43(5):293-300.

Esmail S, Esba LCA, Almodaimegh H, Yousef C, Alabdulkarim H, Khan M. (2020). *An Institutional Guide for Formulary Decisions and Pharmacovigilance of Biosimilars*. (in-manuscript)

Esba, L. C. A., Yousef, C., Ismail, S., Halim, M., Almodaimegh, H., Al-Abdulkarim, H. A., & Alhowimel, M. (2021). Fixed Dose Combinations: A Formulary Decision Guide. *Health Policy and Technology*.)

Yousef CC, Thomas A, Alenazi AO, Elgadi S, Abu Esba LC, AlAzmi A, Alhameed AF, Hattan A, Almekhloof S, AlShammary MA, Alanezi NA, Alhamdan HS, Eldegeir M, Abulezz R, Khoshhal S, Masala CG, Ahmed O. Adoption of a personal health record in the digital age: Cross-sectional study. Journal of Medical Internet Research [Internet] 2020;22(10):e22913. [doi: 10.2196/22913]

Cheriece Yousef, C., Thomas, A., Al Matar, M., Ghandoura, L., Aldossary, I., Musa Almuhanna, S., … AlAmoudi, R. (2021). Liraglutide Effects on Glycemic Control and Weight in Patients with Type 2 Diabetes Mellitus: A Real-World, Observational Study and Brief Narrative Review. *Diabetes Research and Clinical Practice*, 108871. https://doi.org/10.1016/j.diabres.2021.108871

RESEARCH

Principle Investigator: NRD21D/001/01-Investigating the Relationship among Resilience, Loneliness, Work Engagement, and Burnout in Healthcare Workers 1 year into the COVID-19 pandemic: A mixed-methods study

Principle investigator: SP20-507D- Evaluating Patient and Health Care Provider Perceptions of a Personal Health Record in an Integrated Health Care System in the Kingdom of Saudi Arabia, 2021 [Dissertation project]

Principle investigator: RD19/001/D - A Retrospective, Observational Study of Liraglutide Effects on Glycemic Control and Weight in the Ministry of National Guard Health Affairs, 2019

Principle investigator: RD19/002/D - The Digital Age: Health Information Seeking Behavior and Patient Engagement with the MNGHA Care App, 2019

Co-investigator: RJ18/080/J-Off-Label and Unlicensed Drug use in Pediatric Patients across the Ministry of National Guard Health Affairs Centers, Kingdom of Saudi Arabia: Multi-center Retrospective Study, 2019

Principle investigator: Evaluating mortality in a level 2 Neonatal Intensive Care Unit (NICU) in the Eastern Province of Saudi Arabia from 2004-2016 [Master of Public Health project], 2018

TEACHING EXPERIENCE

Preceptor, Doctor of Pharmacy students (5th and 6th year), Imam Abdulrahman Al Faisal University, Dammam, Saudi Arabia, 2014-present

Preceptor, Doctor of Pharmacy students (5th & 6th year), King Abdul Aziz University, Jeddah, Saudi Arabia, 2007-2012

Preceptor, Doctor of Pharmacy students (5th & 6th year), Ibn Sina University, Jeddah, Saudi Arabia, 2007-2012

Pharmacology Lecturer, College of Nursing, King Saud Bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia, Fall 2010