Using eHealth tools for Patient–Healthcare Provider Communication in the Kingdom of Saudi Arabia: An Investigative Analysis

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Abstract

Background: Healthcare organizations worldwide are integrating eHealth tools such as mobile health applications into their systems to improve service delivery. Numerous relevant studies are currently underway, and many more are required to understand how these relatively new applications affect such factors as the cost of healthcare delivery, patient health/eHealth literacy, healthcare provider practice, workflow efficiency, and the patient–healthcare provider relationship.

Objective: This study, which focused on eHealth tools [e.g., Sehaty application] used by the King Faisal Specialist Hospital and Research Center (KFSH&RC) in Riyadh, the Kingdom of Saudi Arabia (KSA), goes beyond most existing research by assessing the experiences of two user groups (patients and healthcare providers) and how their own needs are integrated through technology. At the heart of this research is how common ground is developed or constrained as communication is increasingly mediated through an electronic platform.

Method: By employing a mixed-methods approach, quantitative data were collected from 107 patients through a cross-sectional survey, and qualitative data were gathered from 16 healthcare providers through an open-ended interview process at the KFSH&RC. We interpreted our data through the lens of common ground theory to understand how factors unique to each user group are mutually integrated into the common ground development cycle. Respective user groups and common ground factors were illustrated in our Patient–Healthcare Provider Factors and Functions for Communication (PHPFFC) model.

Results: In this study, we present our results data in two chapters. First, we present our findings under the three research questions and five related assertions that guided our study. We show that eHealth tools affect patients' health/eHealth literacy in a generally positive manner to the extent that healthcare providers perceive and anticipate efficiency gains in their workflows. Second, we present an adapted version of the PHPFFC model (i.e., PHPFFC V2.0) to reflect the empirical, context-specific findings of our study. Furthermore, we demonstrate that many constraints associated with mediated communication are overcome as common ground emerges in a stepwise pattern, through three stages: *coordinative* common ground; *cooperative* common ground; and *collaborative* common ground. We also illustrated common ground factors drawing from our three research questions and their links to the PHPFFC V2.0 model.

Conclusion: This study examined patients and healthcare providers' perspectives concerning technology acceptance as well as barriers to adopting eHealth tools in a healthcare setting. The findings from this empirical, context-specific study are intended to assist developers in understanding how user-group factors interact dynamically, and how such interactions may be facilitated through existing eHealth features and improved through the adaptation of new features.

Keywords: Electronic health systems, eHealth tools, eHealth literacy, communication, common ground, The Kingdom of Saudi Arabia.

Dedication

All thanks to Allah's blessing to provide me the energy, inner strength, knowledge, and consent to complete my Ph.D.'s journey.

As British abstract painter David Willis reminds us, family bonds are not based solely on shared surnames or even blood. Family, he says, is "*defined by commitment and love. It means showing up when they need it most. It means having each other's backs. It means choosing to love each other even on those days when you struggle to like each other. It means never giving up on each other.*"

Foremost, my precious parents, to whom this dissertation is dedicated. My beloved father, **Eng. Obaid Basahih**, and my beloved mom, **Dr. Noor Labban**: you have been with me always, encouraging me to achieve my dreams and be enthusiastic about education and learning. You inspired this journey in the first place, and, when needed, took steps that I was unable to take on my own. You are the source of my joy, honor, brightness, and glory. Your inspiration called this dissertation into existence, and your forbearance spirited it to completion. Thank you.

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Abbreviations

CG: Common ground
E-: Electronic -
eHealth: Electronic health
EHR: Electronic health record
EMRs: Electronic medical records
GPs: General practitioners
H: Hypothesis
HIT: Health information technology
HPP[s]: Healthcare provider–participant[s]
ICIS: Integrated Clinical Information System
ICT: Information Communication Technologies
IT: Information technology
KFSH&RC: King Faisal Specialist Hospital and Research Center
KSA: Kingdom of Saudi Arabia
M-: Mobile-
MOH: Ministry of Health
PGHD: Patient-generated health data
PHPFFC: Patient–Healthcare Provider Factors and Functions for Communication
PP[s]: Patient–participant[s]
PPCI: Physician–Pharmacist Collaboration Instrument
Q: Question[s]
RQ: Research question
SANAD: Saudi Arabia Networking for Aiding Diabetes
TAM: Technology acceptance model
UTAUT: Unified theory of acceptance and use of technology
WHO: World health organization

Chapter 1 Introduction

Electronic health records (EHRs) and health information technology (HIT) systems are a fast-growing field. Patients and healthcare providers are increasingly using electronic health (eHealth) systems to confidently access and update information concerning patient health records over secure computer networks (Tang, Ash, Bates, Overhage, & Sands, 2006). A constant stream of effective communication is crucial to quality patient healthcare (Wright, Sparks, & O'Hair, 2012). The eHealth systems' tools (eHealth tools) help patients better understand, interpret, and manage their health records, including information about "their medical conditions, medications, and lab test results" (Taha, Czaja, Sharit, & Morrow, 2013, p. 1124). Moreover, patients and healthcare providers can use eHealth tools to coordinate their medical appointments, pay hospital bills, download health-related material for self-education, and ask for prescription refills (Rodriguez, Thom, & Schneider, 2011). By improving access to information and facilitating communication and coordination, eHealth tools are expected to help better manage users' healthcare services (Tang et al., 2006).

Furthermore, adopting eHealth tools into hospital systems could benefit end-users. For example, a study by Kossman, Bonney, and Kim (2013) found that participants (i.e., nurses) indicated that eHealth tools facilitated tasks such as managing documents, organizing information, and recalling tasks. Another benefit identified by Rodriguez et al. (2011) was that eHealth tools allowed patients to communicate with healthcare providers for any concern. Thus, eHealth tools (e.g., communication tools) would improve patient–healthcare provider communication.

On the other hand, patients and healthcare providers have identified barriers and facilitators of eHealth tools implemented in a hospital. Taha et al. (2013) indicated that low technical skills could affect patients' intention to use eHealth tools. Moreover, several studies have suggested simplifying the system design to increases the use of eHealth tools, such as providing a standard terminology for eHealth tools (Dohan & Tan, 2014; Unertl, Johnson, & Lorenzi, 2012; Cimperman, Brencic, & Trkman, 2016). Thus, it is essential for eHealth tool developers to address factors that could impact end-users intention to use eHealth tools. To sum up, barriers such as system design and factors that could affect the eHealth tool end-users' intention could affect the patient–healthcare provider communication.

In addition to studying the barriers and facilitators of eHealth tools from the end-user perspective, various authors have developed theoretical models for studying the acceptance of eHealth tools to improve healthcare outcomes (Dohan & Tan, 2014; Kuziemsky, Weber-Jahnke, Lau, & Downing, 2008; Dyk, 2014). For example, Dohan and Tan's Multilevel Variance Model, which explains the use of electronic symptom record tools in chronic disease care, can be used to study physician (healthcare provider) and patient perspectives on HIT adoption (2014). Dohan and Tan's model was used to research HIT usage in healthcare settings. The authors argued that the effectiveness of such technology depends on both patients' and healthcare providers' viewpoints.

First, patient perspectives on their own illnesses (known as "illness coherence") can offer "valuable insights as to how adoption can be achieved, as it relates to the degree to which patients engage in disease-coping activities" (Dohan & Tan, 2014, p. 408). Furthermore, patients' illness coherence influences their decisions about what symptoms to record and how to communicate symptoms with healthcare providers, impacting the accuracy of the information transmitted. Suppose patients have a better understanding of the symptoms that accompany their illness. In that case, they are more likely to differentiate "between a true illness symptom and a normal somatic function" (Dohan & Tan, 2014, p. 412). In turn, the patient would believe that his or her efforts to use eHealth tools are valuable. In sum, patients may perceive usefulness, and such a perception may increase their use of eHealth tools.

Second, Dohan and Tan (2014) argued that “the effective integration of patient symptom data into clinical workflow requires presenting the data in a way that enhances the physician’s ability to gain insight into the patient’s condition” (p. 408). According to Finn (2015), EHR systems provide two different methods of data documentation: “structured data fields and free-text narrative format” (p. 1). Patients must communicate symptoms with healthcare providers to enable them to evaluate the effectiveness of treatments. The efficiency and usability of health information and communication depend on both patients–healthcare providers’ viewpoints.

Moreover, eHealth tools add essential communication modality to current communication practices. Many studies described different communication tools that can be implemented in hospitals’ eHealth tools, such as e-messages (Dorr, Jones, & Wilcox, 2007), e-mail (Dalal & Schnipper, 2016), blogs, and social networks such as Facebook (Baran & Davis, 2015), and WhatsApp (Johnston et al., 2015). Such studies have shown that different communication tools can be used for various purposes. Dorr et al. created “a framework for information system usage in collaborative care” (2007, p. 282). They demonstrated tools used in a clinical information system that may be essential for collaboration, such as tools to facilitate communication among healthcare provider members (via e-messages) and referrals; to manage consent and authorizations; and to support clinical communication as well as notifications, alerts, and responses. Other tools help to manage patient–healthcare provider relationships (contact tracking), communication between healthcare providers and patients/families, and educational tools for patients and families (education tracking) (Dorr et al., 2007). Therefore, implementing different communication tools in an eHealth tool would offer patients various options to communicate with their healthcare providers and improve their health knowledge.

The Kingdom of Saudi Arabia (KSA) is planning to adopt eHealth tools into its healthcare system. The Ministry of Health (MOH) also aims to adopt an eHealth tool that links all healthcare organizations (i.e., public and/or private) across the country to improve their healthcare systems and reach people who live in rural areas (MOH, 2009). Since 1925, the KSA government has collaborated with international health organizations to improve the health system in the KSA (MOH, 2009). In 2009, the MOH operated 2281 health organizations across the KSA (MOH, 2009). Additionally, the MOH has successfully established a web portal that provides different services such as communication tools through the use of social media applications (e.g., Facebook) (MOH Portal KSA, 2015). However, the MOH indicated several barriers to adopting eHealth tools, such as healthcare providers’ resistance to change (MOH, 2009). The present study focused on one KSA governmental hospital located in the capital city Riyadh, to provide insights into how residents (either patients or healthcare providers) are using eHealth tools such as the Internet and Sehaty application.

In conclusion, in addition to communication tools such as e-messaging and social networking applications, understanding the common ground between patients and healthcare providers is equally crucial to ensure successful communication. Moreover, eHealth tools such as mobile health applications could be used to facilitate communication among individuals. The following sections present this study’s statement of the problem, objective, purpose, and research questions and its related assertions statements:

1.1 Statement of the Problem

Scholars have discussed different uses of technology (i.e., eHealth tools), such as mobile health applications, healthcare provider websites, e-mail tools, and social media platforms, for diverse types of health concerns (Hu, 2015). Researchers have found that eHealth tools such as communication tools increased patient–healthcare provider communication and patient satisfaction (Rodriguez et al., 2011; Hu, 2015; Phillips, Kumar, Patel, & Arya, 2014). According to Hu's (2015) systematic review, the use of technology can result in positive consequences; however, eHealth tools require improvements. Hu's analysis could not find any integrated investigation into the quality of eHealth tools for communication purposes (2015). Although a few researchers have discussed the use of technology for patient–healthcare provider communication, the topic has not been explored in the KSA context.

Researchers have explored eHealth tools' influence on patients and healthcare providers. Simultaneously, some researchers have found positive impacts, such as increased patient satisfaction (Beard, Schein, Morra, Wilson, & Keelan, 2012) and reduced costs (Choo et al., 2016). Other researchers have reported physician (healthcare providers) concerns about increased workload and the level of patients' ability to use eHealth tools to communicate and manage tasks (Lusignan et al., 2014; Seto et al., 2010; Bae & Encinosa, 2016). These healthcare provider concerns have not been studied adequately. On the other hand, from the patient's perspective, studies by Taha et al. (2013) and Morrow et al. (2006) have focused on the impact of health literacy and health status on patients' ability to use technology. However, these two teams of researchers did not investigate factors that have been found relevant for technology adoption in other contexts, such as for EHR systems. To the best of our knowledge, and according to Dohan and Tan (2014), such a theoretical model that relies on both patients–healthcare providers' viewpoints is not known to exist.

Despite these studies, the topic of patients and healthcare providers has been under-explored in KSA. The MOH indicated that there are not enough medical or academic studies on this issue in the KSA (MOH, 2009; World Health Organization [WHO], 2013). No research that addresses factors affecting patient and healthcare provider use of eHealth tools in the specific context of the KSA is known to exist.

In conclusion, we believe that understanding the usefulness of eHealth tools, particularly with respect to communication between patients and healthcare providers, is essential for improving healthcare outcomes. Multilevel variance models are required to provide rich descriptions of the use of eHealth tools. Dohan and Tan proposed such a model, but it has not yet been empirically tested in any context (2014). To close this gap, this research developed a model. The model is employed to explore aspects of technology used by patients and healthcare providers for communication in a hospital within the KSA. Furthermore, this study contributes to the MOH's department's research to identify the recent factors of eHealth tools in KSA's users.

1.2 Objective and Purpose of Study

This research aims to investigate how Saudi residents use eHealth tools to communicate in healthcare settings. We investigated how and to what extent eHealth tools affect communication between healthcare providers and patients. In particular, we studied patients' and healthcare providers' perspectives and barriers to using eHealth tools. One critical research question asked whether reported barriers are related to the usability of applications or whether challenges are related to patients' eHealth literacy. We considered how patients' eHealth literacy, usage contexts, and patient–healthcare provider viewpoints are valuable for designers in improving eHealth tools.

The purpose of this investigative study was to describe how people use eHealth tools such as the Internet and Sehaty application. The Sehaty is an application that presents in a mobile versions[1] and a website[2] at the King Faisal Specialist Hospital and Research Center (KFSH&RC) in the KSA. This study examined factors affecting the adoption of eHealth tools (see Figure 1 in Chapter 3, p. 47). We employed a mixed-methods approach that involves a quantitative approach using a cross-sectional survey with a questionnaire distributed to patients to understand their demographics, education level, eHealth literacy, and barriers that could affect their use of eHealth tools. Furthermore, we used a qualitative method (the standardized open-ended interview) to understand healthcare providers' perspectives on how eHealth tools affect their communication with patients, and whether patients' use of eHealth tools impacts their workflow.

1.3 Research Questions and Scholarly Assertions

This study seeks to identify the common understanding and barriers to communication between patients and healthcare providers. Broadly, a fundamental purpose is to determine if the challenges that people may face when using eHealth tools are related to the usability of the specific mobile application (e.g., Sehaty), or whether they are related to patient characteristics (e.g., patients' eHealth literacy), and the impact of eHealth usage on healthcare providers' workflow. An actual investigation of such questions will help designers better understand technology usage. Moreover, insights will help designers consider effects such as patients' eHealth literacy, specific usage contexts, and demographics to improve eHealth tools. Thus, this study provides valuable insights from the viewpoints of both patients and healthcare providers. Both of these are explored through three research questions (RQs), encompassing four related assertions' questions and one hypothesis statement. Table 1 presents the study's RQs and associated assertions questions.

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[1] Sehaty can be download from the Apple Store [IOS] or Google Play [Android]
[2] Access link to Sehaty Website: [https://sehaty.sa/en/home]

Table 1: *Research Questions and Scholarly Assertions*[3]

RQ1	**How do eHealth tools influence healthcare providers' workflow?**
Q1	*Rates of patients' general technical proficiency and existing Sehaty usage, coupled with improving eHealth literacy rates, will lead healthcare providers to anticipate streamlined workflows, if not reduced workloads.*
RQ2	**Does increased use of eHealth tools improve healthcare providers and patients' relationship?**
Q2	*If healthcare providers' usage of eHealth tools increases, their understanding of their patients' health conditions will improve.*
H1	*If patients' usage of eHealth tools increases, their satisfaction with received healthcare services will increase.*
RQ3	**How do patients' eHealth literacy levels influence their communication with healthcare providers?**
Q3	*Healthcare providers with a lower level of information satisfaction (in data provided by eHealth tools) will have decreased intention to use eHealth tools to communicate with patients who have low eHealth literacy.*
Q4	*Common ground in communication increases healthcare providers' trust as well as patients' understanding.*

1.4 Patient–Healthcare Provider Factors and Functions for Communication (PHPFFC) Model

A comprehensive, combined multilevel variance model backed with empirical findings can be used for a more holistic explanation of technology usage and its impact on communication between patients and healthcare providers in healthcare settings. In particular, communication tools and factors from models used by Morrow et al. (2006), Dohan and Tan (2014), and others from the literature review such as healthcare providers' workload (Finn, 2015; De Veer et al., 2015; Beard et al., 2012; Embi et al., 2013; Lusignan et al., 2014; Rosenbloom et al., 2011; Wu et al., 2014) and/or patients' eHealth literacy (Hoffman-Goetz, Donelle, & Ahmed, 2014; Quinn, Bond, & Nugent, 2017; Tennant et al., 2015) are potentially important for collaborative care. Therefore, we created the Patient–Healthcare Provider Factors and Functions for Communication (PHPFFC) model (Basahih & Kuziemsky, 2017) (see Figure 1 in Chapter 3, p. 47). PHPFFC model

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[3] **Note: RQ =** Research Question; **H =** Hypothesis**; Q =** Question **Workflow =** Workflow efficiency; and **Workload =** Workload productivity

can be used in future studies to investigate factors affecting the adoption of eHealth tools between patients and healthcare providers for communication.

In conclusion, guided initially by the PHPFFC model (see Figure 1 in Chapter 3, p. 47), we conducted an empirical study to gain rich descriptions of and insights into the use of eHealth tools from the patient–healthcare provider perspectives at the KFSH&RC in Riyadh, KSA. Also, to provide empirical evidence for eHealth tools' developers. Thus, we present an adapted version of the PHPFFC (i.e., PHPFFC V2.0) model to reflect the empirical, context-specific findings of our study (see Figure 7 in Chapter 6, p. 129).

1.5 Organization of the Dissertation

The remainder of this dissertation organized as follows:

Chapter 2 (Literature Review) presents a literature review and considers the research on the significant components for this study (i.e., communication, effective communication, common ground concept, patients' eHealth literacy, and healthcare providers' workflow), and communication and common ground concept in a healthcare setting (i.e., existing communication tools and platforms, the advantages of communication tools, barriers and facilitators of eHealth tools' use). This chapter also includes an overview of the KSA (e.g., culture, language, and literacy), the healthcare system, and mobile computing trends in the KSA.

Chapter 3 (Research Model and Propositions) provides a more in-depth explanation of our research model (PHPFFC) and the RQs' propositions. The factors used in the research model and its assertions were developed based on the literature review discussed in Chapter 2.

Chapter 4 (Methodology) describes the method and process used to examine our RQs and its related assertions. This chapter explains the research design, how the data obtained, sampling, the researcher's role, instruments, materials (e.g., the structure of the questionnaire), data analysis procedures, and how trustworthiness was ensured.

Chapter 5 (Results) discusses our findings and conclusions from quantitative and qualitative data, drawn from patient–participants and healthcare provider–participants, respectively. The results are organized and elucidated according to three core RQs and its related assertions.

Chapter 6 (PHPFFC V2.0 and CG Development) we present an adapted version of the PHPFFC model (PHPFFC V2.0) to reflect the empirical, context-specific findings of our study. Finally, for each RQ, referring to our derived common ground factors, we describe how common ground is developed by combining insights from, among others, Clark and Brennan (1991) and Kuziemsky and O'Sullivan. (2015).

Chapter 7 (Discussion) summarizes the study's main findings and situates it concerning extant studies discussed in Chapter 2. The study's limitations elucidated with an eye to suggesting fruitful avenues for future research.

References includes all the references used in this study.

Appendices: We have included supplemental material to support some sections of this study related to other chapters, such as Chapter 2. We have also included the full version of the patient questionnaire and the interview protocol for healthcare providers.

Chapter 2 Literature Review

This chapter presents a review of relevant literature, beginning with introducing the significant components for this study (see section 2.1): 1) *Communication* theory background; 2) *Effective communication*; 3) then, turning to a discussion of scholarship related to our critical theoretical concept–*common ground*– and how common ground contributed in this study that reflected in Patient–Healthcare Provider Factors and Functions for Communication (PHPFFC) V2.0; 4) understanding the concept of patients' *eHealth literacy*; and 5) *Healthcare providers' workflow*. After that, we discuss literature on communication and common ground concept in healthcare settings specifically (see section 2.2), including the illustration of some existing communication tools and platforms, the advantages of communication tools for healthcare providers and patients. A discussion of barriers and facilitators of eHealth tools follows them. The chapter concludes with a discussion of studies undertaken in the context of the Kingdom of Saudi Arabia (KSA) (see section 2.3).

2.1 Significant Components for this Study

This study used five main components: communication theory, effective communication, common ground, patient's eHealth literacy, and healthcare providers' workflow.

2.1.1 Communication

In a classic 1966 article, Miller offered a basic definition of communication as referring to "those situations in which a source transmits a message to a receiver with conscious intent to affect the latter's behavior" (as cited in Littlejohn & Foss, 2010, p. 3). This definition worked in concert with other scholars seeking to gauge the effectiveness of communication, which Hoben (1954) judged to be determined when any given exchange has met the communication goals of both partners (see the next section [2.1.2] for its definition in our study). In the 1970s, scholars such as

Howard Giles began theorizing about subjective, behavioral components of human communication (Giles, 2016). Developing what came to be known as communication accommodation theory, Giles sought to explain “speech variables” – adjustments in language, dialect, and accent that people make when interacting with other individuals (Dragojevic, Giles, & Gasiorek, 2015, p. 3). Understanding the influential work of these scholars is necessary, though not entirely sufficient for understanding the full complexity of human communication.

2.1.2 Effective Communication

Effective communication is difficult to define for healthcare settings. Communication studies that discussed healthcare providers’ viewpoints focused on psychometric properties such as “job satisfaction, better time management, and lower burnout levels” through medical training (as cited in Radziej et al., 2017, p. 1). On the other hand, communication studies that discussed patients’ viewpoints measured psychological and behavioral responses such as “higher satisfaction with care, greater adherence to treatment, reduced anxiety, increased information, and improved understanding” (as cited in Radziej et al., 2017, p. 1).

This study is primarily concerned with assessing the intended future use of new technology (in our case, eHealth tools). Thus, our definition for effective communication is a mutual exchange between two or more individuals (i.e., via technological mediated or in-person), in which information is given, received, and comprehended to the satisfaction of all parties. Furthermore, the term satisfaction is critical here because, according to Gudykunst’s (2005) anxiety/uncertainty management theory, stress, and anxiety associated with lack of comprehension have behavioral implications. This is especially true with patients who may become less motivated to communicate with their healthcare providers and/or stop using communication tools.

2.1.3 Common Ground Concept

In the early 1990s, a new and highly influential approach, common communication *ground*, emerged. Also known as grounded communication, common ground is the central communication theory of this study, and a vital component of the PHPFFC V2.0 model we present (see Figure 7, Chapter 6, p. 129). First elaborated by Clark and Brennan (1991), the concept describes how a communication outcome – common ground – is not an outcome at all; Common ground established as communicating parties "coordinate both the content and process" of a given exchange (p. 222). Communicating parties forge mutual knowledge, mutual beliefs, and mutual assumptions through conversation, which is understood as collaborative action. What makes conversation truly collaborative in grounded communication is not the mere development of mutuality, but a shared awareness that mutuality itself is being created and shaped along the way.

While the common ground theory was formulated originally to describe face-to-face communications, it was adapted and applied to mediated communications in essential ways that are key to this study. Among others, Brennan (1998), Zillich, Doucette, Carter, and Kreiter (2005), R. Gallagher and H. Gallagher (2012), and Kucukarslan, Lai, Dong, Al-Bassam, and Kim (2011) have extended the common ground theory to interrogate relationship initiation behaviors, trustworthiness, and role specification. Much mediated communication does not entail explicit utterances that are easily classified by common ground theory. Thus, building on such studies, we formulated our research questions (RQs) and its related assertions to identify pre-existing common ground factors, as well as behaviors, perceptions, and attitudes held by each group toward the other.

Communication common ground is achieved through *grounding.* Through the grounding process, presenters and addressees coordinate both the content and process according to which communication will work effectively for both parties. Successful grounding is underway when speakers make presentations (utterances/words) and addressees signal their acceptance – convincing the presenter that the utterance has been received and, most importantly, understood. Furthermore, according to Clark and Brennan (1991), three types of positive evidence of grounding are present and discernable to speakers when grounding is established: acknowledgment, relevant next turn, and continued attention.

Common ground is not achieved spontaneously, but rather in a cycle described by Kuziemsky and O'Sullivan (2015) that is at once cumulative and, sometimes, regressive – an especially pronounced dynamic in the case of the system at the center of this study. First, grounding changes with the purposes that each interlocutor has in mind. Several studies have indicated that common ground requires not only the exchange of information and knowledge among healthcare providers and/or patients but also the understanding of that information and establishment of trusting relationships (Mitnick, Leffler, & Hood, 2010; Keller, Schaffer, Schoon, Brueshoff, & Jost, 2011). To explore both information exchange and relationship development, we followed Kuziemsky and O'Sullivan (2015), and marshaled our data to describe the development of common ground through three distinct phases: *coordinative* common ground; *cooperative* common ground; and *collaborative* common ground. We identified which grounding references, identified by Clark and Brennan (1991), have been successfully marshaled in order for these common ground steps to emerge, or, as the case may be, falter. Furthermore, where relevant, we discussed how grounding costs might be part of participants' willingness to collaborate given the limitations (as well as benefits) of mediated communication.

Kuziemsky and O'Sullivan (2015) described three contexts that influenced the development of common ground: geography, agency, and technology. For example, individuals' use of technology to communicate with each other affected the development of the common ground. Technology supported transferring information, as well as improved relationships and collaborative practice. Besides, collaboration is a significant component of healthcare delivery for healthcare providers (e.g., treating patients) and the public (e.g., patients understanding their health conditions). Kuziemsky and O'Sullivan (2015) created the Common Ground Development model to illustrate the development cycle of common ground between team members and to understand and support collaborative practices. The authors found that common ground supported collaborative practice (Kuziemsky & O'Sullivan, 2015).

Before discussing the communication and the common ground concepts in the healthcare setting, this study defined patients' eHealth literacy because of its importance in describing different patients' skills (e.g., health and technical literacies) (see 2.1.4), and healthcare providers' workflow concepts (see 2.1.5).

2.1.4 Patients' eHealth Literacy

Patients' eHealth literacy levels affect their initial use of technology, and will, in turn, be affected by its continued use. Defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (Norman & Skinner, 2006, p. 3), eHealth literacy plays a significant role in determining the efficacy of eHealth tools. The Norman and Skinner's eHealth Lily Model (shown in Figure 9 in Appendix 'A', p. 211) used to determine literacy rates, which consists of two main categories that include six core literacies that can be utilized in healthcare settings (2006). One category is *analytical skills* and includes the following three core literacies: traditional literacy, media literacy, and information literacy. The first core literacy is traditional literacy, which is the ability to read, write, understand, and solve problems to achieve certain goals. Norman and Skinner asserted that any images, audio, or video on the web include text-based components that require individuals to understand the health terminology for obtaining the full advantage of eHealth resources (2006). The second core literacy is media literacy, which requires individuals to have critical thinking and cognitive skills so they can evaluate online health information. The third core literacy is information literacy, which is related to the individual’s ability to locate appropriate information online through proper search strategies and filter out the information required from vast amounts of data on the Internet.

The other main category involves three *context-specific skills-based core literacies*: computer literacy, scientific literacy, and health literacy (Norman & Skinner, 2006). The fourth core literacy is computer literacy, which entails the skills required to use computers and different software types. The fifth core literacy, scientific literacy, is defined as “understanding of nature, aims, methods, application, limitations, and politics of creating knowledge in a systematic manner” (Norman & Skinner, 2006, p. 4). Scientific literacy requires individuals to understand how health information is determined scientifically. The final core literacy is health literacy, which enables individuals to read and understand the health data presented to them to make sensible health treatment decisions.

2.1.5 Healthcare Providers’ Workflow

The workload is particularly challenging to measure. Workload and workflow require much more direct observation of the work process itself, which was not in the study’s scope. The challenge of measurement also lies in subjective perceptions of what constitutes “a lot” of work. We define the terms as follows: workload is an extensive measure that refers to the total number of work-related tasks—operational and administrative—to be performed over a given time. Though related, workflow refers to work intensity, describing the sequence (or sequences) by which work tasks are assigned, managed, and performed in a given time.

Scholars have produced several studies on workload and its related workflow impacts. For example, Rodriguez and Buyya’s (2018) study introduced workflow platforms called Waas. The authors defined workflow as “a set of computational tasks with dependencies between them [that] are a commonly used application model in computational science” (p. 739). They explained that this platform enabled data analysis in varied fields, such as biology and medicine, that make meaningful scientific advances; more importantly, it is also intended to manage the performance of a “continuous workload of heterogeneous workflows” (p. 739). The study showed how workflow efficiency is affected by workload productivity or the reverse.

In this study, our first research question asked: “how do eHealth tools influence healthcare providers’ workflow?” Healthcare providers’ workflow could be affected by different factors such as by patient–healthcare provider technical ability to use eHealth tools. Conversely, patients with sound technical expertise could fail to benefit from data provided via eHealth tools due to low health literacy and/or eHealth literacy. Similarly, some critical information (i.e., risky data) may either be inherently challenging to comprehend, or apt to induce strong emotional responses, both of which could hamper workflow. Finally, the style of data presentation –through structured data fields vs. free-text narrative form –can determine the extent to which eHealth tools help or hinder workflow issues to healthcare providers.

2.2 Communication and Common Ground Concept in Healthcare Settings

Communication is vitally important in healthcare settings. Exchanges of information with implications for critical health situations must be thorough, precise, consistent, and as uninterrupted as possible. The introduction of eHealth tools that meditate such crucial exchanges is therefore complex, and the extent to which such tools will affect overall healthcare delivery has attracted considerable scholarly attention. Mitnick et al. (2010) proved that technical language and medical jargon are fundamental communication barriers between patients and healthcare providers; however, the present study reaches beyond the literature on terminology alone. Lyngstad, Grimsmo, Hofoss, and Helleso (2014) studied communication between homecare nurses and General Practitioners (GPs). The authors described two types of communication methods: electronic (e.g., e-mail or e-messages) and non-electronic (e.g., face-to-face). An example of e-messages was a notification message sent to a GP when a new patient was assigned to homecare community facilities. In the updated version of Lyngstad, Hofoss, Grimsmo, and Helleso's study, they found that nurses perceived e-messages as easy to use because they were included on the same electronic health record (EHR) systems that the nurses employed in daily practice (2015). The authors also found that adding e-messages could be complementary, and non-electronic communication methods should not be replaced.

Similar conclusions –that technology should not replace old communication strategies, such as face-to-face interaction —have been reached by some studies dealing with the patient–healthcare provider communication (Kuziemsky & O'Sullivan, 2015; Levinson, Lesser, & Epstein, 2010). Nevertheless, meditated communication seems increasingly inevitable, and so much scholarly emphasis has been placed on understanding the nature of collaboration when technological mediation is present. Zillich et al. (2005) developed the Physician–Pharmacist Collaboration Instrument (PPCI) to measure social exchanges that encourage healthcare providers' relationships with each other. The authors identified seven items related to healthcare provider relationships: "collaborative care, commitment, dependence symmetry, bidirectional communication, trust, initiating behavior, and conflict resolution" (Zillich et al., 2005, p. 60). Zillich et al. (2005) argued that these seven items could measure collaboration among healthcare providers; furthermore, they added three other meaningful factors to the PPCI: (1) relationship initiation behaviors, (2) trustworthiness, and (3) role specification. Zillich et al. (2005) explained that initiation behavior includes the action of one individual to discover another individual's needs, which promotes the relationship. The authors categorized commitment, trust, and communication under trustworthiness. Trustworthiness between two individuals was determined as the ability of each individual to trust the other’s word and expertise. For example, trust between a healthcare provider and a pharmacist may lead to a commitment to work together in the future (Zillich et al., 2005). Finally, the last factor to collaboration was “a mix of items representing the dependence of practitioners on each other and negotiating acceptable activities for the practitioners” (Zillich et al., 2005, p. 63), which was labeled “role specification.” Several studies have addressed some of the PPCI factors for testing relationships among healthcare providers (R. Gallagher & H. Gallagher, 2012; Kucukarslan et al., 2011). Therefore, some PPCI items, such as trustworthiness, were used in the present study to measure collaboration and common ground between patients and healthcare providers.

Mitnick et al. (2010) argued that a healthcare provider website should provide clear, consistent, and understandable information on medical issues. However, healthcare providers believed that they provided enough information to patients and families who thought that they did not receive enough information from the healthcare providers. Healthcare providers used medical jargon and scientific terminology that resulted in confusion for patients (Mitnick et al., 2010). Terminology and healthcare provider perspectives were essential for improving trust and patient – healthcare provider relationships. According to Melby, Brattheim, and Helleso (2015), fixed terminology in e-messages could provide a common understanding of health information. Melby et al. (2015), point out that e-messaging has focused attention on textual content. Thus, the e-message system is mostly “based on templates, and some of the messages contain imported text from the Electronic Patient’s Record” (p. 3397). Both of these characteristics establish a “fixed terminology,” which may be defined as terminology in which predefined terms are employed as much as possible to build shared understanding and consistency.

Moreover, providing clear and sufficient information to patients and families could increase their emotional preparedness, confidence, and willingness to cooperate with healthcare providers (Mitnick et al., 2010). Therefore, healthcare providers must ensure that common ground of understanding exists with their patients and families, especially when their patients disagree about decisions made regarding medical treatment. Patients' misunderstanding of treatment decisions could increase treatment risks and/or prevent the achievement of clinical goals (Mitnick et al., 2010). Therefore, common ground is required for successful communication and to improve patient–healthcare provider relationships.

Besides, communication helps healthcare providers understand patient conditions and select the best diagnosis and treatment (Bartlett, Blais, Tamblyn Clermont & MacGibbon, 2008). In 2007, six critical functions of patient–healthcare provider communication were listed by the National Cancer Institute: "fostering healing relationships, exchanging information, responding to patients' emotions, managing uncertainty, making informed decisions, and enabling patient self-management" (Levinson et al., 2010, p. 1311). Therefore, this study investigated the common ground concept in communication to understand patient–healthcare provider's relationships.

2.2.1 Existing Communication Tools and Platforms

Many critical studies have focused on specific communication tools/platforms (e.g., e-messaging system and social network platforms) to understand how they serve essential duties, such as information exchange, decision making, patient illness coherence, among others. Having e-messaging on hospital systems, for example, enables healthcare providers to read patients' messages at their convenience and, at the same time, enjoy improved documentation of patient–healthcare provider exchanges (Kittler et al., 2004). Closely related to person-to-person messaging, electronic communication systems can provide essential alerts for services, such as appointments, thus extending collaboration and communication in healthcare settings (Dorr et al., 2007; Berry, Prosser, Wilson, & Castro, 2011; Simon et al., 2011; Baran & Davis, 2015).

Besides, Baran and Davis (2015) studied how existing social network platforms, such as Facebook, could be used for health alerts in the absence of well-developed hospital systems. The authors provided an example of a flu notification/alert, for which healthcare providers developed an application that had a search engine allowing patients to search their newsfeeds. Baran and Davis also indicated that healthcare providers could send appointment notifications to patients via social networking tools, and patients could respond by clicking "confirm" or "rebook appointment" (2015). Social networking tools can be created or added to an eHealth system to provide a variety of communication tools within the system and target more patients (Baran & Davis, 2015; Johnston et al., 2015). For example, Johnston et al. (2015) used WhatsApp[4] as a communication tool for surgery team members, finding that it was user-friendly and safely facilitated communication.

Finally, text-intensive platforms, such as online blogs, not only permit communication but also support the development of longer-term outcomes, such as patient education. Educational tools on eHealth systems could include instructions on how to use eHealth tools for communication as well as provide some health information such as library links (Dorr et al., 2007; Bylund, D'Agostino, Ho, & Chewning, 2010; Palumbo, Sandoval, Hart, & Drill, 2016). Rodriguez et al. (2011) suggested that it is essential to provide patients with educational tools (e.g., links to a health information library) on eHealth systems to enhance their understanding of their health conditions. For example, the authors provided a library link on their website (www.labtestonline.org) that included medical "definitions and explanations of common

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[4] **WhatsApp** is a smartphone application used by millions of people worldwide to send and receive messages in different formats, such as text, voice notes, images, and videos (Johnston et al., 2015).

laboratory tests" (Rodriguez et al., 2011, p. 477). Wald, Dube, and Anthony (2007) indicated that providing educational materials such as library links could improve patient use of health science materials. Moreover, they provided examples of library links, such as to the New York Online Access to Health (i.e., http://www.noah.cuny.edu), a website "developed through a library collaboration that provides accurate, timely, relevant, and unbiased full-text health information in both English and Spanish" (Wald et al., 2007, p. 222). Other studies have also suggested adding a video tutorial to teach end-users how to use eHealth tools more effectively (Lynott, Kooienga, & Stewart, 2013; Palumbo et al., 2016).

King Faisal Specialist Hospital and Research Center (KFSH&RC) provides a web-portal[5] that includes useful tools, such as an educational tool (e.g., a health information library tool for drug and safety[6]). However, in this study, we focused on a prime example of eHealth tools: the Internet and Sehaty application (i.e., the app used in KFSH&RC) to illustrate eHealth tools usage by patients and healthcare providers.

2.2.2 The Advantages of Communication Tools

Advantages for healthcare providers: Unertl et al. (2012) studied how health information technology (HIT) impacts healthcare providers' workflow, and they identified two patterns of such workflow. First, nurses used HIT for data entry and collection, such as patient health information and/or laboratory results, which was then accessed by physicians at the time of the patient's visit. Second, physicians used HIT to look for more information, such as the patient's medical history. Both the nurses and physicians used HIT to review patients' data for decision-making (Unertl et al., 2012). Moreover, the authors observed that clerks used HIT to track lab results and communicate with patients regarding follow-up appointments. The authors suggested that there

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[5] https://www.kfshrc.edu.sa/en/home
[6] https://www.kfshrc.edu.sa/en/home/patientcare/healthlibrary

were advantages to implementing a HIT infrastructure such as increased quality of healthcare, continuity of care, decreased costs, and reduced time.

Another advantage of adopting communication tools for healthcare providers is identifying the individuals who access, enter, and/or update data and/or place orders manually in eHealth systems (Dalal & Schnipper, 2016). Secure messaging tools could also link together communication among support healthcare teams. Johnston et al. (2015) also studied WhatsApp as a healthcare communication tool among healthcare providers, particularly surgical teams. In Johnston et al.'s study, WhatsApp required a network to exchange the messages, and therefore they used the hospital's network to ensure security. The social networking application was used as a tool for real-time access to exchange health information and enhance healthcare providers' communication.

Moreover, healthcare providers could use communication tools to manage documents and improve clinical judgment (Kossman et al., 2013). According to Kossman et al. (2013), nurses are interested in using many tools to manage and organize information as well as to update and recall memory/document; for example, "data displays, worksheets, and checklists" (p. 539). The authors found: "(1) nurses rated self-made work lists and medication administration records highest for both clinical judgment and communication, (2) tools aided different dimensions of clinical judgment, and (3) interdisciplinary tools enhanced team communication" (Kossman et al., 2013, p. 539). Furthermore, Lyngstad et al. (2015) indicated that GPs who used e-messages for medication information found "better accessibility and overview of the medication information" compared with GPs who did not use e-messages (Lyngstad et al., 2015, p. 3430). Therefore, technology could help keep nurses more focused and be sufficient for clinical judgment and care team communication.

In addition, healthcare provider notes in EHR systems are crucial tools for communication among them. According to Finn (2015), EHR systems provide two different methods of data documentation: “structured data fields and free-text narrative format” (p. 1). *Structured data fields* in EHR systems allow healthcare providers to select data for clinical use. Using structured fields provides several benefits such as “data reuse and analysis, a reduction in typing, and providing drop-down menus for clinicians to choose from,” which are faster for healthcare providers to use (Finn, 2015, p. 2). Rosenbloom et al. (2011) indicated that structured fields provide a clinical guideline and quality-assessment program of clinical notes. An example of a clinical note data assessment is when some specific data elements are chosen to be a “required” option for monitoring purposes. On the other hand, Rosenbloom et al. indicated that healthcare providers count on the *free-text narrative* format to present detailed information, such as a patient mood, behavior, level of concern, and appearance of their health problem (2011). This is also aligned with Collins et al. (2013), who stated that nurses liked to write narrative notes to describe patient conditions in more detail.

Advantages for patients: Technology allows people to improve their health knowledge and manage their lifestyles in ways that could affect their health treatment decisions. Today, people are surrounded by electronic devices in their lives and use them as a “high-tech” tool, such as bank machines and mobile phones (Hoffman-Goetz et al., 2014). The Internet has empowered people by providing information in different media formats, enabling more immediate access to social supports and people who share common interests, while simultaneously being a source for multiple purposes and activities such as shopping, and healthcare (Hoffman-Goetz et al., 2014). According to Zach et al., 80% of adults in North America use the Internet for online access, and 60% of them seek health information using their mobile phones (as cited in Hoffman-Goetz et al., 2014).

Hoffman-Goetz et al. (2014) discussed the relationship between information technology—such as the Internet—and health literacy. Health 2.0 is a type of Internet technology that supports people's online interactions with others for communicating and confirming their health information (Hoffman-Goetz et al., 2014). The authors indicated that although the Internet provides people with health information, Health 2.0 created health information in a manner that incorporated healthcare into their health information system. They also explained that a demand exists among informed patients to use collaborative tools such as Internet-based health information sources (e.g., social networking) to communicate with their healthcare providers (Hoffman-Goetz et al., 2014). Furthermore, they indicated that patients are no longer most reliant on healthcare providers as their only source for health information and are more likely to go online for health information. Moreover, Hoffman-Goetz et al. (2014) asserted that people who could interact with Health 2.0 could improve their eHealth literacy. The authors contended that young people are more inclined to be "super-users" of technology. However, they may not possess the skills or knowledge to validate the health information they research.

Additionally, the Internet could improve young adults' health knowledge. Briones (2015) indicated that 93% of young adults (aged 18–29 years) seek specific health information via the Internet. The author discovered that young adults seek health information online before visiting their doctors, which allows these patients to understand their health condition better and clarify questions. Moreover, enhanced eHealth literacy increases patients' satisfaction and helps them become more effective communicators with their doctors. Besides, Briones demonstrated that social networking could provide health information seekers with excellent opportunities to become better health communicators (2015).

Advantages for the patient–healthcare provider communication: Communication tools allow healthcare providers to collect patients' data and provide feedback. Dy et al. (2011) developed a web-based tool called Tell USTM to improve communication between patients and healthcare providers, particularly home patients with terminal illnesses. Collecting data from patients helped healthcare providers to monitor patients' health condition. Tell USTM requested that patients enter their health information (e.g., illness symptoms) into the system to be transferred to healthcare providers with an e-mail notification automatically. Dy et al. demonstrated functions for improving communication, such as "authoring of the self-report data items and the associated navigation and alert rules, the interfaces for patient and caregiver self-report, and the reporting and display of information" (2011, p. 528).

Figure 10 in Appendix 'A' (p. 211) illustrates a flowchart of the communication process by Dy et al. (2011), from patients logging in to healthcare providers viewing patient data summaries. The authors found that Tell USTM was user-friendly. Furthermore, Tell USTM included learning materials and generated automatic notifications to healthcare providers. Therefore, online communication (e.g., e-mail) was useful for data collection, real-time monitoring of patients, response, and receive healthcare providers' feedback. Dalal and Schnipper (2016) indicated that patient-centered tools, such as secure mobile messaging, linked patients with their support healthcare teams. In fact, communication tools could improve patient–healthcare provider relationships. Bezreh, Laws, Taubin, Rifkin, and Wilson (2012) indicated that patient–healthcare provider communication could ensure that patients understand their health conditions and could lead to increased trust and satisfaction.

Furthermore, scholars have addressed health issues, such as nutrition, physical disability, diabetes, and mental health concerns that can be managed and controlled online, resulting in improvement to patients’ health conditions (Hu, 2015). With the help of various types of eHealth tools, such as mobile health applications, health provider websites, computer-based intervention programs, and e-mail (Hu, 2015). Although the use of online communication between patients and healthcare providers has been shown to increase efficiency and patient satisfaction (Beard et al., 2012), it is also crucial to pay attention to barriers that hinder effective communication (Hu, 2015). Some of the obstacles that could impact eHealth tools’ end-users and communication are discussed next.

2.2.3 Barriers of eHealth Tools’ Use

<u>Healthcare providers’ perspective:</u> Healthcare providers’ technical ability could impact their clinical workflow when using eHealth tools. Embi et al. (2013) found that time and effort affected healthcare providers’ workflow when they attempted to review documents and/or enter detailed information on EHR systems. Furthermore, Kossman et al. (2013) found that nurses had difficulty finding other healthcare team members’ notes, which affected communication and patient diagnosis. Moreover, Embi et al. (2013) found that healthcare providers with low technical abilities were more likely to use the narrative format because they had difficulty locating information in structured data fields. Unertl et al. (2012) detected several technical factors that affected healthcare providers, such as challenges in navigating HIT systems and log-in difficulties. Therefore, healthcare providers’ technical ability and technical issues can impact their communication as well as patients’ diagnosis.

In addition, e-messages as a communication tool between healthcare providers may involve numerous messages or the need for detailed responses that require more time, which may have unintended consequences (Wu et al., 2014). Wu et al. argued that two negative consequences of e-messages exist: the decontextualization of complex issues and the depersonalization of communication for healthcare providers (2014). The first consequence described is based on the theory that the greater the number of messages being sent back and forth, the greater the chance of misinterpreting the information, and the greater the need for clarification. The second consequence deals more with how e-messages affect relationships between healthcare providers due to more limited face-to-face interactions and conversations among them (Wu et al., 2014). Therefore, when e-messages are the primary form of communication among healthcare providers, detailed or significant information might be missed or forgotten.

The Institute of Medicine reported that healthcare providers preferred to communicate verbally with their patients instead of using EHR tools; healthcare providers indicated that they did not trust the EHR systems' data, as cited in Finn (2015). Healthcare providers have complained about EHR systems that did not contain interdisciplinary communication (Embi et al., 2013; Keenan, Yakel, Lopez, Tschannen, & Ford, 2013). Moreover, According to Embi et al. (2013), many healthcare providers' clinical needs are not met by EHR systems.

Patients’ perspectives: Patients’ technical expertise also could affect their intention to use eHealth tools. Taha et al. (2013) stated that a lack of experience with technology and lower numeracy and cognitive abilities affected the use of a Personal Health Record system for managing the health of elderly patients. The Personal Health Record system is one subset of an EHR system, allowing patients to edit and update personal information, request medications, schedule appointments, and view lab results. Moreover, Park, Roman, Lee, and Chung (2009) concluded that the patient perception of ease of use tended to influence behavior and increased the likelihood of patients using technology. Patients could perceive the ease of use of such a system based on their technical expertise, which is an essential factor that would increase or decrease their actual use of eHealth tools. Moreover, Cimperman et al. (2016) mentioned that patients aged 50 years and older (as conservative users) pose challenges for acceptance of the telehealth system. Barriers, such as effort expectancy and performance expectancy, have influenced older users' intentions to use telehealth systems. Another obstacle that affected such intentions was the social influence, such as healthcare providers' opinions on technology (Cimperman et al., 2016).

Recently, Quinn et al. (2017) stated that people look for health information on the Internet as a diagnostic tool to answer their health inquiries. They suggested that several reasons exist for individuals seeking health information online, such as reassurance, decreased suspicion of the medical field, and the chance to reconcile with their new health conditions (Quinn et al., 2017). The authors sought to identify the relationship between individuals' behavior in searching for health information online and their level of health and eHealth literacy (Quinn et al., 2017). They also argued that not all online health seekers possess the necessary eHealth literacy skills, such as locating the correct health information.

A similar study by Tennant et al. (2015) studied the behaviors of baby boomers (i.e., people aged 50 to 64 years, at the time of the study) and older adults who seek online health information via the Internet and social networking. The study included 283 participants (54.8% male) and found three main components that affect eHealth literacy: educational level, advanced age, and the type of electronic device used. Overall, participants were confident at using the Internet to obtain health information; however, they were concerned about the quality of health data provided online.

Patient–healthcare provider communication: The shifting balance of power in technology-mediated patient healthcare has spawned a new breed of patients, now labeled consumers (Wald et al., 2007; Ball & Lillis, 2001). These consumer-patients expect their healthcare providers to interpret web-acquired health information (Wald et al., 2007) and share the responsibility of selecting the best treatments (Wald et al., 2007; Beard et al., 2012). Consumer-patients want real-time access to healthcare providers, which could potentially increase healthcare providers' workload (Beard et al., 2012; Lusignan et al., 2014). An increase in workload for healthcare providers may decrease their desire to use eHealth tools to communicate with patients (Lusignan et al., 2014).

The amount of health information that patients are willing to communicate could affect healthcare providers' willingness to respond to their patients. Previous research has found that healthcare providers' concern about increased workload and low-quality health information provided by patients with low health literacy could negatively affect physicians' willingness to use eHealth systems (Lusignan et al., 2014; Beard et al., 2012). To sum up, lower levels of health literacy among patients could increase the amount of time required by healthcare providers to explain patient conditions.

Healthcare providers were also concerned about what type of information could be shared via email or what information should be provided during appointments or via eHealth tools (Beard et al., 2012; Rodriguez et al., 2011). Patients could misunderstand the information that they obtain from healthcare providers via eHealth tools (Wald et al., 2007). Therefore, healthcare providers could avoid providing information that might be misinterpreted by patients, such as certain lab results.

A patient's level of eHealth literacy could either have a positive impact on his or her relationship with a physician (e.g., due to an increase in the patient's health knowledge) or adverse consequences (e.g., due to the patient misinterpreting the health information received) (Tanis, Hartmann, & Te, 2016). A study by Wald et al. (2007) addressed patient use of the Internet and its influences on healthcare, including patient–healthcare provider relationships. The study found that patient doubts or concerns about healthcare providers' treatment could produce more questions from patients or the desire to obtain a second opinion from a different doctor. Besides, Wald et al.

(2007) found that healthcare providers resisted giving detailed health information to patients with inadequate health knowledge. By contrast, they provided more detailed health information to patients who asked more questions, were better informed, and were willing to listen to their physicians (Wald et al., 2007). This suggests that from a healthcare providers' perspective, a link exists between patients' health literacy and their ability to use eHealth tools successfully.

2.2.4 Facilitators of eHealth Tools' Use

This subsection explains some of the suggested solutions for overcoming barriers to patients and healthcare providers using eHealth tools.

<u>Simplifying eHealth Tool design:</u> Cimperman et al. (2016) argued that behavioral intention must be addressed at the conceptual level before a specific technology is implemented. They suggested that for a successful implementation, the developer must understand conservative users' behaviors. However, it is challenging to analyze user behavior if certain features of the EHR systems do not exist. Furthermore, Mardis (2009) suggested that providing standardized terminology could enhance healthcare providers' engagement and workflow.

Furthermore, Unertl et al. (2012) argued that healthcare providers require assistance with adopting the HIT system as part of their standard workflow to facilitate healthcare delivery. Their study suggested that several factors must be addressed to overcome resistance to HIT, such as "providing a range of functionality, supporting different approaches to data, and presenting different levels of data" (Unertl et al., 2012, p. 399). Resolving these issues could reduce the time that healthcare providers spend viewing patients' information.

<u>Educational tools:</u> Studies have indicated that video-tutorials would help patients and healthcare providers to understand how to use communication techniques (Lynott et al., 2013; Palumbo et al., 2016). The inclusion of a communication training tool as part of healthcare provider education programs would be ideal (Lynott et al., 2013; Palumbo et al., 2016). Furthermore,

Rodriguez et al. (2011) have suggested the best training programs will be those that provide patients with additional educational materials (e.g., links to a health information library of definitions) on eHealth systems. Preparing patients and keeping them well-informed could limit the time required to ask and answer routine questions via eHealth tools and could encourage healthcare providers to focus more on communicating and answering urgent questions at their convenience.

The effectiveness of in-person training workshops for healthcare providers has also been studied. Jensen et al. (2015) studied healthcare providers before and after implementing a system for communicating with in-hospital aphasia patients. They provided a Supported Conversation for Adults with Aphasia training workshop to healthcare providers, which allowed them to write keywords in dialog notebooks for patients. Furthermore, the workshop provided tools for patients to respond “yes” or “no” to questions or select “images.” Moreover, the training included some videos for teaching people how to understand body language. The study found that patients were positively engaged in communicating with healthcare providers. Moreover, the implementation of supported conversation systems allowed healthcare providers to continue monitoring patients.

Palumbo et al. (2016) found that typing information into a system was time-consuming. To save time and increase the use of communication functions, training on eHealth tools is essential. The authors indicated that healthcare providers must first learn how to use eHealth tools to enter data in the right place. For example, training would help healthcare providers save time looking for where to write a note. Besides, they found that coaching healthcare providers on EHR systems and communication skills helped them to navigate the EHR systems to enter data in the right place (Palumbo et al., 2016). Moreover, Palumbo et al.’s training workshop helped healthcare providers understand the system and, as a result, improved communication with their patients (2016). Their study suggested that training programs save healthcare providers time when navigating systems.

Overall, the above sections discussed significant components in this study, such as communication: how communication and common ground are essential in healthcare settings, and the need for health organizations to include communication tools to ensure effective communication among healthcare providers and with patients. Several eHealth tools, such as communication tools, can be implemented in eHealth systems, (e.g., e-messages and social networks), to provide a variety of options for improving patient–healthcare provider communication. Using these eHealth tools correctly is essential for clinical judgment and efficiency. To overcome such barriers (e.g., healthcare providers' lack of technical abilities), studies have suggested advanced training on how to use eHealth tools (such as Jensen et al., 2015).

Furthermore, because the present study aimed to understand the use of eHealth tools in the KSA context, the following section 2.3 provides an overview of the KSA (e.g., government role, culture, and literacy), the healthcare system in the KSA, and its mobile computing trends.

2.3 Overview of the Kingdom of Saudi Arabia [KSA]

The development of eHealth tools and communication systems is complex in any context. It is especially complicated in the KSA, however, as the government must balance social and cultural factors with its stated desire to preserve cultural traditions and Islamic religious practices. This section offers insight into the government's role in improving healthcare systems through initiatives such as the National Transformation Program 2020. After that, an overview of the language and literacy rates is presented, followed by some discussion of deeply rooted security and privacy concerns related to patient-healthcare providers' communication.

2.3.1 Governance, Civil Society, and Growth

The KSA's population of 34,268,528 (The World Bank, 2020), occupying approximately 80% of the Arabian Peninsula, is governed by an absolute monarchy; legislative and executive functions are performed "by the King and Cabinet" [centralized power] (Al-Rushaid, 2010, p. 5). Unprecedented increases in oil-export revenues since the early 1970s have allowed Saudi leaders to answer concerns about centralized power with reforms and service delivery, including many in healthcare (Batniji et al., 2014). The KSA is thus unique among Arab states, despite facing many of the same criticisms waged against other nations—human-rights issues, poverty reduction, etc. The KSA has the financial capacity because it is a "high-income" country to establish institutions (such as schools and hospitals) that are key to addressing inequality issues (World Health Organization [WHO], 2017).

Just as importantly, the KSA has the ability and willingness to develop stable bureaucratic operations to govern new institutions and exercise power with the appearance of impartiality. Its commitment to such changes reaches back to the 1970s, but real progress has been witnessed since 2000 and the KSA's adoption of the UN's Millennium Development Goals (Al-Rushaid, 2010). The WHO indicated that KSA has excellent facilities for healthcare services (2013). Also, the KSA attempted to develop new strategies that are primarily patient-centered. For example, they increased emphasis "on health promotion and protection, and emphasis on social determinants of health" (WHO, 2013, p. 16). They also improved coordination among MOH and other healthcare sectors, including developing national policies. The KSA has crafted 5-year National Development Plans that have aimed, for example, to build reliable infrastructures (e.g., wireless communication, education, and healthcare); address the inequality and women's rights, and create economic diversification (Ministry of Economy and Planning, n.d.; General Authority for Statistics KSA, 2017).

2.3.2 The National Transformation Program 2020

National Development Plans have provided the operational blueprints for realizing the KSA's broad, long-term development objectives. They were declared in its National Transformation Program of 2020 and, more recently, in the Kingdom's "Vision 2030" (WHO, 2017). Toward its goals and massive investments in infrastructure and bureaucratic capacity, the Ninth Development Plan sought to enhance human development, including the provision of healthcare services (Ministry of Economic and Planning, n.d.).

The 2020 National Transformation Program has earned high ratings from the WHO by identifying interruptions in healthcare services and barriers to access for specific groups, ensuring health security, increasing the assistance of health development, and maintaining more significant control of the health workforce (WHO, 2017). The program promoted different goals, such as a transition from a paper-based to an eHealth system (WHO, 2017). The country's efforts have delivered results, as recognized by the WHO. The WHO founds that KSA improved their eHealth system toward the program of 2020, for example, the WHO noticed an improvement of health policies national wise in the KSA:

1. The private organization is required to precede the strategy on involving the social insurance concept;
2. The Ministry of Health (MOH) is responsible for healthcare services via healthcare facilities such as healthcare centers and hospitals;
3. An improvement in the health network infrastructure includes access to remote regions, such as providing curative care services for all populations, including general practitioners to advance specialists;
4. KSA developed healthcare strategies and national policies. For example, the National Agency for Accreditation of Healthcare Institutions commands all hospitals' mandatory certification in terms of the quality and safety of healthcare services in all healthcare centers;

5. The MOH successfully invested in an e-data capturing system and built an eHealth unit that connected all healthcare facilities, allowing the flow of information more efficiently and promptly (WHO, 2017).

2.3.3 Language and KSA Literacy

Successful adaptation of eHealth systems for communication purposes is contingent on the end-users' understanding of the English language (i.e., Health terminology used in the English language internationally) and their literacy. Thus, we offer insights into the language used in the KSA as well as literacy rates.

Official languages: The official language in the KSA for the government and public is Arabic. However, English is the second official language for businesses and organizations with Arabic used to begin when conducting business organizations/activities (as cited in Abdallah & Albadri, 2010).

Literacy rates: Recently, the KSA decided to terminate the gender gap in literacy. The WHO (2013) indicated that the literacy rate among women (i.e., 15^+ years old) went from around 80% in 2004 to 85% in 2010. Also, the reports indicated that the overall population (aged 25^+) had completed at least a high school diploma in 2010 (50.3% females and 59.1% males) (WHO, 2013).

The WHO (2017) ranked the KSA 56th in its demographics and socioeconomic statistics concerning gender inequality. Though this number is not flattering, it is partly explained by limited access to specific disciplines, such as engineering and veterinary medicine. Saudi women do, however, have substantial access to university education, with some 59% of them earn a degree (WHO, 2013). In 2013, 99.2% of youth 15-24 years old, and 94.4% of adults were literate; and 91.4% of adult females were identified as literate in 2012 (WHO, 2017).

2.3.4 The Effects of the Culture of Security and Privacy for Patient-Healthcare Providers Communication

Factors such as the security systems, privacy (especially for women), and cultural identity would affect end-users' decision to use eHealth tools for communication

Security systems: As Table 2 (p. 38) shows the KSA has a low ranking 2 in the "security & confidence" indicator concerning the adoption of Information Communication Technologies (ICT). A shortage of software protection against viruses and spyware is cited as one reason that people become "victims of various malicious attacks" (Abdallah & Albadri, 2010, p. 7). This can be addressed through investment in advanced security systems, which the KSA has done. For example, for network security, the KSA established emergency response teams and introduced an anti-SPAM framework addressing technical, legal, and policy issues and defining the roles and responsibilities of service providers (Abdallah & Albadri, 2010, p. 7). Likewise, the KSA has launched Public Key Infrastructure technology to secure their e-transactions and transmit information.

Women privacy concerns: Technical protection from vicious attacks does not address deeply entrenched cultural concerns for privacy and security. For instance, in the past, male guardianship has been required for all females' visits to doctors (Arab News, 2014). Even where such limitations are not maintained, many Muslim women refuse to be seen, quite literally, by male doctors. Also, when female doctors attended, concerns persist over access to electronic communication about unusual medical conditions. Such concerns are exacerbated by the reality of a high percentage of expatriate employment in medical professions, deepening trust and reliability (Official GMI Blog, 2020).

Moreover, society, including business organizations, has been inspired by the use of the internet to improve their values. The general population believes that the internet and the new technologies will preserve the KSA’s culture since those tools allow restricted members, such as women, to use it positively for their own seeks (as cited in Abdallah & Albadri, 2010). For example, women can use such technology to improve their education, communication, and to shop online without interacting with men.

Cultural Identity: Abdallah and Albadri’s (2010) study indicated that the KSA ranked between levels 2 and 3 “in terms of their progress towards building information society using various indicators” (see Table 2).

Table 2: *The KSA ranks among 14 other Arab countries “in terms of their progress towards building information society using various indicators”* (Abdallah & *Albadri, 2010. pp.3-4)*

Indicators	**Rank**
Government and all stakeholder support	3 out of 4[7]
ICT infrastructure & penetration rates	3 out of 4
Access to information & knowledge	2 out of 4
ICT capacity building	3 out of 4
Building ICT security & confidence	2 out of 4
Adoption of ICT application	3 out of 4
Preservation of cultural identify	3 out of 4
Total of all levels	**19 out of 24[8]**

Table 2 shows that the KSA ranks at level 3 in terms of “preservation of cultural identity” due to their efforts toward keeping and protecting their cultural identity, “heritage, and national archives” (Abdallah & Albadri, 2010, p. 8). Cultural factors (e.g., “values, beliefs, heritage values, and religion”) impact employees’ attitudes toward using eHealth tools such as ICT; so does the differing perspective attitudes of the public and employees (as cited in Abdallah & Albadri, 2010, p. 171). However, they found that "the role of societal culture and working culture" in the KSA supported research and development in the ICT organizations (as cited in Abdallah & Albadri, 2010, p. 170).

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[7] “Level 4 is the highest degree of effort made by a specific country to move into knowledge society”; 1 is the lowest (Abdallah & Albadri, 2010, p. 3).

[8] The KSA ranks 19 out of 24, where 24 ranks the highest among 14 countries (i.e., The United Arab Emirates, Qatar, Bahrain, KSA, Egypt, Jordan, Kuwait, Oman, Lebanon, Syrian Arab Republic, Palestine, Iraq, Sudan, and Yemen). The most elevated ranks belong to the United Arab Emirates (24) and the lowest in Yemen (i.e., 7).

Moreover, Al-Kinani's study found sufficient components in KSA's culture and society toward adopting new technology, such as ICT (as cited in Abdallah & Albadri, 2010). The study indicated that the community is not fully satisfied with current ICT requirements, which requires support from local organizations. Additionally, public society still hesitates to interact with foreign cultures that could harm their own culture. However, society accepts the new technology or tools, which is a good sign of KSA's e-readiness.

In summary, the KSA occupies a unique position among Arab states concerning healthcare and the adoption of health-related communication technologies. To its credit, the KSA's 5-year development plans (the 10th, mainly) have called for vastly expanded record-keeping capacity to track and verify progress (Ministry of Economy and Planning, n.d.; General Authority for Statistics KSA, 2017; WHO, 2017). Following domestic concerns and, significantly, the country's commitments to multilateral arrangements, such as the World Trade Organization, the country joined in 2005 (Ministry of Economic and Planning, n.d.). However, the country's development plans also stress the importance of protecting Islamic identity (e.g., women's privacy) and traditional values, often ahead of most other priorities (Ministry of Economy and Planning, n.d.).

The adoption of effective, modern institutions has expanded and accelerated the pace at which Saudi citizens interact with a government that prioritizes traditional values. The solution to this issue—of which this study is a small part—is for the KSA government to understand more about how certain technologies such as eHealth systems, however advanced and impressive, may fit into Saudi culture. Advanced testing, as suggested by Abdallah & Albadri's (2010) study of communication technologies, which has been lacking, will result in better communication among patients and healthcare providers, more successful implementation of leading eHealth systems, and efficient use of the KSA's investments.

2.3.5 Healthcare System in the KSA

One of the main goals of this study was to facilitate the use of eHealth tools in the KSA to improve Saudi residents' delivery of healthcare. This section describes researches from the KSA on eHealth systems/tools and provides data on mobile computing trends (including a mobile health application study).

2.3.6 The eHealth Systems in the KSA

To improve the overall healthcare system in the KSA, the MOH plans to implement a national strategy that will incorporate eHealth tools into its healthcare system (Almalki, FitzGerald, & Clark, 2011). For example, the MOH has linked all of the KSA's healthcare resources, such as hospitals and clinics, through an online system, and is also preparing to establish an eHealth system that will include all patients' health data; furthermore, it will be accessible from anywhere in the KSA (MOH, 2009).

The WHO (2013) indicated that the KSA produces a small number of research publications despite its number 2 ranking among other Arab countries in terms of biomedical publications. The WHO noticed the KSA's efforts to adopt the eHealth systems; however, it is still slow. In 2008, the MOH began a 5-year roadmap to centralize the eHealth system in the KSA, which aimed to (a) connect all healthcare providers, (b) control and measure the performance of healthcare outcomes, and (c) transform the healthcare delivery to a consistent world-class standard (WHO, 2013). In 2009, the MOH successfully implemented e-messages through smartphone systems to control epidemics around the time of the Haj (MOH, 2009).

Moreover, patients' access to health information has increased since a fully integrated web portal (www.moh.gov.sa) was launched. The website provides information about the MOH's structure, along with full personnel and facility location assistance. Patients can also discover all available electronic medical services through the MOH and seek general health information at the site. Finally, the website also links to social media applications such as Facebook and Twitter, allowing patients to communicate with the MOH about any health-related topic.

There are some indications that these relatively new innovations have raised expectations (for even more innovation) among Saudis. However, despite innovations and rising expectations, only a few sustained studies address KSA's context (MOH, 2009). Altuwaijri (2008) studied examples of EHR systems that the MOH used at different hospitals in the KSA. The authors drew attention to the MOH's centralized national information system for EHR systems, which could link all hospitals in the KSA (Altuwaijri, 2008). Similar systems were also established at private hospitals and clinics, which linked them with the MOH or insurance companies for financial reasons (Altuwaijri, 2008).

The KFSH&RC has implemented telemedicine systems since 1993 and used advanced information technology systems from as early as 1975 (Altuwaijri, 2008). The KFSH&RC uses different forms of HIT, such as electronic medical reports and new health portals. Moreover, the National Guard Health Affairs implemented advanced computer networks in its four hospitals and 60 clinics connected via a wide area network, whereas Security Forces Hospitals integrated a data and communication infrastructure that supported medical and administrative personnel. Some medical insurance companies have been officially licensed and linked their health information via networks with MOH healthcare resources, such as hospitals (Altuwaijri, 2008). Overall, Altuwaijri concluded that the KSA was slowly starting to take advantage of eHealth systems (2008).

A study by Aldosari (2014) revealed the types of EHR systems that were being used in the KSA. The author surveyed 22 hospitals in Riyadh and found that 11 hospitals had installed EHR systems with full functionality, eight hospitals were still under development, and the other three hospitals had not adopted any systems yet. Aldosari also determined that 16 different EHR systems were used among the 19 hospitals, which could potentially result in problems in data exchange (2014). Therefore, he suggested that a unified EHR system be implemented in the KSA to facilitate data exchange among hospitals.

A similar proposal was made for insurance companies. The KSA established the Council for Cooperative Health Insurance in 1999 to improve healthcare quality (WHO, 2013). The plan to address challenges in three stages started in 2006 (WHO, 2013, p. 9); it:

1. Applies to non-Saudis and Saudis using private-sector health care services;
2. Focuses on a cooperative agreement with Saudis and non-Saudis working in the government sector;
3. And, targets other groups, such as pilgrims.

In 2012, 26 healthcare insurance companies successfully controlled 154 hospitals via a network in the KSA (WHO, 2013). Twenty-two of those hospitals are public-sectors, which are mainly under the guidance of MOH. MOH involvement did not unify the process, nor did it unify the eHealth system in terms of the variety of healthcare insurance companies. Healthcare costs increased, and inefficiencies persisted (WHO, 2013).

However, adopting EHR systems in the KSA can also give rise to concerns. Alkadi (2016) studied the main challenges of utilizing EHR systems for patients with diabetes in the KSA. The author included problems such as human factors (e.g., resistance to change), lack of support for training programs, healthcare providers' difficulties with capturing data (e.g., finding the right information in an appropriate amount of time), and the uncertain quality of data due mostly to data entry errors and incomplete details. Alkadi indicated that common mistakes could result from a lack of healthcare provider training and awareness (2016). Although the author found that many of the KSA's hospitals had adopted EHR systems, challenges often existed with data exchange related to the number of different EHR systems as well as privacy and security issues. Alkadi stressed the need for a unified standard EHR system and standardized health terminologies in EHR systems in the KSA (2016). The author indicated several advantages of adopting a standard EHR system: enhanced quality of information exchange, improved healthcare system structure, improved management, reduction in medical errors, and timely data analysis, such as for morbidity data. These findings are consistent with Aldosari's (2014) study, which indicated the need for a unified EHR system in the KSA. In conclusion, the KSA still faces challenges in adopting EHR systems. The following subsection examines mobile computing trends in the KSA.

2.3.7 Mobile Computing Trends in the KSA

Mobile computing allows users to access data remotely through portable devices as well as wireless communication systems. The present study focused on how to use mobile applications to facilitate communication between patients and healthcare providers. Therefore, conducting an overview of mobile phone use in the KSA was crucial. The United Nations Conference on Trade and Development reported that KSA has the highest percentage of smartphone users worldwide (as cited in Alanzi, Istepanian, & Philip, 2014). This subsection introduces some of the recent literature on mobile computing trends in the KSA.

Alotaibi's (2014) study sought to understand the popularity of mobile computing in the KSA because, in 2013, 53 million residents of the KSA had smartphone subscriptions. Figure 11 of Appendix 'A' (p. 212) indicates mobile computing trends in the KSA based on user types, use purposes, platforms, and critical features. Alotaibi concluded that 43% of mobile applications were mobile government (m-government) applications, whereas 57% used for mobile business (m-business) (2014). Mobile apps are vital for enhancing communication between KSA residents and different organizations, such as the government and corporations.

Alqahtani, Alhadreti, Alrobaea, and Mayhew (2015) investigated mobile applications' usability in the KSA. The authors explained that mobile phones are currently not merely used for telephone needs but also for social networking, mobile banking, health, and entertainment. Alqahtani et al. indicated that usability was one of the main factors influencing Saudi users' intentions to use mobile applications (2015). Their study found that the users of selected mobile apps were not satisfied with specific mobile applications because they were not yet fully developed. The authors recommended that the KSA government support healthcare organizations by increasing awareness of mobile apps via media.

Alanzi et al. (2014) addressed mobile applications' use in managing patients with Type 2 diabetes. The authors proposed the Saudi Arabia Networking for Aiding Diabetes (SANAD) system, which tests Saudi patients' social behavior with diabetes using smartphone technology. Alanzi et al. (2014) stated that "usability factors have influenced the design of the SANAD system in order to toe relevant usability factors among Type 2 diabetic patients in the KSA" (p. 298). The authors found that the SANAD system was a useful tool widely accepted by patients with Type 2 diabetes. Alanzi et al. offered recommendations to improve the SANAD system by using more basic terminology and educational tools (2014).

More modernized systems could benefit the KSA's citizens in terms of increasing their health knowledge. However, the KSA government has been moving slowly to adopt new healthcare systems. They face many challenges, such as resistance to change by healthcare providers, a lack of support for training programs and workshops, and the need for a unified EHR system in the KSA hospitals.

In summary, Chapter 2 reviewed scholarly literature related to the core components of this study –communication theory, effective communication, common ground, patient's eHealth literacy, healthcare providers' workflow. This chapter also introduced studies on current communication systems and the rise of common ground concepts in healthcare settings. As we have shown here, much of the literature addressing eHealth technologies in healthcare settings emphasizes barriers to implementing such tools. Though understanding barriers is essential for developing such systems, this study deploys objective data from a healthcare setting to better understand the advantages and facilitators of eHealth tools as common ground is established. Moreover, because this study was conducted specifically in the KSA, we also discussed KSA background information and their cultural concepts, recent literature regarding the healthcare system, and mobile trends in KSA.

This study focused on answering the following RQs: 1) how do eHealth tools influence healthcare providers' workflow? 2) Does increased use of eHealth tools improve healthcare providers' and patients' relationships? And 3) how do patients' eHealth literacy levels influence their communication with healthcare providers? After offering a definition and brief background in communication and common ground theories, we decided to go through those theories that provide the most significant methodological contribution of this study. Thus, building on such studies, we formulated our research questions (RQs) and its related assertions to identify pre-existing common ground factors, as well as behaviors, perceptions, and attitudes held by each group toward the other. Moreover, to explore both information exchange and relationship development, we followed Kuziemsky and O'Sullivan (2015) and marshaled our data to describe the development of common ground through three distinct phases: coordinative common ground; cooperative common ground; and collaborative common ground.

Furthermore, both common ground theory and PHPFFC model (i.e., Basahih and Kuziemsky, 2017, see Chapter 3) guided our analysis of empirical data and, ultimately, our revised PHPFFC V2.0 model according to empirical study (see Chapter 6). The following chapter discusses our research model as well as this study's RQs propositions.

Chapter 3 Research Model and Propositions

This study considers the importance of eHealth tools, such as communication tools, and barriers and facilitators to their end-users in the context of the Kingdom of Saudi Arabia (KSA). Thus, we created the Patient–Healthcare Provider Factors and Functions for Communication (PHPFFC) model that assesses patients' and healthcare providers' factors that affect the intention of both to use eHealth tools for communication (Basahih & Kuziemsky, 2017). Section 3.1 explains the theoretical perspectives employed for this study, as well as our PHPFFC model (See Figure 1) (Basahih & Kuziemsky, 2017). We believe that different communication tools (such as e-messages) would help to improve and increase patient–healthcare provider communication, as would understanding the common ground required for successful communication. Section 3.2 lists and explains the research questions for this study.

3.1 Theoretical Perspectives

The PHPFFC model (Figure 1) was initially developed to fill a significant gap in the literature. Though many studies illustrated single-group factors in the context of eHealth-enabled communication, very few analyzed multi-group factors emerging from joint communication. Thus, the PHPFFC model assesses patients' and healthcare providers' factors that affect the intention of both to use eHealth tools for communication (i.e., common ground) (Basahih & Kuziemsky, 2017). We divided each of these three main components into four main categories: information, technology, workflow, and outcomes.

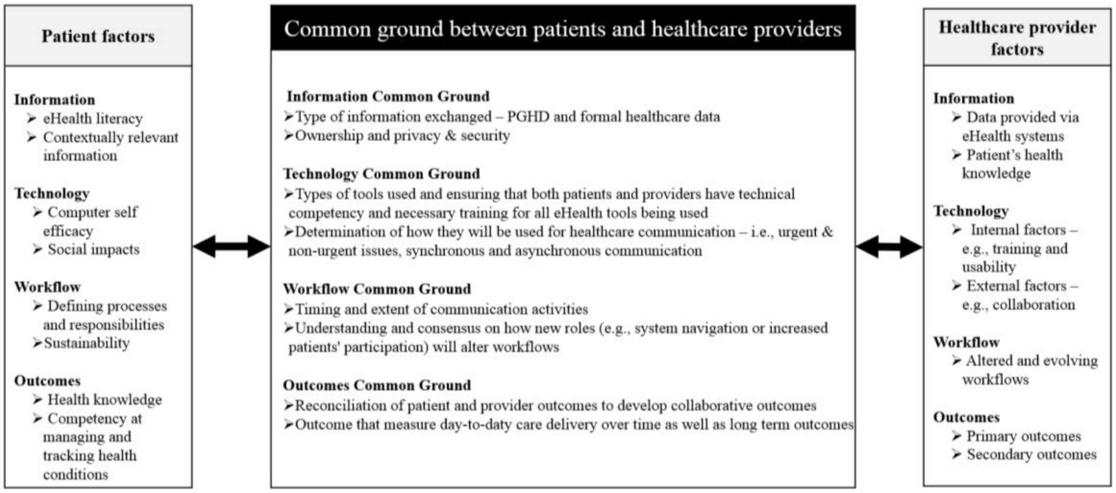

Figure 1: *Patient and Healthcare Provider Factors and Functions for Communication (PHPFFC) Model (Basahih & Kuziemsky, 2017)*

3.1.1 Patient Factors

The left column in Figure 1 identifies patient factors that may affect healthcare providers' intentions to use eHealth tools, such as communication tools (Basahih & Kuziemsky, 2017). The following subsections introduce the four main categories of patient factors: information, technology, workflow, and outcomes.

A. Patient Information Factors

Scholars consider patients' eHealth literacy (Quinn et al., 2017; Tennant et al., 2015; Basahih & Kuziemsky, 2017) to be a factor that affects their intention to use eHealth tools. Moreover, Norman and Skinner (2006) posited that eHealth literacy could be affected by different influences, such as computer literacy and health literacy. Health literacy was determined as being the capability to interpret and communicate data within different health contexts (as cited in Rootman, Frankish, & Kaszap, 2007). Rootman et al. indicated that patients' health literacy could be affected by their ability to interpret health information as well as their level of education (2007). Thus, eHealth literacy contains various factors, including patients' ability to interpret health information, their level of education (Rootman et al., 2007), and their technical skill (Norman &

Skinner, 2006). Another patient factor related to the information section in Figure 1 is contextually relevant information, which was determined as the ability of patients to understand and manage the health information related to their illness (i.e., chronic diseases or undergoing disease rehabilitation), including understanding clinical information and practical guidance (Davoody, Koch, Krakau, & Hägglund, 2016; Basahih & Kuziemsky, 2017).

B. Patient Technology Factors

Technology is influenced by sub-factors such as computer self-efficacy (De Veer et al., 2015; Seto et al., 2010; Weiner, 2012; Basahih & Kuziemsky, 2017), which entails technical expertise (Taha et al. 2013; Weiner, 2012) as well as the perceived usefulness and ease of use of a technology (Dohan & Tan, 2014). Social impacts, such as social influence and social networks (Basahih & Kuziemsky, 2017), are also patient technology factors. For instance, patients might be influenced by healthcare providers to use eHealth tools (Dohan & Tan, 2014; Tung, Chang & Chou, 2008; Venkatesh, Morries, M. Davis, & F. Davis, 2003; Basahih & Kuziemsky, 2017). Weiner (2012) and Demiris (2012) also reported that various web applications provide health information that helps social networks grow. Patients could benefit from using technology to make them socially isolated or, on the contrary, over-reliant on it (Basahih & Kuziemsky, 2017).

C. Patient Workflow Factors

Patients have many responsibilities in managing their health conditions when using eHealth tools (Basahih & Kuziemsky, 2017). They may feel overwhelmed when managing their healthcare needs, as Ozkaynak et al. (2013) discovered in the case of anticoagulation management. The sustainability of responsibility requires patients to track and manage their health conditions (Basahih & Kuziemsky, 2017). In Abdelhamid’s (2018) study, the author indicated that providing a variety of eHealth tools, such as health information exchange systems, would help patients be active and improve sustainability as the exchange systems allowed patients to share personal health information into the system. Other studies have explained how patients may initially intend to be active participants in maintaining their self-healthcare, but that energy decreases over time (Thackeray, Crookston, & West, 2013; Basahih & Kuziemsky, 2017). Therefore, we have considered defining processes, responsibilities, and sustainability — which could involve the time required by patients to acquire more health knowledge or obtain technical skills — as factors that could affect patients' workflow, as well as their intention to use eHealth tools (Basahih & Kuziemsky, 2017).

D. Patient Outcomes

Finally, patients could benefit from eHealth tools' outcomes, such as increasing health knowledge and competency at managing and tracking their health conditions through the use of eHealth tools (Earnest, Ross, Wittevrongel, Moore, & Lin, 2004; Kelly, Ziebland, & Jenkinson, 2015; Basahih & Kuziemsky, 2017). For example, Street, Makoul, Arora, and Epstein (2009) indicated that patients with cancer could manage their pain by communicating with their healthcare providers. Therefore, patients' use of eHealth tools could increase their health knowledge and allow them to build competency in managing and tracking their health conditions, which could impact their intention to use eHealth tools.

3.1.2 Healthcare Provider Factors

The right column in Figure 1 identifies healthcare provider factors that may affect their intentions to use eHealth tools for communication purposes (Basahih & Kuziemsky, 2017).

A. Healthcare Provider Information Factors

The data provided via eHealth tools could be generated through e-formal data collection, such as electronic medical records (EMRs) and/or patient-generated health data (PGHD) (Basahih & Kuziemsky, 2017). PGHD occurs through the use of eHealth tools such as Fitbits or mobile phone applications (Basahih & Kuziemsky, 2017). Moreover, Jiaren (2017) mentioned that EMRs (as an example of e-formal data collection) support data provided via physicians’ regular clinical duties, administrative tasks, and support access to the medical domain, such as a web-based interactive visualization system. The second healthcare providers’ factor concerning health information via eHealth tools is the level of patients’ health knowledge (Basahih & Kuziemsky, 2017). Some healthcare providers are concerned about allowing their patients to view data provided via eHealth tools before discussing it with them (Beard et al., 2012), and have also voiced concerns about the possibility of patients misinterpreting such information (Wu et al., 2014).

B. Healthcare Providers Technology Factors

Healthcare providers’ technical factors include internal and external factors (Basahih & Kuziemsky, 2017). Internally, training workshops for healthcare providers can ensure practical eHealth tools’ usability (Basahih & Kuziemsky, 2017; De Grood, Raissi, Kwon, & Santana, 2016; Monkman & Kushniruk, 2015). The training helped healthcare providers understand systems as well as improved their technical ability, which in turn could improve communication with their patients (Lyngstad et al., 2015; Bylund et al., 2010; Jensen et al., 2015; Schooley, Walczak, Hikmet & Patel, 2016). External factors include collaboration and communication between healthcare providers and others, such as patients and other healthcare organizations (Basahih & Kuziemsky, 2017). As we stated in our previous study “physicians also need to have tools to support different aspects of healthcare delivery, which can include synchronous and asynchronous healthcare delivery” (Basahih & Kuziemsky, 2017, p. 124).

C. Healthcare Providers Workflow Factors

Scholars have discussed healthcare providers’ concerns about increased workload when adopting such technology (Aantjes, Quinlan, & Bunders, 2014; Bae & Encinosa, 2016; Seto et al., 2010; Lusignan et al., 2014). Text-based communication between healthcare providers may include numerous text messages or the need for detailed responses that require more time (Wu et al., 2014). Embi et al. (2013) also found that extra time and effort were required for healthcare providers to enter detailed information or review documents on EHRs.

Workflow factors include altered and evolving workflow for healthcare providers and patients due to changes in patient–healthcare providers' workflow routines resulting from the use of eHealth tools. In short, patients' cooperation in their healthcare delivery (Steel et al., 2016; Ozkaynak et al., 2013; Basahih & Kuziemsky, 2017) and healthcare providers viewing of patients' health data, create an "eTeam." The eTeam is a form of collaborative healthcare delivery, which could affect healthcare providers' workloads (Ozkaynak et al., 2013; Rai, Chen, Pye, & Baird, 2013; Basahih & Kuziemsky, 2017).

D. Healthcare Providers Outcomes

Healthcare providers' outcomes can be listed in two classes —primary and secondary outcomes (Basahih & Kuziemsky, 2017). First, the primary outcomes are related to healthcare delivery (i.e., medical tasks); for example, healthcare providers could benefit from eHealth tools, especially communication tools, because they could improve the patient–healthcare provider relationship (Earnest et al. 2004). De Grood et al. also reported that EMRs supported healthcare providers to reduce medical errors such as drug interaction, prescription errors, and facilitated electronic prescriptions (2016). In short, healthcare providers (e.g., physicians) use eHealth tools to support healthcare delivery tasks such as using communication tools to reduce unintended consequences (Basahih & Kuziemsky, 2017). Second, the secondary outcomes for healthcare providers are related to administrative tasks, such as billing and tracking patients' health conditions (Basahih & Kuziemsky, 2017). For example, remote monitoring can be realized when healthcare providers can easily access their patients' health information, remain updated and informed of any new inquiries through communication tools such as a notification tool (Davis & Oakley-Girvan, 2015; Aantjes et al., 2014). In return, such a tool would allow patients to track their own health conditions and update their healthcare providers regarding new concerns or health symptoms (Seto et al., 2010).

3.1.3 Common Ground between Patients and Healthcare Providers

The middle column of Figure 1 describes the types of common ground that are required around each of the four concepts in the PHPFFC model (Basahih & Kuziemsky, 2017).

A. Information Common Ground

Information common ground is required in terms of the type of health information exchange that is best suited to documenting patients' healthcare delivery (Basahih & Kuziemsky, 2017). According to Mitnick et al. (2010), the information provided in eHealth tools should be clear, consistent, and understood by patients and healthcare providers (both end-users). Understanding information can be defined as when both there is an agreement on the terminology used between both end-user (Mitnick et al., 2010; Dohan & Tan, 2014; Unertl et al., 2012; Cimperman et al., 2016). More research is required to understand trust as a common-ground factor among healthcare providers, such as healthcare providers' satisfaction regarding the health information provided through eHealth tools (Basahih & Kuziemsky, 2017). Furthermore, ownership, privacy, and security of data must also be considered between both end-users, resulting in increasing trust being a common ground factor. Providing data in eHealth tools would always increase privacy risks, though one scholar deems the benefits to outweigh those risks (Carabollo, 2016).

B. Technology Common Ground

Different types of technology (e.g., eHealth tools) and the determination of how they will use them are required to build common ground between both end-users (Basahih & Kuziemsky, 2017). First, healthcare organizations must adopt a variety of eHealth tools capable of adapting to the specific contexts they will use (Ross, Stevenson, Lau, & Murray, 2016; Basahih & Kuziemsky, 2017). There are different tools (e.g., free-text narrative tools and structured field) available to support transferring health information between both users, which influence decision-making and follow-up clinical care. Providing communication tools in different formats could facilitate the use of all these other tools, facilitating accessibility by patients, and targeting more patients (Levinson et al., 2010). Furthermore, because technical abilities would vary among patients, providing them with the necessary tools would be more appropriate than sophisticated ones (Basahih & Kuziemsky, 2017). Second, a need exists to determine how users (i.e., especially patients) will use the eHealth tools (e.g., communication tools), such as for urgent and non-urgent concerns, and synchronous or asynchronous communication (Basahih & Kuziemsky, 2017). The determination of one single ideal tool will be hard to obtain; thus, an organization should provide several tools to satisfy its needs and support communication between patients and healthcare providers (Basahih & Kuziemsky, 2017).

C. Workflow Common Ground

Common ground on workflow has two main parts. First, patients and healthcare providers must agree on the timing of communication and understand the difference between what constitutes urgent and routine issues (Basahih & Kuziemsky, 2017). Such an agreement regarding the use of eHealth tools could limit the time spent on communication and enhance their effectiveness. For example, Palumbo et al. (2016) indicated that educational tools would allow both users to navigate the system more accurately and in a timelier manner. Moreover, educational tools such as library links could increase patients' understanding of their health conditions (Rodriguez et al., 2011), which could affect the types of questions they ask their healthcare providers (Dohan & Tan, 2014). Second, there must be an "understanding and consensus on how new roles such as system navigation or increased patient participation will alter workflow" (Basahih & Kuziemsky, 2017, p. 124). Using eHealth tools such as communication tools would further develop the relationship between patients and their healthcare providers; this would encourage patients to gain self-management competency skills to ensure adequate healthcare delivery (Basahih & Kuziemsky, 2017). In return, healthcare providers' roles would be affected by their communication with other healthcare providers or patients' navigation and the emergence of teamwork as part of healthcare delivery (Safran, 2003; Basahih & Kuziemsky, 2017).

D. Outcome Common Ground

Outcome common ground also has two main components. First, the rapprochement of patients and healthcare providers –both agreeing that using eHealth tools would promote collaborative outcomes (Basahih & Kuziemsky, 2017). For example, educational tools could improve patients' eHealth literacy, particularly their technical skills (Rodriguez et al., 2011) and health knowledge (Seto et al., 2010; Kelly et al., 2015), facilitating enhanced communication. These eHealth tools also support healthcare providers in accessing and monitoring patients' data (Dalal & Schnipper, 2016; Dohan & Tan, 2014); allowing patients to update their own health information (Taha et al., 2013); and communicating any concerns with their healthcare providers (Rodriguez et al., 2011). Second, the outcomes also measure the daily routine of healthcare delivery overtimes and underlying outcomes (Basahih & Kuziemsky, 2017). In other words, long term metrics must be employed to monitor participatory healthcare delivery on a daily basis (Demiris, 2016; Basahih & Kuziemsky, 2017). Moreover, eHealth tools have facilitated real-time access (Dy et al., 2011), sharing of information (Melby et al., 2015), managing uncertainty (Levinson et al., 2010), making informed decisions (Rodriguez et al., 2011), managing documents (Alanzi et al., 2014), organizing information, and recalling memory (Kossman et al., 2013) for both end-users. In addition to helping patients better understand, interpret, and manage their health records (Baran & Davis, 2015).

In conclusion, our PHPFFC model presents factors that could affect patient–healthcare provider communication (Basahih & Kuziemsky, 2017). Additionally, we discussed the common ground elements required between both end-users. We created four main factors (i.e., information, technology, workflow, and outcomes) in our model as the basic requirements for our explanation to produce eHealth-mediated communication. Furthermore, our model explained the value of eHealth tools for supporting communication between patients and healthcare providers. Moreover, it demonstrated how common ground supports a common understanding between both end-users of how, when, and what type of health information should be exchanged on eHealth tools, both promptly and for successful communication. The following section discusses rationales and propositions for these factors (provided on the PHPFFC model) in the form of three research questions and their associated assertions questions for this study.

3.2 Research Questions and Scholarly Assertions Propositions

This section explains the factors and functions that may affect communication between healthcare providers and their patients according to the PHPFFC model. We also include rationales (i.e., associated assertions questions) for concepts that could affect patients' and healthcare providers' intentions to use communication tools from the literature review.

3.2.1 RQ1: How do eHealth tools influence healthcare providers' workflow?

Q1: *Rates of patients' general technical proficiency and existing Sehaty usage, coupled with improving eHealth literacy rates, will lead healthcare provider to anticipate streamlined workflows, if not reduced workloads.*

Patients' technical self-efficacy and healthcare providers' workflow: Patients' technical expertise —which is affected by computer self-efficacy, active coping, perceived ease of use, and the perceived usefulness of eHealth tools (p. 48)[9]—could impact healthcare providers' workflow.

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[9] As discussed in Patient Technology Factors

De Veer et al. (2015) indicated that a patient's computer self-efficacy, technical ability, and actual use of technology would impact his or her intention to use new technologies. According to Rodriguez et al. (2011), patients who used eHealth tools with their healthcare providers exhibited an increase in active coping with their disease. For example, a patient's discovery of the wrong test in his or her lab results on the eHealth tools led to communication with the healthcare provider to solve the mistake, as a form of active coping (Masys, Baker, Butros, & Cowles, 2002). Furthermore, patients who communicate with healthcare providers and receive responses could perceive greater usefulness of the eHealth tools. Kittler et al. studied an online communication system between healthcare providers and patients (2004). They found that using a Web-based portal and e-mail to communicate with patients increased healthcare providers' workload. The authors also indicated that answering e-mails or contacting patients about minor health issues using e-mail may have required more of the healthcare providers' time (Kittler et al., 2004). Moreover, several studies have opined that the flexibility and ease of access of eHealth tools prompt patients to want real-time access to healthcare providers, which could lead to more work for healthcare providers (Beard et al., 2012; Lusignan et al., 2014; Bae & Encinosa, 2016).

Patients' eHealth literacy and healthcare providers' workflow: Researchers consider patients' eHealth literacy as a factor that affects their intention to use eHealth tools as well as understanding contextually relevant information (p. 47)[10]. Therefore, patients with a high degree of eHealth literacy are able to use technology to locate, read, and understand health information to solve health problems. Norman and Skinner (2006) defined two main eHealth literacy skills: (1) analytical skills, including traditional literacy and information literacy, and (2) context-specific skills, including computer literacy and health literacy (p. 15)[11]. Patients with high eHealth literacy

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[10] As discussed in Patients Information Factors

[11] As discussed in section 2.1.4 Patents' eHealth literacy

skills could decrease healthcare providers' workload (Taha et al., 2013) and make them more efficient. Furthermore, according to Wald et al. (2007), their participants (physicians) were willing to provide more detailed health information to patients with high health literacy.

On the other hand, Rodriguez et al. (2011) indicated that patients who could not understand or interpret lab results appreciated using eHealth tools to communicate with their healthcare providers for more clarification (p. 49)[12]. However, this could increase the number of messages back and forth between patients and healthcare providers, resulting in an increased workload for healthcare providers (p. 50)[13]. Moreover, Taha et al. (2013) stated that patients with low technical abilities and health literacy preferred to make more visits to see their healthcare provider rather than using eHealth tools. This consistent with a study by Wu et al. (2014), which indicated that patients who misinterpreted health information through eHealth tools might require additional visits for clarification.

Online access to health information could also affect patients' health decisions (p. 54)[14]. Rodriguez et al. (2011) argued that patients develop pre-formed opinions that may be difficult to overcome when accessing health information online, making it challenging for healthcare providers to explain that different treatments could vary in effectiveness from one patient to another. For this reason, healthcare providers have been discouraged from using eHealth tools with patients who have low levels of eHealth literacy. Thus, the patient's ability to interpret the information produced by eHealth tools could impact healthcare providers' workflow (p. 49 and 50)[15]. In sum, Q1 discussed patients' ability to use eHealth tools—what Norman and Skinner (2006) referred to as computer literacy—and described patients' health, both of which are related

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[12] As discussed in Healthcare Provider Information Factors
[13] As discussed in Healthcare Provider Workflow Factors
[14] As discussed in Outcome Common Ground
[15] As discussed in Healthcare Provider Information Factors & Healthcare Provider Workflow Factors

to patients' eHealth literacy. Therefore, patients' eHealth literacy could impact healthcare providers' workflow.

Overall, RQ1 asked: Do healthcare providers perceive a potential streamlining of their workflow, given patient knowledge and technological self-efficacy, through the use of eHealth tools? We find that patients' levels of technical self-efficacy and eHealth literacy can impact healthcare providers' workflows for better or worse. The exact nature of this impact is highly dependent on the individual patient–healthcare provider dynamic, including the ability of the former to comprehend certain information delivered by eHealth tools.

3.2.2 RQ2: Does increased use of eHealth tools improve healthcare providers and patients' relationship?

Q2: *If healthcare providers' usage of eHealth tools increases, their understanding of their patients' health conditions will improve.*

H1: *If patients' usage of eHealth tools increases, their satisfaction with the received healthcare services will increase.*

Using eHealth tools could increase healthcare providers' understanding of patients' conditions and lead to greater patient satisfaction in the decision-making process (p. 52)[16]. As a result, this shared understanding between patients and healthcare providers could improve their relationship (p. 51, 53, and 54)[17]. Wald et al. (2007) found that healthcare providers were willing to share more information with patients who had greater health knowledge because they had a better understanding of their health conditions. Moreover, the availability of eHealth tools could assist healthcare providers in viewing and managing patients' data and helping patients view, manage, and track their health conditions. Bezreh et al. (2012) indicated that a shared understanding was essential for improving patients' trust and satisfaction. Moreover, Dy et al.

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[16] As discussed in Information Common Ground

[17] As discussed in Healthcare Provider Outcomes, Workflow Common Ground, and Outcome Common Ground

(2011) found that eHealth tools improved patient–healthcare provider relationships. The authors explained that eHealth tools allowed users to exchange feedback and were helpful to healthcare providers seeking to collect patients' information and monitor their patients' healthcare. Moreover, Dohan and Tan (2014) stated that healthcare providers must perceive value and usefulness in the information available on eHealth tools when monitoring a patient's health condition. If the healthcare provider is satisfied with an eHealth tool, the patient will think his or her engagement with that eHealth tool is valuable.

Overall, RQ2 asked: How do patients' eHealth literacy levels influence their relationships with healthcare providers? The eHealth tools can increase healthcare providers' understanding of their patients' conditions and their satisfaction, both of which could influence their relationship. Thus, to answer RQ2, this study examined whether these factors (presented in Q2 & H1) affected the patient–healthcare provider relationships.

3.2.3 RQ 3: How do patients' eHealth literacy levels influence their communication with healthcare providers?

Q3: *Healthcare providers with a lower level of information satisfaction (in data provided by eHealth tools) will have decreased intention to use eHealth tools to communicate with patients who have low eHealth literacy.*

Healthcare providers attach much value to the quality of the information in eHealth tools (p. 49, 50, and 52)[18]. DeLone and McLean (2003) and Wixom and Todd (2005) argued that the quality of information retrieved from an electronic system is judged according to its usability. A healthcare provider's access to patient information starts with the eHealth tool's information, which aids in diagnosis (Dohan & Tan, 2014). The relevance of information is another vital ingredient, especially when the issue of patient-generated data is considered (Dohan & Tan, 2014; Huba & Zhang, 2012). However, healthcare providers have expressed concerns about the impact

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[18] As discussed in Healthcare Provider Information Factors, Healthcare Provider Workflow Factors, and Information Common Ground

of eHealth tools on patients with low health literacy (p. 47, 49, and 50)[19]. Ross et al. (2005) indicated that healthcare providers were worried about the risk of emotional harm when patients with inadequate health literacy were allowed to access health records that they were unable to understand and interpret correctly. Moreover, Wald et al. (2007) reported that although patients' advanced knowledge and their ability to search the Internet could play a pivotal role in enhancing their interaction and experience with their healthcare providers. Greater online access could also cause patients to develop preformed opinions that may be hard to overcome.

Besides, healthcare providers have voiced concerns about the possibility of patients misinterpreting information provided by eHealth tools (Wu et al., 2014). As a result, patients might feel anxious during online exchanges of information with healthcare providers, which may increase the need for patient visits (Wu et al., 2014; Tanis et al., 2016). Therefore, healthcare providers' level of satisfaction with information provided in eHealth tools could decrease their intention to use such tools for communicating with patients who have low eHealth literacy. When a healthcare provider is satisfied with the level of health information that can be sent to patients and can understand the health information they receive via communication tools (e.g., e-mails or alert messages), then communication between them will become easier and more effective. On the other hand, if healthcare providers feel that information provided to patients through eHealth tools could emotionally harm their patients, they will hesitate to use them. Furthermore, scholars such as Jiaren (2017) have indicated that healthcare providers trust e-formal data (i.e., the data provided on eHealth tools generated directly from healthcare organizations) more than those from PGHD.

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[19] As discussed in Patient Information Factors, Healthcare Provider Information Factors, and Healthcare Provider Workflow Factors

Q4: *Common ground on communication increases healthcare providers' trust as well as patients' understanding.*

The common ground between patients and healthcare providers is crucial for understanding and making more effective use of eHealth tools (Basahih & Kuziemsky, 2017). Kuziemsky and O'Sullivan (2015) emphasized the importance of common ground in establishing collaboration between eHealth tools' users (p. 50 and 54)[20]. The authors found that common ground helped healthcare providers choose the best treatment for their patients and provided patients with a better understanding of their health conditions, while also supporting successful communication between them (p. 49, 52, and 54)[21]. Successful communication is achieved when both users trust the other's word and expertise (Zillich et al., 2005). Therefore, common ground can be measured when eHealth tools' users reach their goal of improved communication (p. 50, 54, 53, and 54)[22].

Overall, RQ3 asked: How do patients' eHealth literacy levels influence their communication with healthcare providers? Patients' eHealth literacy, healthcare providers' level of information satisfaction (Q3), and the establishment of common ground could all impact patient–healthcare provider communication (Q4). Thus, to answer RQ3, this study examined whether these factors have affected patient–healthcare provider communication.

This section has summarized our research model and this study's research questions and their assertions. The research model indicated the factors that could affect communication between patients and healthcare providers from both parties' perspectives. We then described how we developed the rationales based on evidence from the literature review (Chapter 2, 11) as well as factors on the PHPFFC model. Chapter 4 addresses the method used to conduct this study.

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[20] As discussed in Healthcare Provider Technology Factors and Outcome Common Ground

[21] As discussed in Healthcare Provider Information Factors, Technology Common Ground, and Outcome Common Ground

[22] As discussed in Healthcare Provider Technology Factors, Healthcare Provider Outcomes, Workflow Common Ground, and Outcome Common Ground

Chapter 4 Methodology

Chapter 4 returns us to our primary empirical focus, eHealth tools usage such as the Internet and the Sehaty application and their potential use in the King Faisal Specialist Hospital and Research Center (KFSH&RC) in Riyadh, the Kingdom of Saudi Arabia (KSA). This chapter explains how the data obtained and discusses the key research instruments and recruitment processes used to establish the study participants and methods of sampling. The methods and procedures used to answer the research questions are also described in this chapter. Table 13 (at Appendix 'B', p. 213) presents the major phases of this study.

4.1 Research Design

We employed a mixed-methods approach, defined broadly by Johnson, Onwuegbuzie, and Turner's study as a "type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches...for the broad purposes of breadth and depth of understanding and corroboration" (2007, p. 108). Our quantitative data-driven from patients' responses via a questionnaire and qualitative data-driven from healthcare providers' responses via semi-structured interviews. Fundamentally, our purpose for mixing methods was practical in nature. We speculated that healthcare providers might reflect an automatic bias against eHealth tools based on subjective and possibly inaccurate anecdotes about patients' health literacy and workload increases. Thus, we determined that the differences in healthcare providers' opinions were more likely to be captured in semi-structured interviews and deciphered via the thematic coding process employed in our qualitative analysis. We determined that mixing methods would yield insights through five features described by Greene, Caracelli, & Graham (1989): triangulation, complementarity, development, initiation, and expansion, see Table 3.

Table 3: *Five Features Described by Greene et al. (As cited in Johnson et al., 2007)*

Terms	Explanation
Triangulation	"Seeking convergence and corroboration of results from different methods studying the same phenomenon." (p. 115)
Complementarity	"Seeking elaboration, enhancement, illustration, clarification of the results from one method with results from the other method." (p. 115)
Development	"Using the results from one method to help inform the other method." (p. 115)
Initiation	"Discovering paradoxes and contradictions that lead to a reframing of the research question." (p. 116)
Expansion	"Seeking to expand the breadth and range of inquiry by using different methods for different inquiry components." (p. 116)

Our specific research design was shaped with careful consideration of our research aims as well as the institutional and cultural context in which it was conducted. Following a typology described by Creswell and Plano Clark (2011), we have adopted a convergent parallel design, which dictates three characteristics of our approach: timing, emphasis, and focus. Timing: Although we address patients and healthcare providers separately in certain instances, our qualitative and quantitative data were implemented concurrently throughout the research project. Emphasis: neither qualitative nor quantitative methods were given analytical or explanatory priority. Focus: methods did not focus specifically; both were used in addressing our research questions.

4.1.1 Quantitative Method

The quantitative method relied on a questionnaire issued online and as hard copies to reach the largest number of patients possible. The questionnaire employed a cross-sectional survey method that has been commonly used in healthcare studies to analyze patients' and/or healthcare providers' perspectives (Aiken et al., 2012; Zurovac et al., 2013). The questionnaire was developed using a Google online document in a survey form (Google Docs). The questionnaire sought background information, such as patients' technological abilities and eHealth literacy, as well as factors related to technology acceptance, such as perceived usefulness and intentions to use eHealth tools such as Sehaty. The questionnaire was built based on existing questionnaires used to test similar variables in other studies (see Table 15 in the Appendix ‘B’, p. 214). However, we also developed additional questions to meet our study objectives (p. 73)[23].

4.1.2 Qualitative Method

The qualitative method used for this study involved interviewing physicians and/or other healthcare providers and asking them to explain their experiences and opinions regarding their use of eHealth tools, such as Sehaty, and how it affects healthcare delivery. DeJean, Giacomini, Simeonov, and Smith (2016) found that using qualitative research to assess health technology systems provided “evidence for evaluating social, experiential, and ethical aspects of health technologies” (p. 1307). Miles, Huberman, and Saldaña (2014) stated that “qualitative data are useful when one needs to supplement, validate, or illuminate quantitative data gathered from the same setting” (p. 12). They also pointed to other strengths of qualitative research, which include providing an understanding of locally grounded phenomena and offering a view of the meanings that people place on structures, processes, and events they encounter in their lives.

For this study, the researcher interviewed some healthcare providers at the KFSH&RC individually to learn about their experiences using eHealth tools and then compiled their responses to determine a common pattern. Patton (2002) indicated that the interview process’s main reason is to collect data that we cannot otherwise observe, including the interviewee’s thoughts, behaviors, and intentions. It also allows researchers to conduct a more in-depth examination of individual perspectives, such as what is meaningful and understandable to the individual. The researcher designed a standardized open-ended interview. Such interviews are highly focused, enabling the interview to be conducted with high efficiency (Patton, 2002). The interview questions asked healthcare providers specifically about their satisfaction with eHealth tools (e.g.,

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[23] As discussed in Data Collection and Instruments

Sehaty), their technical experience, the hospital's information system, and their perspective on patients' use of eHealth tools. They were providing an in-depth analysis of issues that are hindering the acceptance of eHealth tools at the hospital. Although we developed additional questions to meet our study objectives (p. 73)[24], we also used instruments from other studies to construct our interview questions (see Table 16 in Appendix 'B', p. 214). Furthermore, both the interview questions and the questionnaire were available in Arabic and English.

4.1.3 The Sehaty Application

Sehaty is an eHealth tool provided in a mobile health application[25] and a website[26], used by the KFSH&RC. This study determined whether Sehaty has communication functionality based on our participants' responses. Our data revealed that a significant number of patient–participants (PPs) (65.4%) admitted that they did not use Sehaty as a communication tool. Whereas 34.6% indicated that Sehaty was a useful communication tool because it allows them to perform certain services, such as book appointments[27]. Likewise, we determined that healthcare provider–participants (HPPs) have varying opinions regarding whether they consider Sehaty to be a tool with which they can communicate with their patients. While some of HPPs regarded Sehaty as a communication tool, others felt that it is not mainly a direct communication tool, and the balance of HPPs indicated that it could be considered a communication tool for certain specific services such as appointment scheduling.

Moreover, all HPPs indicated that Sehaty is an application for patients' use only. Overall, Sehaty is designed to allow patients to view and track their health conditions and facilitate booking/rebooking appointments; it is not intended to be a direct communication tool for PPs and

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[24] As discussed in Data Collection and Instruments
[25] Sehaty can be download from the Apple Store [IOS] or Google Play [Android]
[26] Access link/main page to Sehaty Website: [https://sehaty.sa/en/home]
[27] For instructions on how to book an appointment via Sehaty, please visit https://www.kfshrc.edu.sa/en/home/servicedirectory/2867

HPPs to discuss health concerns. A communication tool means a feature embedded in an application that allows patients to communicate directly with their healthcare providers, such as a chat room. Many HPPs agreed that it would be beneficial to add an option or feature to Sehaty – in the future – that would allow them to instantly access patients' health records and communicate with them through the application to support patients' diagnoses. Please visit the Sehaty manual at (in English), https://sehaty.sa/Templates/img/SehatyManual-20DEC17-EN.pdf, to learn more about Sehaty application.

4.2 Recruiting, Sampling, and Participants

The study took place at a government hospital — the KFSH&RC in Riyadh — and targeted separate groups of participants, who were patient–participants (PPs) and healthcare provider–participants (HPPs).

4.2.1 Patient–Participants (PPs)

Many sample size calculators introduce a sufficient number of participants to be recruits for a study. We used the Qualtrics[28] website to calculate our sample size, which was 378 participants out of the 21,347 total number of active patients who use Sehaty at the hospital. Thus, the study's goal was to collect at least 378 PPs.

According to Seham A., the total number of patients who downloaded the Sehaty application at the KFSH&RC was 26,018 patients; furthermore, 21,347 of them were active users, referring to patients who actually use Sehaty (personal communication, 2017, April 18). This indicated that there were many patients who use Sehaty at the hospital. Thus, the sampling design was "random purposeful," which means the sample was randomly selected with some criteria (i.e., those who used Sehaty). The purpose of the "random purposeful" approach is to "add credibility

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[28] https://www.qualtrics.com/experience-management/research/determine-sample-size/

to sample when potential purposeful sample is too large” (as cited in Creswell, 2012, p. 158). The researcher generated a random number, N, between one and six using dice, and then approached the N^{th} patient that walked by the waiting room. Patients in the hospital were asked to participate at their convenience with a hard copy (paper) or the online questionnaire. The researcher advised potential participants before giving them the questionnaire that they must be patients who have been treated at the hospital for at least six months, as well as use Sehaty. The PPs were told the deadline for submitting their completed questionnaires and where they could submit them if they prefer to respond at a later time. The deadline for each participant varied according to the date they received the questionnaire. For example, if the PP received the questionnaire one week before the end of data collection date, then the PP had three days to finish it. The PPs were made aware that they also had the choice not to participate in the questionnaire. The time slots for questionnaire distribution were assigned randomly. Extra copies of the questionnaire were provided at the hospital’s reception desks to reach more patients. Posters were displayed on one of the main north-entrance doors at the reception desks to help make patients aware of the questionnaire.

Although we provided a poster at one of the main entrances (the north side) about the online version, none of the PPs chose to fill out the questionnaire via the online version. Thus, almost all the PPs’ data was collected personally in the waiting rooms or hallways. Overall, the researcher successfully collected data from 107 PPs – which is sufficient to conduct this study with specific analysis tests (p. 79)[29] –in paper copies of the questionnaire; 79% were female, and 21% were male (see Figure 2). Figure 3 shows that the highest number (39%) of PPs belonged to the age group of 29–39 years. See Appendix ‘F’ for other PPs demographic variables, p. 233).

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[29] As discussed in Quantitative Analysis

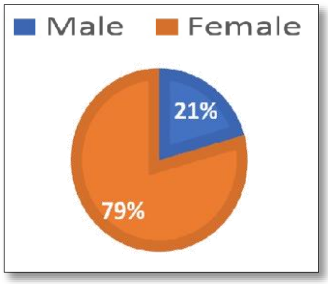

Figure 2: *PPs' Sex*

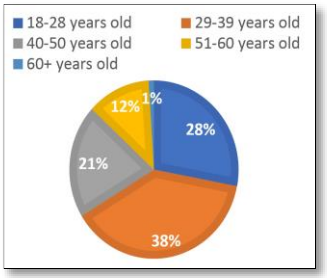

Figure 3: *PPs' Age Groups*

4.2.2 Healthcare Provider–Participants (HPPs)

Our study provides an understanding of phenomena that are locally grounded. According to Creswell (1988), a sample size of 5-25 suggested for phenomenological research, and Morse (1994) recommended at least six participants (as cited in Statistics Solutions, n.d.). Our goal for this study was to collect 20 HPPs. Since this study was assigned to recruit the data for a specific time (i.e., three months), also due to the nature of the HPPs' environment (i.e., call for emergency duty), and the duration time to conduct the interview (i.e., 45-60 minutes). Thus, the researcher collected 16 HPPs successfully, which is sufficient for this study. HPPs were recruited via the KFSH&RC's human resources department, as well as while the researcher walked along the hallways of the hospital (i.e., via observing white lab coats). According to the sample design, the following criteria were used to select healthcare providers: eligible HPPs who had worked at the hospital for at least three years and who used Sehaty. The purposes of a "criterion" approach are applicable when all cases "meet some criterion," and it is "useful for quality assurance" (as cited in Creswell, 2012, p. 158). After collecting the healthcare providers' contact information, the researcher contacted them via phone or in person. The researcher introduced herself and briefly explained the reason for the contact as well as the research study; each healthcare provider was informed of the option to participate or not. If the healthcare provider was willing to participate, then the researcher booked an appointment for the interview.

The HPPs at the hospital selected from different departments, most of whom had different specialties, more specifically: five technicians (i.e., one derma-technician; one ophthalmic-technician, and three lab-technician); four nurses (i.e., two nurses and two staff-nurses); two patient-care assistants; one social worker; one ward clerks; one senior ophthalmic photographers; one senior SNII; one from IT department (i.e., data & analytics solution manager). This diverse sample was randomly chosen to provide more insights into the hospital’s technical support based on participants’ experiences. We interviewed 16 HPPs (see Figure 4) who had sufficient work experience (i.e., ranging between 3 to 18 years of experience) at the hospital to participate in this study (see Figure 5).

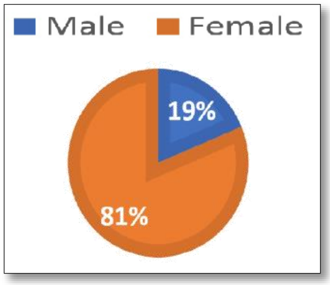

Figure 4: *HPPs’ Sex*

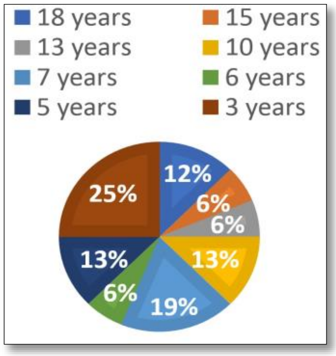

Figure 5: *HPPs’ Work Experience at the Hospital*

4.3 Role of the Researcher

4.3.1 Ethics and Data Collection

The researcher's role is to produce quality results using ethical research principles as per the University of Ottawa's ethics guidelines[30]. The researcher obtained both the hospital's authorization[31] (i.e., collaborating with Dr. Bander M. AlKhudairi) and full disclosure authorization from all participants. The researcher ensured that the data collected remained anonymous and that all findings remained confidential. Weekly meetings were taken with our Riyadh based investigator, in which responses were reviewed anonymously for validation of coherence – which responses answered the questions asked. Otherwise, after some deliberation, it was agreed that logistical issues precluded consistent application of any formal member-checking techniques. For example, some respondents who were interviewed during lunch breaks were unwilling to return for additional verification. In lieu, each response was immediately read back to respondents, who offered on-the-spot confirmation of accuracy.

The researcher conducted 16 interviews, which ran between 45 and 60 minutes each, and compiled the results from the 107 valid questionnaires, which each required 20–30 minutes to complete. The researcher collected and entered all the data into the system (i.e., patient data were entered manually to Google Docs when the patients selected the hard-copy version) during a three months stay in Riyadh. The Ministry of Higher Education in the KSA financially supported this study, which covered the researcher's travel costs and accommodation costs in Riyadh.

The following subsection identified the biased perspective that could be occurred in this study and described what the researcher's actions to avoid bias with PPs and HPPs were:

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[30] **Ottawa University:** File #: ORA/934/38, received on May 29, 2017; closed on April 28, 2018.

[31] **KFS&RC Ethics:** File #: H09-17-02, received on Oct 13, 2017; closed on Oct 12, 2018.

4.3.2 Bias Perspective

Being a researcher who is collecting the data in-person (physically) would involve a biased view. As indicated by Pannucci and Wilkins' (2010) study, the bias would occur before, during, and after the data collection. Bias could cause the wrong assumption of a theory. For example, before 1998, an approach to hormone replacement therapy would reduce the chance of heart attack for postmenopausal women. However, other recent studies that were "rigorously designed to minimize bias" indicated that it would increase the risk (as cited in Pannucci & Wilkins, 2010, p. 2).

Moreover, knowing the culture concepts would either reduce or increase the first impression of bias, Fang and Rajkumar (2013) indicated that the first impression of bias could be affected when national culture uses the media. They also mentioned that they did not use the "national-culture dimensions measurement" (p. 1). Hofstede identified five national-culture dimensions: "power distance, uncertainty avoidance, masculinity-femininity, individualism-collectivism, and long-term orientation" (as cited in Fang & Rajkumar, 2013, p. 3). However, they reported that researchers must first understand the national culture before understanding their use of media to decrease the first impression of bias.

The researcher is a female Saudi Citizen, which means she is aware of Saudi Culture. Moreover, she understands the privacy and security concerns when dealing with her participants, especially female participants. The researcher could not avoid the first impression of bias in terms of being there (i.e., by her introducing herself as a researcher). Also, she stood out by her appearance due to wearing a lab coat. Additionally, the hospital administrators perceived her as being "external", as demonstrated by their assignment of a co-investigator charged with overseeing and regulating the research process.

Presenting as a Saudi researcher in the KSA actually facilitated the researcher's interaction with the hospital and patients. To a considerable extent, it helped with the hospital in achieving permission for the research and having ongoing cooperation/support throughout the data collections process. Moreover, the KSA official language is Arabic (p. 36)[32], so the researcher's ability to communicate in Arabic increased her opportunity to collect data from patients who can speak only Arabic, and thus avoided a language barrier. Finally, being a Saudi woman helped her gain trust among female participants who were potentially hesitant to share facts of their experiences with men (see p. 37). The researcher also could access places not accessible to men, such as female waiting rooms.

A. The researcher role in avoiding bias with the PPs

After explaining the purpose of this study, gaining participant permission, and signing consent forms, the researcher declared to PPs that she would be available if they needed help completing their questionnaires. The PPs were then left alone to fill out the questionnaire, and the researcher walked around the hospital's area seeking another participant but in the same room or close by. The researcher shadowed her and observed them (PPs) remotely, watching them, and avoiding eye-to-eye contact. After 20 to 30 minutes, the researcher collected the responses.

B. The researcher role in avoiding bias with the HPPs

HPPs were more educated on average, according to their position at the hospital; some have even undertaken research and would thus appreciate issues of bias. The researcher comported herself professionally (e.g., wearing a lab coat), and presented questions word-for-word—without reformulating the items. She took notes during the interviews. Once HPPs responded to an assigned question, the researcher did not reframe their answers but repeated the answers carefully to ensure accuracy. The researcher remained conscious of not reacting physically or verbally to HPPs' responses. Also, she avoided movement, such as moving the head up and down, or right or left, as that could lead to involving the researcher's opinion.

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[32] As discussed in Language and KSA Literacy

4.4 Data Collection and Instruments

The researcher collected all data from Nov 15, 2017, until Feb 15, 2018 (see Table 14 of Appendix ‘B’ for the Research Timeline, p. 213). This study used two different research tools (a cross-sectional survey through a questionnaire and standardized open-ended interviews) to gather data from the two target participant groups. The participants in both categories (PPs and HPPs) were required to be at least 18 years of age, and either male or female. Tourists and children were not included in the study.

Additionally, the researcher assured her participants that their information would be strictly confidential, and no personal data would be collected. The PPs were also assured of anonymity by choosing six random numbers between 1 and 49, and this sequence of numbers was then used as their means of identification for future correspondence. If, for example, the PPs decided to withdraw from the study, they would need to tell the researcher their identification numbers to be removed from the study. On the other hand, although the HPPs were asked for their actual name, the researcher assured them that their name would remain confidential and that only the researcher would notify them for any future correspondence.

The researcher distributed the consent form in person to all participants, and this required their signatures. Two original copies were provided, one for the participant and another for the researcher. Participants also notified verbally that a digital copy of each participant’s consent form is kept in the medical records at the KFSH&RC and could contact them for further inquiry (i.e., at the contact information provided at the consent form). The consent form summarized the purposes of the study and other concerns that could arise among the participants. The form also included the researcher’s contact information if the participant had to clarify any of the information on the document or choose to withdraw from the study.

The data collected through the interviews and questionnaires will be kept securely in electronic files for up to 5 years following the analysis, after which they will be destroyed. To ensure confidentiality, only the researcher has access to the data. The researcher backed up the electronic versions of the data on Flash Memory, encrypted them using the SHA-512 algorithm, and stored them together with the hard copies in a locked filing cabinet in the researcher's home office.

Some of the interview questions and the questionnaire developed using items from existing instruments (e.g., the eHEALs tools) that have been used to test similar variables in other studies. Table 15 at the Appendix 'B' (p. 214) provides insights into the instruments used to measure the study's variables, such as patients' eHealth literacy, technical abilities, and whether social influences have affected their use of the eHealth tools. Table 16 also shows the instruments used to measure healthcare provider variables such as workflow and information satisfaction (see the Appendix 'B', p. 214).

The researcher also developed other questions to focus on the objectives of the study specifically. Many tools needed to be developed because, according to our knowledge and other studies, there are limited or no scales that test specific variables. For example, Radziej et al. (2017) indicated that there is a lack of tools that address communication. Castillo-Montoya (2016) described four phases to follow when developing questions from a grounding perspective. The researcher used three phases out of the four: (a) ensuring interview questions align with research questions; (b) constructing an inquiry-based conversation; and (c) receiving feedback on the interview protocols (p. 812). For the third step, the researcher discussed both instruments with her primary supervisor and the qualitative tool with the principal supervisor and a thesis committee member. Additionally, both ethics departments from the school and the hospital approved the instruments. The fourth phase indicated doing a pilot test; however, the researcher did not do it due to the time limits she had to go through the ethical procedures with both organizations. A full copy of the questionnaires can be found in Appendix ‘C’ (p. 225) while the interview questions are listed in Appendix ‘D’ (p. 229).

4.5 Structure of the Questionnaire and the Interview Questions

Subsections 4.5.1 and 4.5.2 below explain in detail which type of questions were used for PPs and which were used for HPPs.

4.5.1 The Questionnaire

This subsection explains which type of questionnaire and/or questions were used to test variables that affect PPs’ eHealth literacy, perceptions of usefulness, social influences, intentions to use, and actual use of eHealth tools such as the Internet and the Sehaty app. The questionnaire contains 29 items in total (see Appendix ‘C’, p. 225). All PPs signed the consent form before starting the questionnaire.

A. Instructions

The first part of the questionnaire provides a brief description of PPs about the goals of this research, the length of time required to complete the survey, and assurances that their name would not be asked. Participants’ responses will remain anonymous. To ensure that the PPs’ identities remain anonymous, we asked each of them to choose six random numbers between 1 and 49 to be their identifier number if they decide to withdraw from the study.

B. Demographic variables

The questionnaire starts with general questions to obtain some background information about the PPs. The demographic variables include gender, age, education, language, marital status, employment status, and economic status. The demographic analysis enables the researcher to see how responses vary among PPs based on their demographic characteristics.

C. Technical abilities and social influence

To test PPs' technical abilities — such as the perception of usefulness and the actual use of Sehaty, social influences, and intentions to use it — we adopted questions from Khechine, Lakhal, Pascot, and Bytha (2014) to test the unified theory of acceptance and use of technology (UTAUT) concepts. The UTAUT is an updated version of the technology acceptance model (TAM) (Venkatesh et al., 2003). Many scholars have used Davis's TAM to examine users' perspectives on technology acceptance in different fields, such as e-commerce (Basahih, 2013; Hsiao & Yang, 2011), digital libraries (Park et al., 2009), online banking (T. Pikkarainen, K. Pikkarainen, Karjaluoto, & Pahnila, 2004), and the health sector (Holden & Karsh, 2010). Various researchers used the TAM found that when users are presented with new technology, their decisions on when and how to use it are influenced by multiple factors. For example, users' intention to use technology increases because they perceived usefulness (Dohan & Tan, 2014; Hsiao & Yang, 2011; Park et al., 2009), perceived ease of use (Hsiao & Yang, 2011; Park et al., 2009), and due to their subjective norm (social influences) (Dohan & Tan, 2014; Hsiao & Yang, 2011). We included 15 items that addressed all of the previously mentioned factors from Venkatesh et al. (2003).

D. The eHealth literacy

We incorporated Norman and Skinner's (2006) eHealth Literacy Scale (the eHEALS), which includes ten elements that measure PPs' eHealth literacy. The eHEALS has been used as an instrument in numerous studies to test PPs' eHealth literacy skills, such as knowing where to locate necessary health information online (Quinn et al., 2017; Tennant et al., 2015). We adapted the ten items of the eHEALS from Hoffman-Goetz et al.'s (2014) book for our questionnaire.

E. Communication

This study focused on the communication approaches between PPs and healthcare providers. Therefore, we developed 11 questions about the use of communication tools and whether these tools would support their communication with their healthcare providers. Moreover, we included two other questions about their communication frequency with healthcare providers, the reasons for these communications, and one question to examine if their communication was unsuccessful and whether this affected their relationship.

F. Workflow

The researcher developed questions related to PPs' workflow to determine whether difficulty in understanding online health information could impact their decision to use communication tools during interactions with their healthcare providers and whether they find it too time-consuming to search for health information online.

G. Conclusion

We concluded our questionnaire with two final questions: the first asks PPs whether they are willing to communicate with healthcare providers using a communication tool; the second is an open-ended question where PPs are free to include any additional concerns or suggestions they might have regarding eHealth tools.

4.5.2 Interview Questions

HPPs were asked standardized questions addressing views of how eHealth tools influence workflow factors and satisfaction as well as their relationships, including communication, with patients. The questions also addressed HPPs' opinions on how patients use eHealth tools. The interview questions contained 25 items (see Appendix 'D', p. 229). All HPPs signed the consent form before starting the interview.

A. Instructions

At the start of the interview, HPPs were given information about the goals of this research, the length of time required to complete the interview, and assurances that participants and their responses would be anonymous. Anonymity allows participants to answer questions and share their experiences more freely.

B. Background information

The researcher started by asking general questions to the HPPs, such as their age group, the position at the hospital, and the length of time they have worked there, followed by questions related to their technical background.

C. Use of Sehaty

The researcher asked questions related to HPPs' use of Sehaty. We included questions about the HPPs' use of eHealth tools and the factors specific to eHealth tools that facilitate their workflow. Following Moody, Slocumb, Berg, and Jackson (2004), mixed questions, consistent with a "Likert-type attitude scale," were devised to obtain healthcare providers' disposition towards EHR.

D. Information satisfaction with Sehaty

HPPs must perceive benefits in the use of eHealth tools, and the data supported by such means. Benefits are weighed against the potential for emotional distress among patients who misinterpret data available on eHealth tools. Therefore, the researcher developed questions intended to measure HPPs' satisfaction with the data provided by Sehaty, given the balance described above.

E. Communication

Effective communication allows HPPs to diagnose their patients' health and improve their understanding of their health condition. Therefore, the researcher developed six questions related to the types of communication that occur between HPPs and their patients, communication reasons, Sehaty, as a communication tool, would Sehaty able to improve or allow patients to understand their health conditions.

F. Workflow

Despite the advantages of capable patient–healthcare provider communication, the possibility exists that it could also affect HPPs' workflow. Therefore, the researcher designed questions related to HPPs' perception of workflow impacts in relation to patients' health literacy, especially their online access to health information and the potential to misinterpret health information online. The researcher also adapted some items from Kittler et al.'s (2004) study, which used a paper survey to test healthcare providers' attitudes toward using an electronic system to communicate with patients. However, we reformulated these items into open-ended questions.

G. Conclusion

We ended our interview with two questions asking the HPPs about any additional concerns they had or whether they would change anything to improve Sehaty.

4.6 Data Analysis

Overall, we relied on concepts used in similar studies that tested related variables, such as patient eHealth literacy or healthcare provider workload, to ensure the validity of our questionnaire and interview questions. The researcher removed incomplete responses and responses that did not correspond to the main parameters of this research.

4.6.1 Quantitative Analysis

Our sample (i.e., n=107) did not reach the sample size suggested by the Qualtrics website (i.e., 378; see p. 66 for details)[33]. Nonetheless, the types of statistical assertion tests used in this study were not affected. The different assertion tests required different minimum numbers for the sample size to conduct the analyses. The questionnaire was analyzed using the R program (R i386

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[33] As discussed in Patient–Participants (PPs)

2.15.2). Specifically, H1 involved only patient variables, which allowed the researcher to analyze H1 quantitatively. H1 stated, “If patients’ use of eHealth tools increases, their satisfaction with healthcare services will increase.”

The researcher used two different types of methods to ensure the validity of the results. First, the researcher tested the correlation between the independent variables, namely X1: “patients use of eHealth tools” and Y1: “patients perceived satisfaction with healthcare services. “ Then, the researcher used the Chi-square test and Fisher’s exact test to check whether the differences within the categories were statistically significant. Both tests are widely used for analyzing relations between categorical variables. McDonald reported that Fisher’s exact test could be used with a small sample size (2015).

Table 4: *Contingency Results*

	[,1]	[,2]	**Total**
[1,]	96	11	107
[2,]	56	51	107
Total	152	62	**214**

The sample size adequacy was analyzed as follows. The researcher analyzed each cell’s expected values in the contingency table to check whether the minimum sample size requirements for the Chi-squared test (X^2) were met. The requirements are met if the expected value is greater or equal to 5 in at least 80% of the cells. Besides, “no cell should have an expected value of less than one" (as cited in McHugh, 2013, p. 144). Table 4 shows the observed frequencies. The minimum sample size requirements were met. Table 5 shows the expected values and that all cells have$E \geq 5$.

Table 5: *Expected Values ‘E’ for each cell*

	[,1]	[,2]
[1,]	107*152/214=76	107*62/214=31
[2,]	107*152/214=76	107*62/214=31

Therefore, the researcher used a Chi-squared test (X^2) to analyze whether any two variables correlated (i.e., tested the significance of the relationship). The correlation coefficients allowed us to understand how powerful a connection is between two variables and whether a positive, negative, or no correlation exists (Statistics How To, n.d.). Technically, correlation coefficients are represented in the statistical program as a digit ranging between [−1] to [1] to describe the average of the corresponding change between two variables (Statistics How To, n.d.). The result of the correlation coefficient is called the probability value, also known as the P-value. The P-value must be 5% ($P < 0.05$) to be significant, which is called an Alpha level.

4.6.2 Qualitative Analysis

The healthcare provider data employed for RQ1, RQ2, and RQ3 were qualitative, written responses to our questionnaire. One HPP was interviewed in Arabic, and the remaining participants were interviewed in English. The interview that was conducted in Arabic was first transcribed in Arabic and then translated into English. Only two of the interviewees consented to have their interviews digitally recorded. For the remaining 14 interviews, the researcher took notes during the meeting and transcribed the answers into a Microsoft Word document within three hours of each interview to reduce memory loss issues.

Qualitative data examined through a thematic analysis approach, by which essential themes were identified, aggregated, analyzed, and interpreted (Creswell 2012; Braun and Clarke, 2006). At the beginning of the study, the researcher decided to conduct deductive coding due to limited KSA literature and to avoid imposing the researcher’s assumptions (as a Saudi researcher), which is a methodological way to remove bias. Yi (2018) defined deductive coding as when the researcher develops the codebook before starting the data collection. Themes developed through manual, deductive coding. Before interviews, a coding table was prepared and arranged according to the study’s guiding research questions (RQs) and the range of interview questions corresponding to each RQ (see Appendix 'B' Table 18, for Example, p. 218).

Once transcribed, all interview results were read in full, twice, with careful consideration by the interviewer that the transcriptions reflect participants' accounts accurately (Starks and Trinidad, 2007). This data review allowed the researcher to then develop and assign codes for each theme. Therefore, the researcher decided to change her approach from deductive coding to create inductive coding since the data allowed the researcher to develop codes and themes from it. Yi (2018) defined inductive coding as when the researcher creates codes according to the exploratory study (the data). Codes were assigned to relevant passages from the interviews, as appropriate (i.e., representing inductive coding). For example, RQ1 asked: How does eHealth literacy influence patients' use of eHealth tools? The researcher ensured that the inductive codes would help identify patterns regarding what factors influenced healthcare providers (e.g., altered in work efficiency) and patients (e.g., patient's technical ability) to use eHealth tools. (See Table 20, for an example of the RQ1's inductive coding, p. 224). Besides, as the researcher was going back and forth between responses and comparing the assigned codes, she combined the findings in the data according to their similarities to identify patterns. The researcher also included notes (memos) when analyzing the data. Several studies have suggested that recording memos help when working to follow up and refine the codes (Miles et al., 2014; Creswell, 2012).

4.7 Ensuring Trustworthiness

Following recent work by Nowell, Norris, White, and Moules (2017), the researcher has ensured that the data meet three criteria of trustworthiness: credibility, auditability, and transferability. "Credibility" is achieved when, as readers' and/co-researchers encounter the research, it is recognizable to them as representing a 'fit' between the interviewer's process, and conclusions reached (Nowell et al., 2017, p. 3). Second, the researcher has maintained careful records of the coding and decision-making process, ensuring this study's auditability (Nowell et al., 2017). Finally, the approach taken and described here is sufficiently explicit that other researchers are able to judge the “transferability” of our findings to other sites (Nowell et al., 2017, p. 3) (see Table 17 and Table 19 for PPs and HPPs data coding, p. 215 and 219).

Chapter 4 described this study’s methodology, such as how data were obtained as well as the research instruments and recruitment process for collecting the data. Furthermore, the researcher’s strategy was explained for analyzing data, both quantitatively and qualitatively. The following chapter explains the data collection results.

Chapter 5 Results

The results of this study are presented in two chapters. Chapter 5 discussed the results and analyzes of the three research questions (RQs) and its related assertions (i.e., four assertions questions [Q] and a hypothesis [H]). Chapter 6 discussed the adopted Patient–Healthcare Provider Factors and Functions (PHPFFC V2.0) model and the common ground (CG) development for the RQs. Table 6 illustrated the results of the RQs and their assertions. For Q1, 2, 3, and 4, quantitative data from the patient–participants (PPs) were used and analyze, as well as qualitative data from the healthcare provider–participants (HPPs), which are presented separately. Subsequently, correlations between these two datasets were tested and analyzed using a mixed-methods approach. H1 was tested exclusively with quantitative data. Then, this study clearly stated whether each particular assertion was rejected or supported by the data.

Table 6: *Research Questions and their Assertions Results*

RQ1	**How do eHealth tools influence healthcare providers' workflow?**	See p. 108
Q1	*Rates of patients' general technical proficiency and existing Sehaty usage, coupled with improving eHealth literacy rates, will lead healthcare providers to anticipate streamlined workflows, if not reduced workloads.*	Supported
RQ2	**Does increased use of eHealth tools improve healthcare providers and patients' relationships?**	See p. 115
Q2	*If healthcare providers' usage of eHealth tools increases, their understanding of their patients' health conditions will improve.*	Supported
H1	*If patients' usage of eHealth tools increases, their satisfaction with the healthcare services they receive will increase.*	Rejected
RQ3	**How do patients' eHealth literacy levels influence their communication with healthcare providers?**	See P. 124
Q3	*Healthcare providers with a lower level of information satisfaction (in data provided by eHealth tools) will have decreased intention to use eHealth tools to communicate with patients who have low eHealth literacy.*	Rejected
Q4	*Common ground on communication increases healthcare providers' trust as well as patients' understanding.*	Supported

5.1 The Term "eHealth Tool" Used in This Study

At various points throughout this study, "eHealth tool," "Sehaty," and "the Internet" are used interchangeably. Although the three are not perfectly indistinguishable entities, this interchangeable usage is justifiable in a few respects. First, although the term "eHealth tool" implies a distinct, stand-alone apparatus or system, Sehaty (an eHealth tool) is, in fact, has two platforms one is at King Faisal Specialist Hospital and Research Center's website, as well as used as a mobile health application. World Wide Web content is, in turn, one of several protocols delivered to users on the network infrastructure commonly known as the Internet. Therefore, Sehaty is synonymous with the Internet in the fundamental sense that use of Sehaty is, by definition, the use of the Internet. The core competencies identified by Van Deursen and Van Dijk (2010) required to use the Internet effectively—conducting broad searches and orienting and navigating results to identify useful information—are identical to those required for Sehaty use. Thus, we feel justified in taking for granted that patients' inclination and ability to seek information on Sehaty are also applicable to searching for information on the Internet per se

Second, the conflation of Sehaty and the Internet is consistent with the eHealth literacy test employed in this study. The eHEALs, developed by Norman and Skinner (2006), use the "Internet" as a generic term when testing patients' eHealth literacy. However, despite these justifications, our use of these terms interchangeably is limited to basic and formal skills associated with the navigation of electronic platforms. We do not imply—nor does existing research support—a direct link between the basic navigation of eHealth tools and expanded knowledge about health issues; that is, health literacy.

Finally, the researcher ran the R program to seek and identify a correlation between Sehaty usages specifically, and internet usage generally. The results indicated that no direct relationship existed between the two. However, the results did reveal a significant[34] association between PPs who use Sehaty and those who said, "I feel confident in using the information on the Internet to make health decisions" (derived from Q#11.10 in the study questionnaire). Thus, in this study, the examples of eHealth tools are Sehaty and the Internet as a source of health information.

5.2 Research Questions and Assertions Analysis

The following subsections address RQ1 and its related assertions statement.

5.2.1 RQ1: How do eHealth tools influence healthcare providers' workflow?

To answer this question, the researcher first analyzed Q1, including the variables related to RQ1.

A. Interpretation of Q1: Rates of PPs' general technical proficiency and existing Sehaty usage, coupled with improving eHealth literacy rates, will lead HPPs to anticipate streamlined workflows, if not reduced workloads [Supported].

The primary variables for Q1—the rates of PPs' general technical proficiency and existing Sehaty usage—are discussed first below, followed by eHealth literacy rates and technical capacity for health information purposes. Next, we examine HPPs' perceptions of Sehaty's usability, improve eHealth literacy, and streamline workflows. Then, we test the correlations among the findings.

1) Quantitative Results: PPs' Sehaty Usage, Technical Ability, and eHealth Literacy Rates

i. Rate of Current Existing Sehaty Usage among PPs

a. PPs' Current Sehaty Usage

The vast majority (89.7%) of PPs indicated they use Sehaty for at least one purpose, mostly to track or check their health condition and book appointments. A significant number of PPs (65.4%) admitted that they did not consider Sehaty a communication tool, whereas 34.6% deemed it a highly useful communication tool given its appointment-booking feature.

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[34] A Chi square test reveals that "Sehaty usage" (S_USE_TIME) depends on the "use of the internet" (INT_CONFIDENT_HEALTH_DECISIONS). There was a significant association between (X^2 (8) = 28, $p < .001$)

b. PPs' Anticipated Use of Sehaty

77.9%[35] of PPs agreed on how important it is for them to be able to access health tools and resources on the Internet. Furthermore, 86.9%[36] of PPs described the Internet as a useful tool for supporting their decisions on health-related matters. These figures provide an indirect measure of eHealth literacy by reflecting a desire for information gleaned through electronic means. All PPs (100%)[37] agreed that they intend to use Sehaty in the future. Moreover, 98.1% indicated that they were willing to collaborate with their healthcare providers through online communication tools to improve their health.

ii. PPs' Technical Capacity and eHealth Literacy Rates

a. PPs' Technical Experience

Overall, 100% of the PPs stated that they have the necessary resources to use Sehaty, such as smartphones. 96.3%[38] of them possessed the knowledge required to use the application. 75.7% of the PPs reported no time issues when searching online for health information; furthermore, 41.1% of the PPs asserted that they use Sehaty because they are familiar with technology, whereas 58.9% felt that Sehaty's simple design encouraged them to use it. In addition, 87.9% agreed that Sehaty is compatible with other systems/applications they use daily.

b. PPs' eHealth Literacy

The eHealth literacy is defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (Norman and Skinner, 2006, p. 1). This definition encompasses technical aspects related to the use of electronic sources and the comprehension and application of the information discovered. Here, eHealth literacy was assessed according to three inter-related components: PPs'

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[35] 77.9% = 48.6% Useful (U) + 43% Very Useful (VU)

[36] 86.9% = 43.9% U + 43.0% VU

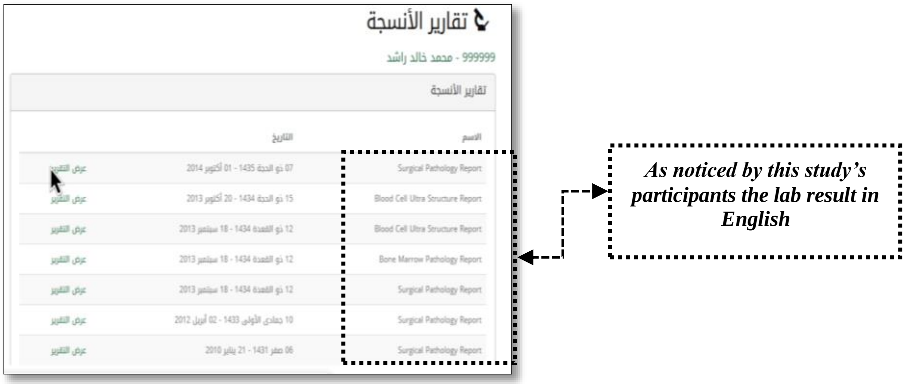
[37] 100% = 5.6% Somewhat Agree (SA) + 94.4% Completely Agree (CA)

[38] 96.3% = 77.6% CA + 18.7% SA

understanding of health knowledge provided by eHealth tools, Sehaty usage for health knowledge purposes, and eHealth literacy test results.

1. PPs’ Understanding of Health Knowledge Provided Through eHealth Tools

The Sehaty app is available in English and Arabic, but lab results are presented only in English (e.g., see Figure 6); therefore, understanding the PPs’ English language skills was crucial. Furthermore, understanding the PPs’ educational level was critical to ensure they understood the health information provided through eHealth tools.



تقارير الأنسجة

محمد خالد راشد - 999999

تقارير الأنسجة

الاسم	التاريخ	
Surgical Pathology Report	07 ذو الحجة 1435 - 01 أكتوبر 2014	عرض التقرير
Blood Cell Ultra Structure Report	15 ذو الحجة 1434 - 20 أكتوبر 2013	عرض التقرير
Blood Cell Ultra Structure Report	12 ذو القعدة 1434 - 18 سبتمبر 2013	عرض التقرير
Bone Marrow Pathology Report	12 ذو القعدة 1434 - 18 سبتمبر 2013	عرض التقرير
Surgical Pathology Report	12 ذو القعدة 1434 - 18 سبتمبر 2013	عرض التقرير
Surgical Pathology Report	10 جمادى الأولى 1433 - 02 أبريل 2012	عرض التقرير
Surgical Pathology Report	06 صفر 1431 - 21 يناير 2010	عرض التقرير

As noticed by this study’s participants the lab result in English

Figure 6: *E.g. of the Arabic Version of the Lab Result (Sehaty Manual, pp.24)* [39]

The eHealth literacy required the patients to understand the necessary language (i.e., English); 85% of the PPs filled out the questionnaire in Arabic, and the remaining 15% used English. Besides, 43% stated that they knew English and Arabic, whereas 57% reported knowing only Arabic. 82.2% of the PPs said that presenting test results in Arabic was not necessary. However, 17.8% requested the test results to be in Arabic. This indicated that the majority of PPs understand health information presented in English.

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[39] Image source (Sehaty Manual in Arabic [دليل المستخدم], pp.24): https://sehaty.sa/Templates/img/SehatyManual-20DEC17-AR.pdf

2. Sehaty Usage for Health Knowledge Purposes

91.6%[40] of PPs indicated that Sehaty enables them to track their health condition, whereas 88.8%[41] found that Sehaty helps them understand their health condition. 87%[42] of the PPs indicated that Sehaty allows them to view their medical reports, and 86%[43] felt that Sehaty increases their ability to learn more about their health conditions. Finally, 77.9%[44] felt that Sehaty allows them to prepare questions for their healthcare providers before their next hospital visit.

3. PPs' eHealth Literacy Test Results

The eHealth literacy test results (see Table 21 in Appendix 'E', p. 232) revealed that the PPs' ability to use the Internet in terms of their technical skill and health knowledge (i.e., how and where to find useful health information). It also shows how they are using health information on the Internet that could influence their decision-making (Norman & Skinner, 2006). Only 8.4%[45] of the PPs admitted that they do not know how to use online tools to answer health questions and concerns. Whereas 47.7%[46] indicated that they know how to use the Internet to answer health-related questions; by contrast, 45.8% reported being "unsure" about their capacity to use and interpret online tools. The Table also illustrates that 88.8%[47] of PPs knew how to use the health information they find on the Internet to understand their health conditions better. This is a crucial finding, indicating that, if made the data available to patients, it will assist them with understanding health conditions and facilitate their relationship building with healthcare providers. Thus, most PPs exhibited high eHealth literacy because of their mid-to-high technical ability to use Sehaty and the Internet for health knowledge purposes and their English language and educational levels.

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[40] 91.6% = 72.9% CA + 18.7% SA
[41] 88.8% = 18.7% SA + 70.1% CA
[42] 87% = 69.2% CA + 17.8% SA
[43] 86% = 66.4% CA + 19.6% SA
[44] 77.9% = 61.1% CA + 16.8% SA
[45] 8.4% = 1.9% NUA (Not Useful at All) + 6.5 % NU (Not Useful)
[46] 47.7% = 45.8% U + 1.9% VU
[47] 88.8% = 43.9% U + 44.9% VU

2) Qualitative Results: HPPs’ perceptions of Sehaty’s usability and potential to improve eHealth literacy and streamline workflows

The HPPs were asked about their general perceptions of Sehaty’s data and usability, as well as barriers to its use by patients. Subsequently, they were asked about its likely role in improving health and eHealth literacy. Finally, they were asked about their perceptions and expectations of streamlined workflows through the use of Sehaty.

i. The eHealth Tool Usage from the HPPs’ Perspective

Patients and eHealth tool usage: As previously discussed, our data reflect a strong willingness to use Sehaty as well as considerable confidence in assessing and interpreting the Internet among PPs. Many HPPs harbored a general sense of optimism about the improved eHealth literacy of patients based on the ubiquity of the Internet and a likely increase in curiosity among patients:

> *“The fact that the Internet is everywhere would increase the health curiosity among patients.” (HPP#6)*

Sehaty usage from the HPPs’ perspective: All HPPs described Sehaty as an application for patients to view and track their health conditions:

> *“Sehaty is an application for patients’ use.” (HPP#6)*

HPPs’ responses in this category reflected their dual subject positions vis-à-vis Sehaty—as both patient-users and healthcare providers monitoring patient experiences. From this dual perspective, the HPPs reported that Sehaty is an organized and simple application. Most agreed that Sehaty is a user-friendly application for patients.

> *“Handy, flexible, and accessible at any time. [The] Sehaty application is easy to use.” (HPP#1)*

Some HPPs provided highly positive reports about Sehaty’s ease of use. HPPs recounted from direct experience how much usability allows patients to access their health information, and view lab results, thereby mitigating the need to call or visit the hospital to ask about their health history:

> *"Sehaty makes patients' lives easy. Sehaty is easy to use, and it allows patients to access their health history. Also, it allows patients to view and book their own appointments without relying on phone calls or bothering coming [to the hospital] in person. And that facilitates our workflow." (HPP#14)*

Also revealing is the fact that most HPPs were sufficiently convinced of Sehaty's ease of use as an intuitive application, to the extent that they considered providing workshops for instructing patients unnecessary. HPP#10 and #15 suggested that if any training were required at all, a video tutorial would be sufficient, with the caveat that patients with certain disabilities would require one-on-one training.

> *"Yes, but a video tutorial or a printed guide would serve better instead and would serve the same purpose. Only patients with disabilities, poor vision, for example, would need one-to-one training." (HPP#10)*

ii. HPPs' Perceptions of Sehaty Data and Barriers to Its Use

HPPs' perceptions on the barriers to using Sehaty: HPP#13 anticipated a usage threshold based on patients' technical abilities and/or awareness that the Sehaty application exists:

> *"… at some point, not all patients are capable of using the application, yet this would be due to their technical experience." (HPP#13)*

However, this reservation is more a general "hunch" and does not align with the abovementioned quantitative evidence regarding PPs' expressed intent to use the tool, because they illustrated their mid-to-high technical ability and high eHealth literacy. More specific potential barriers to practical Sehaty usage from the HPPs' perspective identified as follows:

The Sehaty language: Sehaty is available in English and/or Arabic. However, lab/test results are provided exclusively in English, which poses a challenge for patients who cannot understand English (i.e., see Figure 6, p. 88). One HPP indicated that providing lab results in

English would only prompt requests for more clarification from patients who might misunderstand medical terms, and this would complicate the workflow (HPP#2).

> *"Sehaty provides health information like test results in English, which would be hard for some patients to understand. Also, it would increase our workflow through having to clarify the health terms." (HPP#2)*

Types of health information provided through Sehaty: Health data are crucial for promoting informed decision-making. All HPPs indicated that they were satisfied with the health information currently provided for patients through Sehaty, and many reported confidences in patients' general health and eHealth literacy. Nevertheless, how effectively patients are able to use data was understood by some HPPs as being highly dependent on the individual. HPP#9 offered a relatively representative statement along these lines:

> *"It depends on patients. Some patients would see an advantage of [using] Sehaty and tracking health conditions, such as their weight." (HPP#9)*

The successful use of data provided through Sehaty was thus perceived as dependent on both patient knowledge and the nature of information in question. Some types of data, which in this study, we refer to as "risky data," maybe inordinately tricky for patients to understand despite their general health and eHealth literacy. Examples of risky data include lousy news about a patient's health condition and critical health results, such as cancer symptoms identified in a patient's test results. In short, risky data is a type of health information whose interpretability may be affected by patients' emotional responses to the data. In other words, pre-existing health knowledge and eHealth literacy may not serve patients in certain circumstances.

A significant number of HPPs indicated that their patients have a right to view all health information on Sehaty, including risky information. In addition, HPP#8 specified that all health information should be provided to patients in their own native language.

> *"I would provide all of the patients' health information, including the risky information; however, [I would provide it] in their language [Arabic]." (HPP#8)*

Seven of HPPs suggested that risky information should not be provided to patients before they visit the hospital and noted that the provision of risky information through Sehaty should be determined according to each patient's health knowledge because it would affect them emotionally.

> *"No, in terms of risky information, first, it should only be delivered by the physician to the patients directly. Then the risky data can be provided on Sehaty." (HPP#10)*

iii. HPPs' Opinion on the Impact of Sehaty on Patients' eHealth Literacy and on Improving Patients' Health Literacy:

<u>Health condition awareness and online tracking:</u> Although Sehaty's recognized an easy app to use, however, it cannot be linked empirically to increased health knowledge. For example, we cannot assume if the new users would meet at least one of the other Norman and Skinner's (2006) core literacies such as computer literacy. More importantly, from a common ground (CG) development point of view, HPPs perceived that ease of use would enable a greater understanding of personal health conditions, if not of eHealth and health literacy more generally.

> *"Sehaty would be a beneficial tool for patients, as patients gain a greater understanding about their health condition." (HPP#6)*

Significantly, patients can receive this benefit irrespective of time and location, assuming they have access to the Internet.

> *"Sehaty would be a beneficial tool for patients, especially when patients are abroad, and they can track their health information online." (HPP#5)*

<u>The eHealth tools improve patients' eHealth literacy:</u> Some HPPs reported that Sehaty is essential for improving patient's health knowledge. Furthermore, some HPPs reported perceiving Sehaty's positive impacts on patient knowledge (eHealth literacy), which aligned with findings of

improved patient health knowledge (HPP#7), awareness (HPP#12), and it is considered a beneficial, self-educational tool (HPP#13).

> *"That [patient' Sehaty usage] will be a good sign that most patients are pre-educating themselves and trying to have a good healthy lifestyle, as well as managing their treatments after discussing it with their doctors." (HPP#13)*

iv. Sehaty: Patient Usage and HPPs' Perceptions of a Streamlined Workflow

HPPs' negative perceptions: Some HPPs were ambivalent about the prospect of a streamlined workflow resulting from Sehaty use. It was indicated that some patients misunderstand health information on the Internet, which negatively affects HPPs' workflow. HPP#4 stated that some patients argue with their doctors because of misinformation they receive from the Internet, and some contact them only for this reason, which would negatively affect healthcare providers' workflow. HPP#2 and #16 asserted that they are specialists in understanding their patients' conditions. They have the experience to treat their patients; thus, patients should not rely solely on the Internet's information. HPP#9 also noted that patients begin comparing their own health treatments to those that are available on the Internet.

> *"I don't agree with getting health information from the Internet, as patients start arguing with doctors and call us for clarification, and this increases our workflow." (HPP#4)*

HPPs' role regarding patients who misinterpret health information from the Internet because of their low health literacy: Some HPPs indicated that they would clarify any misunderstandings for patients. For example, patients who found inaccurate information using eHealth tools such as the Internet or communicating with patients who have low health literacy would increase their workload. Some HPPs noted that their communication with patients with low health literacy is inefficient and complicated and that it takes extra time to explain some types of health information to them.

> *"Explaining some health information to patients with low health literacy will be challenging, difficult, and sometimes requires extra time." (HPP#13)*

In addition, HPPs explained how they interact with patients with low health literacy, including redirecting them to a specialist or asking them for an in-person visit.

> *"I'll redirect patients who have misunderstood or misinterpreted any health information to the right person, for example, a doctor." (HPP#4)*

Additionally, the HPPs indicated that sometimes they find it challenging to communicate with older patients. However, older patients sometimes receive help from someone, such as relatives, who can understand more health information and better understand their health conditions and how to treat them.

> *"We face this issue [i.e., patients with low health literacy] with older people, but sometimes, there is someone with them who can take care of them, and we explain the problem to both of them." (HPP#15)*

<u>HPPs' positive perceptions:</u> With the abovementioned reservations in mind, most HPPs were satisfied with their patients' use of Sehaty. When asked directly whether Sehaty improves patient care, 10 of 16 HPPs stated that it does or would. The remaining six were unsure, and no HPPs answered negatively. Crucially, the two dominant reasons are given for drawing such positive responses related to improved health knowledge in patients and efficiency gains from a reduction in direct-contact scheduling of appointments. For example, regarding improved health knowledge, HPP#6 stated that Sehaty "*improves patients' awareness of their health conditions*," and regarding efficiency gains, HPP#14 referred to medication requests; furthermore, HPP#9 and #2 discussed patients being able to obtain health information or lab results. HPP#2 identified the most significant source of anticipated efficiency gains as eliminating direct-contact scheduling and alteration of appointments:

> *"Sehaty would reduce the amount of time needed to contact patients to simply change or cancel appointments, so we can spend more time on another patient's care. Sehaty also helps patients check, update, and track health records. Therefore, Sehaty would also provide lab results to patients when the results are good and there is no need for the patient to respond to us, especially with patients who have high health literacy."*

Along similar lines, HPP#5 noted that one of the advantages of Sehaty is that it enables sharing patients' health information with outside doctors for a second opinion.

> *"So far, nothing is wrong with it [i.e., Sehaty]. By contrast, I love it as I can access it from anywhere and I can show it to any doctors outside the hospital (or even outside the country) for further consultation." (HPP#5)*

The type of information-sharing identified above is part of what most HPPs considered Sehaty's capacity for improving clinical records overall. Nine of sixteen HPPs affirmed their belief that Sehaty improves clinical records in at least one significant way. For example, HPPs #2 and 3 alluded to the *centralization* of records, and corresponding benefits: "*Sehaty helps to check, update and track health records [all in one location]*" (HPP#2); "*all patients' information will be updated on the website [i.e., a single location]*" (HPP#3). Others refer to *streamlined accessibility*, which entails both speed and off-site review of documents, as a clear advantage of this electronic system over paper-record filing. Echoing others on this point, HPP#7 put it most succinctly, stating "*the accessibility to clinical records anytime and anywhere. It [Sehaty] keeps all the documents online; it is better than using and filing papers.*" Finally, whereas concerns about privacy and security are commonly associated with electronic health records, ten of sixteen HPPs answered "*yes*" when asked if Sehaty poses less of a risk to patients' privacy than paper records; only four said "*no*," and the vast majority believe the hospital has taken strong cyber security measures.

3) Mixed-Methods Approaches: Finding and Testing the Correlation for Q1

Q1 entails two separate but related propositions: PPs' current usage of Sehaty and general technical proficiency. Furthermore, their overall health/eHealth literacy levels supported the perception of a streamlined workflow for HPPs.

i. PPs' Sehaty usage and overall health literacy correlated highly with HPPs' assumptions about what factors will deliver streamlined workflows:

While 96.3%[48] of PPs stated clearly that they possessed the ability to use Sehaty, the vast majority (89.7%) reported that they use the tool for at least one purpose, most commonly to check their health condition or to book appointments. Furthermore, the remaining PPs said that they use Sehaty regularly (i.e., 1–3 or 3 or more times a week), to track and view their health information, whereas 34.6% indicated that Sehaty is a useful communication tool because it allows them to book appointments. All PPs (100%)[49] agreed that they intend to use Sehaty in the future.

We inferred that PPs' unanimous declaration about their future intent is at least technically feasible because 100% of those surveyed own the necessary devices, such as smartphones. 41.1% of PPs reported using Sehaty effectively because they are familiar with technology, whereas 58.9% of PPs were drawn to the tool by its simple design. In addition, 87.9% of PPs agreed that Sehaty is compatible with other systems/applications they use daily. Besides, 75.7% of PPs confirmed that looking for health information online was not time-consuming.

Moreover, the growing use of Sehaty goes hand-in-hand with a positive disposition to engaging with technology for health information purposes, as well as an overall increase in patients' eHealth literacy. HPP#13 regarded Sehaty usage as a "*good sign*" of patients' growing health literacy, and the quantitative data supported this. The majority (75%) of the PPs already

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[48] 96.3% = 77.6% CA + 18.7% SA
[49] 100% = 5.6% SA + 94.4% CA

knew where to find useful online tools to gather health knowledge, and the vast majority (91.6%)[50] of PPs stated that they could discern high-quality health resources from low-quality ones on the Internet. A significant majority (88.8%)[51] said they are confident using health information on online tools to understand health conditions and make decisions about treatment.

Several HPPs reported efficiency gains from patients using Sehaty is to book, alter, or cancel appointments. Although by and large most considered their prospects for a streamlined workflow is dependent on patients' technical abilities, use of eHealth tools such as Sehaty, and by extension patients' eHealth literacy. Certain circumstances (such as dealing with elderly patients, risky data, and misinterpretation of the information provided on Sehaty) were identified by HPPs as likely sources of less-efficient workflows, especially with patients with inadequate health knowledge. However, the reverse was perceived as equally true—streamlined workflows can be predicted by high Sehaty usage and expanded health knowledge. In other words, the HPPs viewed expanded health knowledge as an essential precondition for streamlined workflows, as well as regarded Sehaty as an easy-to-use tool that improves patients' health knowledge (HPP#s 7, 12, and 13). Thus, the HPPs' expectations were highly correlated with quantitative evidence of PPs' actual Sehaty usage and health knowledge. This allowed the conclusion that HPPs perceive and anticipate streamlined workflows with increased Sehaty usage.

4) Q1 Results

Quantitative and qualitative data for Q1 indicated two parallel, correlated trends. First, the PPs had mid-to-high proficiency with online health tools and utilized Sehaty at remarkably high rates for various purposes, with anticipated usage reaching 100% of PPs. Furthermore, the PPs exhibited a highly positive disposition for turning to electronic tools (either online or Sehaty itself)

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[50] 91.6% = 48.6% U + 43% VU
[51] 88.8% = 43.9% U + 44.9% VU

to manage the logistics of their healthcare needs and expand their health knowledge in general. The vast majority of PPs considered themselves highly discerning when distinguishing proper online tools from bad ones. Although the PPs exhibited high eHealth literacy through their eHealth literacy test results, their health literacy rates have not been measured directly. Therefore, from PPs' strong willingness to apply the information they acquire through electronic tools (eHealth tools) to inform critical health decisions, this study inferred that health literacy rates are strong and growing.

The second correlated trend was that HPPs anticipated overall efficiency gains in their workflow, with possible exceptions for some instances of eHealth tools' usage. Many HPPs believed that Sehaty and online tools are essential for expanding eHealth literacy; many were satisfied with their patients' current use of Sehaty and online tools in increasing health knowledge. Moreover, although HPPs viewed efficiency gains as contingent on patients' health knowledge, this study deduced from quantitative data concerning the use of Sehaty and patients' health knowledge that HPPs' positive perceptions will be maintained or improved further. Finally, good reason exists to expect this correlation to strengthen because nearly all the PPs (98.1%) stated their willingness to collaborate with HPPs to improve their health knowledge. Therefore, Q1 was supported.

5.2.2 Mixed-Methods Approaches: RQ1 Results

A hospital environment features healthcare providers and patients. Therefore, would provide new technologies such as eHealth tools to healthcare providers and patients support them in delivering healthcare? Furthermore, do eHealth tools influence healthcare providers' workflow? These questions are addressed as follows.

A. Would providing technology such as eHealth tools to healthcare providers and patients improve healthcare delivery?

This subsection reviews HPPs and PPs' communication patterns, technical backgrounds, reasons to use eHealth tools, and Sehaty training workshops, to understand their perspectives on the actual use of eHealth tools.

1) Communication Patterns

i. How PPs Currently Communicate with HPPs

Among the PPs, 72.9% indicated that they do not obtain help from healthcare providers if they have problems with Sehaty, whereas 44.8% said that their healthcare providers encouraged them to use it. Furthermore, almost all the PPs (98.1%) reported that they would collaborate with healthcare providers using a communication tool in the future. Moreover, the PPs indicated that communication tools encouraged them to use eHealth tools for various reasons. They stated that they had used a variety of communication tools at the hospital: 78% have used phones, 14% have used smartphone e-messages, and only 8% have used e-mail. Furthermore, 99.1% of the PPs indicated that they had received text alert messages on their phone.

Moreover, 71% indicated that they use a phone to communicate, and they would continue calling healthcare providers until their call is answered. However, 66.4% preferred communicating in person if they are unable to receive responses from their healthcare providers via phone. Moreover, the PPs indicated several reasons for communicating with healthcare providers, such as discussing health concerns (55.1%), clarifying health information (41.1%), and making complaints (26.2%). Besides, 78.5% communicated with their healthcare providers to book or rebook an appointment.

ii. How HPPs Currently Communicate with PPs

The hospital provides HPPs with a phone and e-mail address to communicate with patients. All HPPs indicated that they use the phone, and five of them used e-mail for communication with patients. The HPPs stated the importance of regular communication with patients to ensure they understand their health conditions. HPPs specified several reasons for contacting patients using standard communication tools such as phone, including explaining or modifying health information and providing appointment services. Besides, the HPPs expressed that they must communicate with patients to guide and prepare them for upcoming visits or inform them that their medication is ready to be picked up. Other reasons for communicating with patients included updating their health information, following up on health conditions, and reviewing their health conditions. For example, one HPP stated the following:

> *"... To follow up with patients, explain health information, and give them instructions to prepare them for their next visit." (HPP#12)*

Furthermore, the HPPs communicating with patients can influence their decisions to call them back. For example, HPP#4—a social worker—noted that some patients call their healthcare providers back to follow up on hospital services, such as financial support options. Patients may also require emotional support when they talk to their physician (HPP#13). Besides, healthcare providers may request that patients call them back if they experience an urgent matter (HPP#14).

> *"Sometimes they contact us. Also, sometimes we ask them to call us back once they have an urgent situation, or when our doctors are going for emergency leave or need to see the patients earlier than scheduled. Then we ask them to call back with their decision (i.e., to either confirm, reschedule, or cancel)." (HPP#14)*

2) Reasons to Use eHealth Tools

Both the HPPs and PPs explained several advantages of using eHealth tools such as Sehaty and the Internet. For example, Sehaty allows them to view their health history and track their health conditions. Moreover, it has features that enable them to perform some tasks online, such as booking/rebooking appointments and requesting medication. Furthermore, the PPs indicated that viewing their health information on Sehaty expanded their understanding of their health conditions and prepared them to ask their healthcare provider for their next appointment. Moreover, PPs believed that the Internet is a useful tool for gathering health information that would influence their healthcare decisions. In addition, the HPPs agreed that eHealth tools improve patients' health knowledge and eHealth literacy and would be considered a tool for self-education. For HPPs, the main advantage of eHealth tools such as Sehaty is that they allow patients to view their health information and/or search it using the Internet anytime and anywhere. This enables patients to prepare for their treatments and, as a result, helps HPPs to generate proper diagnoses.

3) Technical Experience

The HPPs and PPs both have high levels of technical experience. More specifically, the PPs had mid-to-high technical expertise because of their familiarity with technology and existing Sehaty usage. The PPs did not have any problems with the amount of time they spend searching for information online, and they intended to use eHealth tools such as Sehaty in the future. Moreover, all the HPPs described themselves as having high levels of technical skills.

> *"To date, I'm good. And generally, I like to know everything related to technology. Especially exploring different types of applications." (HPP#11)*

They use various forms of technology daily, including computers, phones, smartphones, and tablets, and various software applications such as the Integrated Clinical Information System (ICIS), Sehaty, WhatsApp, and Pyxis. All the HPPs stated that the use of eHealth tools is an essential part of their jobs. For example, they use ICIS to document patients' data and request medications.

> *"Usually I use the phone, but mostly I use ICIS on my computer at work to [review] document[s] and observe patient progress, and I also use Pyxis for medication [services]." (HPP#14)*

4) Sehaty Training Workshops

Sehaty's simple design positively influenced both the HPPs and PPs. The PPs reported that Sehaty is compatible with other applications they use daily, and HPPs agreed that it is user-friendly and easy to use. This was to the extent that they widely considered in-person workshops unnecessary. If any training was required at all, some HPPs suggested that eLearning tools such as video tutorials would provide sufficient training on the technical aspects of Sehaty. On the other hand, HPP#13 expressed a common and fundamental concern related to education, namely that "*patients don't know if Sehaty exists.*" Thus, it was suggested that any training required would be along the lines of promotion and public awareness campaigns.

B. Does PPs' eHealth literacy influence healthcare providers' workflows?

This section provides insights into the PPs' eHealth literacy and the HPPs' workflows at the hospital.

1) PPs' eHealth Literacy

Several factors affect patients' eHealth literacy. First, regarding their technical ability, the PPs demonstrated the necessary technical expertise to use eHealth tools. Also, they found eHealth tools (e.g., Sehaty and the Internet) to be useful for searching for health information and informing their health decisions. Second, regarding language, all the PPs knew the official language of the KSA—Arabic—whereas almost half indicated that they also know English. English is an important language because it is used by medical journals and international conferences to communicate health information to the world. So, knowing English is helpful for understanding the health terms used by eHealth tools. Third, regarding educational levels, this study found that nearly all PPs have the necessary skills to read and write, whereas a significant number also held a university degree, indicating that they have the ability to understand health information. Thus, the abovementioned three factors reinforce that the PPs had high eHealth literacy.

Besides, all the HPPs indicated that eHealth tools would improve patients' health knowledge. Whether or not patients understand the health information through eHealth tools, due to their health/eHealth literacy level, English language, and technical skills, HPPs—as health specialists—would clarify these misunderstandings. In short, the results showed that PPs have high eHealth literacy, which is a factor that influences them to use eHealth tools (i.e., their current use of Sehaty), and thus facilitates healthcare providers' workload.

2) HPPs' Workflow at the Hospital

i. Current HPPs' Workflow at the Hospital

The HPPs noted that their patients' current use of Sehaty overall facilitates their workflow. The Sehaty allows patients to book/rebook appointments and request medications, which are features that reduce patients calling their HPPs and/or extra visits to the hospital for such purposes. In addition to arranging clinical visits, patients could formulate informed questions in advance, a development that has the potential to accelerate and ensure more accurate determinations about health status and treatment. As a corollary, the vast majority of the HPPs expressed confidence that eHealth systems such as Sehaty result in enhanced clinical records. Moreover, the HPPs felt that patients with high health/eHealth literacy, who view their lab results via Sehaty, would better understand their medical health, which would affect their decision to contact the hospital for non-urgent matters.

> *"It depends on the patients' knowledge. It would have a positive impact and save time or the other way around—for example, it would facilitate the workload if patients understand the health information provided on Sehaty." (HPP#15)*

In addition, the HPPs stated that they sometimes need to contact patients for different purposes, such as to follow up on their health conditions, prepare them for their next visit, and alert them to pick up medication, or request an appointment. The hospital provides the HPPs with a technology-friendly system, an accurate training program for new staff, and information technology (IT) specialists when required.

> *"Yes, they provide training, courses, and manual documents. Also, I can be up to date using my online training courses provided by the hospital." (HPP#7)*
>
> *"When there is a problem with ICIS, I usually contact the administrative departments, or call Healthcare Information Technology Affairs (HITA), which is the IT department at the hospital." (HPP#5)*

Almost all HPPs use the telephone, and few of them use the e-mail to communicate with patients, and all of them use ICIS to diagnose patients. Although the hospital provides them with technical systems intended to make their jobs easier, the HPPs often face problems such as poor Internet infrastructure or power outages, which delay their workflow.

> *"Very useful, yet in some applications, we need to focus more on some of the link issues. Sometimes we face issue[s] with the link that allow[s] access to [the] pharmacy department. Also, usually, the problems occur because of slow [Internet] or [the] loss of the Internet connection." (HPP#13)*

Moreover, one HPP noted that the hospital provides an interpreter for patients who can speak Arabic exclusively to facilitate communication among patients and healthcare providers.

> *"Usually, we use the phone for communication. Also, we communicate with patients verbally and/or provide a brochure /flyer for their visit. Also, we have an interpreter available for English and Arabic language speakers." (HPP#14)*

Thus, the HPPs emphasized the need to provide patients with health results in their primary language to facilitate their understanding.

ii. Would Using Sehaty as a Communication Tool Affect HPPs' Workflow in the Future?

The question of workflow elicited ambivalent responses from the HPPs. Many saw Sehaty's advantages, but several provided anecdotal examples of situations in which Sehaty may even increase their overall workload. Among these situations, the communication of risky data and misinformed and argumentative patients were the most common. The HPPs have asked the hospital to add some features to Sehaty that would facilitate other tasks. For example, they asked to provide a comment box to write comments or real-time patient diagnoses (e.g., adding a direct-communication tool [HPP#14]); and allowing healthcare providers to access patients' files.

> *"Sehaty does not cover all types of work, such as writing a comment or writing patients' diagnoses. Sehaty does not allow you to view patients' health records without their consent. For work, I like to use the computer ICIS system." (HPP#1)*

Overall, Sehaty is designed to allow patients to view and track their health conditions and facilitate booking/rebooking appointments—it is not intended to be a communication tool for patients and healthcare providers to discuss health concerns. Many of the HPPs agreed that it would be beneficial to add an option or feature to Sehaty that would allow them to instantly access patients' health records and communicate with them to support diagnoses.

> *"Yes, having Sehaty as a communication tool would help to improve the application. Also, adding a communication tool would be a good way to communicate with patients." (HPP#14)*

All the HPPs exhibited overall satisfaction with their patients' uses of Sehaty. However, they had differing opinions about the effect that adding a direct communication tool (e.g., chat room) would have on their workload. Moreover, some HPPs suggested hiring a special employee whose responsibility it would be to answer patients' inquiries via Sehaty. Some HPPs Believed Sehaty Would Save Time: HPP#4 indicated that the flexibility of Sehaty in accessing patients' files from anywhere and at any time would save time.

> *"Sehaty would help my workflow in terms of the accessibility of the Sehaty application from anywhere and at any time. This would reduce the time [I spend on certain tasks (e.g., view lab results)] in terms of contacting the hospital via phone or having to be there in person." (HPP#4)*

<u>Some HPPs believed Sehaty would decrease their workload:</u> Some HPPs agreed that including a direct communication tool in Sehaty would facilitate their workflow by reducing face-

to-face interaction with patients. Direct communication tools would facilitate communication in an urgent situation. HPP#13 noted that direct-communication tools between patients and their doctors would help patients rely on doctors' opinions, which would increase their awareness about their health conditions. In effect, enhanced communication is most likely to result in greater clarity and less doubt among patients, thus reducing the need for the in-person meeting through with patients traditionally seek reassurance from clinicians. Moreover, HPP#15 felt that if patients had a high level of health literacy, this would positively affect healthcare providers' workflow.

Some HPPs believed Sehaty would increase their workload: Some HPPs indicated that adding a direct communication tool to Sehaty would increase healthcare providers' workload. They explained that the direct communication tool could be putting them in a position to answer more questions from their patients, particularly on non-urgent matters. HPP#2 noted that adding a chat option to Sehaty would prompt many patients to ask irrelevant questions, which would likely require extra communication time.

> *"It depends on the patients' knowledge. It would have a positive impact and save time or the other way around—it would increase the workload if patients, for example, try to communicate with us through Sehaty about non-urgent issues." (HPP#15)*

Suggested additions to Sehaty [i.e., emerging role]: A pattern arose among the HPPs, who suggested that the hospital should establish a call center or employ specialists to answer patients' concerns through Sehaty.

> *"Adding a two-way communication option via Sehaty is a good idea. However, this must result in another job opportunity. This new job should be for a capable person who can be available online to answer patients' concerns." (HPP#16)*

C. RQ1 Summary

RQ1 asked, “How do eHealth tools influence healthcare providers’ workflow?” This study determined that both the HPPs and PPs use eHealth tools at high rates, which is consistent with everyday technology usage in other aspects of their lives. Indeed, the HPPs and PPs reported that Sehaty’s accessibility, positive user interface, and overall easy-to-use design drew them to the tool. The Sehaty, according to its users, is like many other electronic applications.

Both groups indicated several advantages of using Sehaty, such as greater access to health information. Its effectiveness, however, is understood to be contingent on individual abilities. Thus, the researcher asked the PPs several questions about eHealth literacy rates, general health knowledge, and technical skills, and found that they had mid-to-high-level abilities in terms of device usage and online use platforms. Furthermore, the PPs illustrated how they have a highly positive disposition toward gleaning information from online sources and reported a high degree of comfort in their ability to interpret what they discover. A significant number of PPs felt confident in applying knowledge acquired online to health decisions.

Moreover, the HPPs indicated that patients’ current use of Sehaty facilitates a streamlined workflow in several aspects. Although the HPPs expressed concerns about the use of eHealth tools by patients with low health literacy and a direct communication tool being added to Sehaty in the future, they were generally optimistic about the tool’s features. Whereas the HPPs felt that the use of Sehaty would be most effective given PPs’ sufficiently high rates of health literacy, this study inferred from the PPs’ data that the HPPs perceived a positive future effect on their workflow. The HPPs encourage patients to use eHealth tools and believe that the advantages of using the system will continue to facilitate their workflow. Perhaps most promising is the remarkably high rate at which both HPPs and PPs reported a willingness to collaborate in the future.

5.2.3 RQ2: Does Increased Use of eHealth Tools Improve Healthcare Providers and Patients' Relationships?

To answer this question, Q2 and H1 are analyzed first. Although relationship in this context is commonly understood as a collegial interpersonal interaction, the researcher took a more encompassing and formal view of it—as a consensual arrangement through which a patient willingly seeks care and a healthcare provider willingly accepts that patient along with the duty of due care, full disclosure of medical conditions, and confidentiality.

A. Interpretation of Q2: If HPPs' use of eHealth tools increases, their understanding of their patients' health conditions will improve [Supported].

Most of the results used to address Q2 were used for and explained in answer to RQ1. For this reason, this section moves directly to introduce Q2 findings.

1) Q2 Finding

i. If HPPs' use of eHealth tools increases, their understanding of their patients' health conditions will improve.

a. HPPs' Use of eHealth Tools

Several HPPs reported candidly that power outages and/or inadequate Internet infrastructure sometimes hamper their eHealth tool usage. The preparation of reports, along with documentation and ordering of patients' medication, are two delays associated with these technical problems. From time to time, technical difficulties also hinder HPP–patient communication, sometimes resulting in e-messages and e-mail alerts going out slowly or not at all.

However, such technical difficulties were reported as relatively rare. They have not diminished the HPPs' perception of the importance of eHealth tools nor discouraged them from using such devices. For example, concerning communication breakdowns, HPP#4 indicated that patients could easily be contacted by phone, as they were before the advent of eHealth tools.

Notwithstanding technical issues beyond the HPPs' control, the majority considered the training and IT support they receive to be from good to excellent. Furthermore, all the HPPs understood that technology use is integral to their jobs. Moreover, they understand that using the tool is part of their duty of due care, to the extent that they view it as helping maintain better clinical records (see the summary for RQ1) and facilitate efficient exchange of records between healthcare providers. Three of the 16 HPPs (e.g., #s 3, 5, and 6) characterized their technological skills as "*good*," whereas the majority confidently reported them as being "*excellent*" or in the case of HPP#10 "*competent and skillful*."

b. HPPs' Understanding of Patients' Health Conditions

HPPs were satisfied with their patients' use of eHealth tools such as Sehaty. They encouraged patients to use Sehaty to track their health conditions remotely and as a way to improve their health knowledge. They also indicated that Sehaty would improve patients' understanding and awareness of their health condition.

Some of this study's findings indicated that the HPPs have found it challenging to communicate with patients with low health literacy; extra time is required to explain misunderstandings. This level of attention can subsequently prompt patients to increase their communication with HPPs to clarify certain health information. Moreover, the results for RQ1 showed that healthcare providers communicating with their patients could influence the patients' decisions to reply to them again for various reasons, including emotional support, urgent matters, and clarification on health information.

By contrast, the HPPs indicated that their interactions with patients with high eHealth literacy help facilitate their workflow. In short, HPPs' use of communication tools influenced patients contacting them again as well as clarified any possible misunderstandings regarding their health conditions. Such clarification would be affected by patients' health literacy, eHealth literacy, and language skills.

The quality of data provided regarding eHealth tools is an essential element supporting patients' diagnoses. HPP#13 mentioned that patients' diagnoses would be affected by the efficiency of the people entering the data into the system. For example, HPP#13 stated that a patient's health data should be entered in detail for a better diagnosis. In other words, this HPP implied that healthcare providers' understanding of patients' health information provided through eHealth tools could positively or negatively affect their decisions regarding a patient's diagnosis.

> *"Although we are specialists in understanding patients' health conditions, every health diagnosis depends on the efficiency of the data collector and how the data was entered on the system. That way, other users [healthcare providers] can access information easily and for a better diagnosis, when patients' profiles are completed and properly detailed." (HPP#13)*

2) Q2 Results

Q2 proposed that "If healthcare providers' usage of eHealth tools increases, their understanding of their patients' health condition will improve." Our qualitative data supported this assertion question because the HPPs stated that eHealth tools facilitate critical improvements, such as maintaining better clinical records and sharing information with other healthcare providers as necessary. Given such clear enhancements to patient care, HPPs accepted technology usage as essential and reported high skill levels.

Overall, our data exhibited the following trends: (1) the need for eHealth tools to facilitate healthcare providers' understanding of patients' health conditions. Addressing and eliminating interruptions to eHealth services—through power outages and/or poor Internet infrastructure—will have direct benefits both in terms of healthcare providers' knowledge of patients' conditions as well as potentially on healthcare provider workflow; furthermore, reparations to system infrastructure will reduce delays in reporting patient conditions. (2) The use of eHealth tools is essential both for patients (i.e., to improve their knowledge) and healthcare providers (i.e., communication, access, follow-up, and understanding patients' health conditions). (3) HPPs must use communication tools to ensure that patients understand their health conditions. (4) HPPs' understanding of patients' health conditions is affected by the quality of data entries provided on eHealth tools.

B. Interpretation of H1: If PPs' use of eHealth tools increases, their satisfaction with healthcare services will increase [Rejected].

1) Quantitative Strategy for H1

i. H1 Variables

We used different variables to represent patients' use of eHealth tools, which were X1, X2, X3, and X4 (see Table 7).

Table 7: *Variables for PPs' Use of eHealth Tools*

#	Variable Name	Derived From	Value	R's Code's Name
X1	S_TIME_USE	Q#8: How often do you use Sehaty?	[0] = "Never" [1] = Other responses, such as "1 to 3 times or more"	X1 <- WOZ$S_TIME_USE
X2	S_I_INTENDED_USE_FUT	Q#I0.13: I intend to use Sehaty in the future.	[2] = "Completely Agree" [1] = "Somewhat Agree" [0] = Neutral [-1] = "Somewhat Disagree" [-2] = "Completely Disagree"	X2 <- WOZ$S_I_INTENDED_USE_FUT
X3	S_I_PREDICT_USE_FUT	Q#10.14: I predict I will use Sehaty in the future.		X3 <- WOZ$S_I_PREDICT_USE_FUT
X4	S_I_PLAN_USE_FUT	Q#10.15: I plan to use Sehaty in the future.		X4 <- WOZ$S_I_PLAN_USE_FUT

Furthermore, "patients' perceived satisfaction with healthcare services" was initially measured using questions Q#13 to Q#20[52] in the questionnaire. These questions surveyed whether PPs perceived an improvement in communication tools or their relationship with their healthcare provider. Thus, we used four variables (Q#14, Q#16, Q#18, and Q#20) as dependent variables to test H3 (see Table 8).

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[52] **Q#13:** Have you received an alert message via text for a specific service (e.g., appointment or medication refill)?; **Q#15:** Have you ever received emails from your healthcare provider?; **Q#17:** Have you ever received a notification via social networks from your healthcare provider?; and **Q#19:** Does your healthcare provider have a text platform such as a blog where you can send and receive messages? Furthermore, **Q#14**, **Q#16**, **Q#18**, and **Q#20** are described in the study.

Table 8: *PPs' Perceived Satisfaction with Healthcare Service Variables*

#	Variable Name	Derived From	Value	R's Code's Name
Y1	SETTING_ALERT_SUPPORT_COM	Q#14: Do you think that setting alert messages for specific services helps you to communicate or collaborate better with your healthcare provider?"	[1] = "Yes" [0] = "No"	Y1 = WOZ$SETTING_ALERT_SUPPORT_COM
Y2	E_SETTING_E_MAIL_SUPPORT_COM	Q#16: Do you think that e-mail systems improve your communication with your healthcare providers?		Y2 = WOZ$E_SETTING_E_MAIL_SUPPORT_COM
Y3	SN_SUPPORT_COM	Q#18: Do you think that notifications via social networks improve your communication with your healthcare providers?		Y3 = WOZ$SN_SUPPORT_COM
Y4	SN_TEXT_FORM_SUPPORT_COM	Q#20: Do you think that text platforms improve your communication with your healthcare providers?		Y4 = WOZ$SN_TEXT_FORM_SUPPORT_COM

ii. Fisher's Exact Test

Next, we used Fisher's exact test for the difference within the contingency table. The table was constructed in the following way. First, we divided X1 (i.e., the length of time using Sehaty) into two groups: those using Sehaty three or more times a week; and those who used it fewer than three times. Furthermore, the responses to Y3 were grouped based on the answers "*Yes*" or "*No*." The table shows that 96 of PPs, who used Sehaty three times a week or more, and 11 of PPs who used Sehaty fewer than three times a week. These two numbers are only relevant for double-checking the H1 contingency table (see Table 4, p. 80).

iii. Chi-squared Test (X^2)

Next, we used the Chi-squared test (X^2) to analyze whether any two variables were correlated. The Chi-squared test of independence is a nonparametric test that determines whether an association exists between categorical variables. Both the independence of observations and sample size requirements were met. Subsequently, we used the R code to create a contingency table and conduct the test (see Table 9).

Table 9: *Contingency Codes and Test Results*

Command

```
WOZ=read.csv2 ("D: / Patient Provider Communications/Statistic-Patient-numeric.csv")
count_Xl_equal_3 = length(WOZ[(WOZ$S_TIME_USE==3),]$S_TIME_USE)
count_X1_lessthan_3 = length(WOZ[(WOZ$S_TIME_USE < 3),]$S_TIME_USE)
count_Y3_yes = length(WOZ[(WOZ$SN_SUPPORT_COM==1),]$SN_SUPPORT_COM)
count_Y3_no = length(WOZ[(WOZ$SN_SUPPORT_COM==0),]$SN_SUPPORT_COM)
contingency_1=rbind(c(count_Xl_equal_3,count_X1_lessthan_3),c(count_Y3_yes,count_Y3_no))
chisqtest=chisq.test(contingency_1, correct=T)
> chisq.test(contingency_1, correct=T)
```

Result

Pearson's Chi-square test with Yates's[53]continuity correction:

```
data: contingency_1
X-squared = 35, df = 1, p-value = 4e-09
```

Similarly, we conducted various Chi-squared tests with the dependent and independent variables (see Table 10).

Table 10: *Pearson's Chi-Squared Test Results*

Commands	Results	
> chisq.test(x1,y4)	data: x1 and y4	X-squared = 12, df = 6, p-value = 0.06
> chisq.test(x2,y3)	data: x2 and y3	X-squared = 12, df = 4, p-value = 0.02
> chisq.test(x3,y3)	data: x3 and y3	X-squared = 12, df = 4, p-value = 0.02
> chisq.test(x4,y3)	data: x4 and y3	X-squared = 13, df = 4, p-value = 0.01

We then created a table to show the correlation between Xs and Ys (see Table 11).

Table 11*: H1 Overall Correlation Results among Variables*

Variables	Y2	Y3	Y4
X1	No association	No association was found between X1 and Y3. However, there was a significant association when X1 was grouped into two parts—"3" and "less than 3": (X^2 (1) = 34.54, p <.001).	Significant ($X^2(6) = 12$, $p < .1$)
X2	No association	Significant ($X^2(4) = 12$, $p < .05$)	No association
X3	No association	Significant ($X^2(6) = 12$, $p < .05$)	No association
X4	No association	No association	Significant ($X^2(4) = 13$, $p < .05$)

2) H1 Results

Because the p-value (i.e., 4e-09) was less than our chosen significance level of α = 0.05 (see Table 9), we rejected the null hypothesis. We concluded that an association existed between Sehaty usage and whether or not PPs found it beneficial to receive messages via social networks. Furthermore, based on the results in Table 11, we were able to make the following statements:

---

[53] "In statistics, Yates's correction for continuity (or Yates's chi-square test) is used in certain situations when testing for independence in a contingency table." From: http://imaging.mrc-cbu.cam.ac.uk/statswiki/FAQ/yates

- There was a significant association between X1 (S_TIME_USE) and Y3 (SN_SUPPORT_COM): (X^2 (1) = 34.54, p <.001).
- There was a significant association between X2 (S_I_INTENDED_USE_FUT) and Y3 (SN_SUPPORT_COM): (X^2 (4) = 12, p <.05).
- There was a significant association between X3 (S_I_PREDICT_USE_FUT) and Y3 (SN_SUPPORT_COM): (X^2 (6) = 12, p <.05).
- There was a significant association between X1 (S_TIME_USE) and Y4 (SN_TEXT_FORM_SUPPORT_COM): (X^2 (6) = 12, p <.1).
- There was a significant association between X4 (S_I_PLAN_USE_FUT) and Y4 (SN_TEXT_FORM_SUPPORT_COM): (X^2 (4) = 13, p <.05).

5.2.4 Mixed-Methods Approaches: RQ2 Summary

RQ2 asked, "Does increased use of eHealth tools improve healthcare providers and patient's relationship?" We rejected the proposition in H1 based on the available quantitative data: PPs did not explicitly perceive greater satisfaction with their healthcare services through increased use of eHealth tools in their current format. Nevertheless, some dependent variables were significantly correlated; the PPs believed that improving communication features on eHealth tools or the use of social networks would support communication with their healthcare providers. Thus, they intended to use Sehaty in the future.

We suggest that the availability of improved communication platforms will enhance one crucial factor—*anticipated interaction*—for PPs, 71% have attempted to communicate with their healthcare providers several times in search of clarification regarding their health condition. An ability to anticipate improved results from eHealth tools—especially in terms of communication—may have a strong positive correlation between increased usage and satisfaction with healthcare services.

The anticipation factor is related to Q2 (the HPPs' perspective), which states, "If healthcare providers' use of eHealth tools increases, their understanding of their patients' health conditions will improve.” The results showed that HPPs need eHealth tools because they are part of their job environment and facilitate their understanding of patients’ health conditions. Furthermore, the HPPs indicated that patients should use eHealth tools to improve their health knowledge. However, they also mentioned that eHealth tools’ perceived usefulness would be affected by patients’ English language skills and health/eHealth literacy, including their technical ability and awareness of the existence of such eHealth tools. In short, examples of the anticipated interaction factor are HPPs’ use of eHealth tools to improve their understanding of patients’ health conditions and PPs’ use of eHealth tools to improve their health knowledge.

In conclusion, although we rejected H1, combined data from Q2 and H1 allowed us to answer RQ2 in the affirmative: increased use of eHealth tools does improve the HPP–PP relationship as we define the term. Indeed, workflow efficiencies are sometimes lost when HPPs are called upon to explain health information to patients with low health literacy/eHealth literacy; by contrast, correspondence with patients with high eHealth and health literacy rates can be expected to reflect efficiency gains.

Regarding the actual relationship between HPPs and PPs, we anticipate that increased use of eHealth tools will result in improvement by enabling the HPPs to expand their knowledge of patients’ conditions and maintain and share that knowledge as required. HPPs, in other words, will be aided in observing their duty of due care and disclosing the fullest, most efficiently organized information possible to patients—the core tenets of our definition of their relationship.

Additionally, we argued that when PPs can anticipate improved interactions with healthcare providers via eHealth tools, an increasing number of already committed users of Sehaty will be more confident in their healthcare services; and thus in their consent-to-care—the key tenet of an improved relationship from the patients’ perspective.

5.2.5 RQ3: How do patients' eHealth literacy levels influence their communication with healthcare providers?

The results for variables related to both Q3 and Q4 were discussed earlier under RQ1 and RQ2. Therefore, we proceed to interpret these two assertions' questions by introducing the finding.

A. Interpretation of Q3: HPPs with a lower level of information satisfaction (with data provided by eHealth tools) will have decreased intention to use eHealth tools to communicate with patients who have low eHealth literacy [Rejected].

1) Q3 Finding

a. Satisfaction with patient access to data

All the HPPs held positive views about allowing patient access to data on Sehaty. The vast majority believed that access to the system improves patients' awareness of their personal health conditions. Furthermore, some HPPs (e.g., HPP#2) felt that it provides patients with "*reassurance*," whereas others (HPP#10 and #14) regarded access to health data as a personal right of patients.

There were, however, specific reservations held by some HPPs concerning the types of data provided on Sehaty. HPP#4 objected to providing some health information to patients with "*low health literacy and low income*." Moreover, HPP#11 and HPP#13 indicated that the type of data provided is highly dependent on the patient in question, and specifically on that individual's level of health knowledge. Most of the HPPs agreed that critical health news (risky data) should either not appear on Sehaty or, at the very least, only be posted after patients receive the news in person from their healthcare providers.

Although the HPPs were generally satisfied with the data provided on the system they use as providers (i.e., ICIS), HPPs #10 and #13 noted that patients' diagnoses and patient's understanding of their health conditions could be affected positively or negatively by the quality of the data provided on ICIS. One HPP indicated that the performance (i.e., whether the data contains enough detail) of the employee entering patients' data on eHealth tools is a critical factor in facilitating their understanding of patients' health conditions (HPP#13). In short, the HPPs rely on the data provided through ICIS, and furthermore, their satisfaction will be affected either positively or negatively based on the quality of data provided on eHealth tools.

b. HPPs' communication with patients who have low eHealth literacy

The phone is the primary communication tool used at the hospital. HPPs reported several reasons for communicating with their patients, such as clarifying health information. However, they revealed some communication problems with patients who have low health literacy, those who misunderstand health information on the Internet, and those of advanced age.

Besides, some HPPs reported that their workflow was negatively affected when they deal with patients who have low health literacy or those of advanced age. HPP#1 stated that it was sometimes difficult to explain health conditions to patients with low health literacy. Another HPP revealed that in some cases, patients always call their HPP back, and she would continue to explain their health condition in a more straightforward language until they understood it better (HPP#2). HPP#15 noticed that some patients of advanced age have difficulty understanding health information, and thus they require someone such as a relative to assist them in interpreting health information—help that is commonly available.

Notwithstanding apprehensions about communicating health information to patients with low health literacy, most HPPs signaled a commitment to persisting until patients are adequately informed. Our data showed that this commitment is held equally by those who expressed direct concerns about low health literacy. HPP#4, for example, reported he would do his best to "*explain in clear words*," or, if unable to do so, redirect the patient to someone better suited to explain. Similarly, HPP#15 expressed a commitment to providing explanations in "*the most suitable way*."

Most HPPs alluded directly to their responsibility as healthcare professionals to ensure effective communication irrespective of perceived barriers. Although some information is "*hard to explain*," according to HPP#2, "*they [patients] have a right to know*." HPPs #6 and #12 referred to there being "*no choice*," which indicated that efforts must be made until the patient is adequately informed. Indeed, HPP#6 reported that she had to solve any misunderstandings that her patients may have because it is her responsibility to ensure they understand their health conditions, even if this requires extra time. Furthermore, several HPPs indicated that they needed to simplify their language to fit the patients' level of understanding. HPP#14 explained that when she deals with low health literacy patients, she redirects them to a specialist. Another HPP indicated that sometimes she has had to request face-to-face communication with patients (HPP#8). HPP#14 explained that her approach with patients who have misunderstandings is to communicate with their doctor to clarify their situation before having direct conversations with the patients. HPP#10 addressed the matter most explicitly by stating that in any case, "*patients' health literacy [levels] should not prevent us from helping them.*"

2) Q3 Results

Our data supported a strong rejection of Q3, which was that "HPPs with a lower level of information satisfaction (in data provided by eHealth tools) will have decreased intention to use eHealth tools to communicate with patients who have low eHealth literacy." Although many HPPs illustrated their concerns about communicating with low-health literacy, they continue to use these communication tools to facilitate patients' understanding of their health conditions. Overall, the data exhibited the following trends: (1) The HPPs were satisfied with the current data provided by Sehaty. (2) The HPPs used communication tools such as phones with patients for different reasons, such as following up or clarifying health information. (3) The HPPs were committed to providing clarification to patients who misunderstand health information provided on eHealth tools, including those with low health literacy or advanced age. (4) The HPPs employed different techniques when dealing with low health literacy's patients, such as explaining health information to fit patients' level of understanding, redirecting patients to a specialist, requesting face-to-face visits, or requesting clarification from the patient's doctor regarding his or her misunderstandings. (5) The HPPs did not mind spending extra time with patients to explain their health concerns or employing the methods required to do so, such as a phone call or requesting a visit in person.

B. Interpretation of Q4: Common ground on communication increases HPPs' trust as well as PPs' understanding [Supported].

Although patients and healthcare providers' needs have been studied individually, identifying technology and communication common ground (CG) between the two is also essential if practical eHealth tools are to be developed that meet the needs of both. CG is achieved through objectively measured fundamental traits such as language. However, several other bases for CG can be identified. For example, by deciphering healthcare providers' work requirements, patients' commitments to collaboration, the mutual expectations of each in terms of knowledge, relationship behaviors, and role specification (i.e., anticipated interaction) (p. 13)[54]. Trust connects many of these elements. Here, we discuss what our data revealed about bases for CG and the degree of mutual trust between patients and healthcare providers.

3) Q4 Finding

i. CG on communication increases HPPs' trust and PPs' understanding

Health tools such as Sehaty play a crucial role in mediating the patient–healthcare provider relationship, and therefore the overall provision of healthcare in the KSA. Both patients and healthcare providers must be able to trust that the tool is as effective as possible at providing this mediation, based on their known and assumed knowledge of the other. The most fundamental basis

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[54] As discussed in Common Ground Concept

of CG is language, and with the exception of lab results (provided in English only), the HPPs felt assured that patients receive accurate information through Sehaty, which is available in both English and Arabic. Some of the HPPs suggested translation services for patients who are unable to interpret lab results on Sehaty as a result of their limited English skills. For example, HPP#7 stated that “*Sehaty could provide test results in the Arabic language*.”

Some HPPs expressed concern regarding patients with low health literacy, as well as the difficulties that can arise from Sehaty data being misunderstood. From a workflow standpoint, some HPPs were apprehensive about anticipated slowdowns resulting from patients looking to dispute elements of their health condition or misinterpreting information due to strong emotional responses, especially in risky data. Nominally, these factors appear to militate against CG between patients and healthcare providers in terms of knowledge. However, our data revealed several bases of CG that offset these apprehensions. First, there was a considerably positive view overall among the HPPs of patients’ opportunities to expand their own health literacy. Most HPPs, according to our data, had confidence in patients seeking information before clinical visits and were optimistic that patients’ health knowledge foundation would expand as they do so. A vast majority of the PPs felt similarly, with 86% of them indicating that Sehaty has increased their ability to learn more about their health conditions, and 77.9% of PPs reporting that it allows them to prepare questions for their healthcare providers. In short, HPPs trust that patients generally have the capacity to learn and benefit from the use of eHealth tools.

Furthermore, cases of limited patient knowledge are mitigated to a degree by the real-time tracking of health conditions enabled by eHealth tools; time lags do not exacerbate misunderstandings in information-sharing. Finally, a large majority of HPPs explicitly stated that patients’ lack of knowledge does not alter their (healthcare providers’) duty to explain until understanding is achieved. Misunderstandings do occur, but all of them—whether from eHealth data or in a clinical setting—must be resolved in any case.

Technology CG—a shared sense of feasibility of using tools such as Sehaty—is found in the ease of use of the platform (Basahih & Kuziemsky, 2017). To begin with, nearly 100% of PPs own a smartphone, which is the primary device that Sehaty can be readily accessed. More crucially, a large majority of the PPs reported that Sehaty is much like other phone-based applications they use in their daily lives. The HPPs agreed virtually unanimously that Sehaty is intuitive and easy to use, and most were highly content with their patients' use of Sehaty.

Although Sehaty is not currently a direct communication tool, many PPs and HPPs agreed that some type of direct-communication option (e.g., text boxes) would enhance its effectiveness, especially in cases where brief clarification is required. Otherwise, previously used methods such as phone and e-messages would be used in the event of disturbances to Internet service or power outages. Overall, 78% of PPs reported that they use their phone to communicate with healthcare providers, and 14% use smartphone e-messages. The PPs elaborated on some of their reasons for communicating with their healthcare providers, such as to discuss health concerns (55.1%) and clarify health information (41.1%). On the other hand, the HPPs noted that they use the phone as a tool to communicate with their patients to explain or modify health information, review patients' health conditions, and prepare patients for future visits. Using communication tools would increase HPPs' understanding of patients' conditions and lead to greater satisfaction among patients in the decision-making process, which, as a result, would improve their relationship.

Furthermore, anticipated interaction is a factor that would improve the relationship between patients and healthcare providers. The critical results of HPPs' anticipated interaction were formed for Q2, which concluded that as HPPs' use of eHealth tools increases, their understanding of their patients’ health conditions would increase too. On the other hand, HPPs’ anticipated interaction revealed their reasons for communicating with patients, such as clarifying health-related matters to ensure patients understood their health condition.

At this stage, the matter of improved workflow efficiency is difficult to test and will require further study as the user base of eHealth tools expands. There are, however, current bases for linking patient and healthcare provider factors to illustrate workflow CG. One factor, as we have shown, pertains to healthcare provider perceptions of streamlined workflows. Contingent mainly on patients' health/eHealth literacy, the HPPs in our study reported confidence in patients' current knowledge and future potential to expand such knowledge and perceive future workflow efficiencies as a strong possibility. Additionally, our data revealed that the most critical factor is a shared, mutual commitment to ongoing collaboration where eHealth tools are concerned. Nearly 100% of the PPs said they intend to use Sehaty in the future, and almost all are willing to collaborate with healthcare providers in the future. Likewise, as we have shown, the HPPs perceived efficiency gains through eHealth tools or, at worst, they need to use conventional means (phone) in cases of low health literacy or to circumvent technical issues such as power outages. In short, healthcare providers exhibited a commitment to collaboration and overall were not hesitant based on the relatively uncommon circumstances in which their workflow may slow.

4) Q4 Results

Q4 stated: “CG on communication increases HPPs’ trust as well as PPs’ understanding,” which our results supported. Overall, the data exhibited the following trends: (1) the availability and variety of communication tools for both the PPs and HPPs facilitate their communication and relationships. (2) The HPPs and PPs’ anticipated interaction allows them to take advantage of communication tools to exchange health information and improve HPPs’ trust and PPs’ understanding of their health conditions. (3) Trustworthiness occurs when PPs and HPPs commit to continue using eHealth tools in the future, including communication tools. (4) The PPs and HPPs are currently satisfied with the data provided by Sehaty. The PPs demonstrated that they possess high eHealth literacy, whereas the HPPs indicated that patients having high eHealth literacy and English language ability reduce their workload. Moreover, the HPPs appreciated communicating with their patients to ensure patients' understanding.

5.2.6 Mixed-Methods Approaches: RQ3 Summary

RQ3 asked, "How do patients' eHealth literacy levels influence their communication with healthcare providers?" The results showed that patients' eHealth literacy levels could negatively or positively influence their decision to contact their healthcare providers. The PPs who had high technical ability, considerable health literacy, the necessary English language skills, and mid-to-high eHealth literacy was influenced to use eHealth tools. The PPs indicated that they use different eHealth tools, such as Sehaty and the Internet, to learn more about their health conditions. They also added that they are using Sehaty because it allows them to prepare questions to ask their healthcare providers on future visits. The PPs also stated that the Internet is a useful tool to support their decisions and provides them with confidence in receiving health information to make health decisions.

Furthermore, communication would lead to an increase in patients' satisfaction and their belief that their efforts in using eHealth tools for communication are valuable. PPs indicated that they used various communication tools such as phone and Sehaty for different purposes and revealed their satisfaction with these tools. In fact, 99.1% of the PPs reported that they received text message alerts from their healthcare providers, and all of them agreed that sending alert messages for specific services helps them to communicate and collaborate with their healthcare providers. By contrast, when PPs were not satisfied with the communication tools for some services, such as when they tried to phone their healthcare providers and could not reach them, the

PPs would see them in person instead.

Although the PPs had high eHealth literacy, they do not rely solely on their own health knowledge. This is because they felt the need always exists to communicate with their healthcare providers when they have difficulty understanding certain health information. Moreover, they indicated that they would collaborate with their healthcare providers using communication tools for health information.

In addition, the HPPs indicated that patients with high eHealth literacy and who are satisfied with the health information provided by Sehaty often decide not to contact them for these purposes. One HPP stated, "*It is hard to explain some health conditions to patients with low health literacy, but it works with patients with high health literacy*" (HPP#1). Communicating with patients who have low health literacy would increase the HPPs' workload. The HPPs also specified that they had experience dealing with patients who misunderstand health information on the Internet. However, they were not concerned about spending more time with patients to clarify health information. Ensuring patients' understanding and simplifying their language to fit patients' health knowledge are all part of their job, and they are specialists.

Furthermore, part of Q4 was that "CG on communication increases PPs' understanding," and our data supported this statement. CG on communication, which includes factors such as sharing information (e.g., patients' health information provided by Sehaty), language (e.g., English language skills), and knowledge (e.g., health literacy and eHealth literacy), affect patients' understanding. We discussed these factors in the previous section. The key results were that PPs have the necessary language, health literacy, educational level, and eHealth literacy that influence them to use eHealth tools to improve their health well as to use communication tools to clarify any misunderstandings.

Other CG aspects included PPs and HPPs' initiation behaviors toward increasing their relationship, trustworthiness, anticipated interaction, and sharing of understanding among them. As explained in Q4, the relationship between patients and healthcare providers can be developed by providing communication tools, anticipated interaction, and time; the last three factors also establish trust and a shared understanding. The study results showed that the PPs use different types of communication tools to communicate with their healthcare providers and that they will continue attempting to contact HPPs on the phone until they connect with them; otherwise, they prefer to see them in person.

This chapter discussed and answered the three RQs and their corresponding assertions. Quantitative and qualitative data were presented under these headings and according to variables identified for each. Correlations for HPP and PP factors were discussed and tested. In the next chapter, our revised PHPFFC V2.0 model is introduced, and its empirically derived factors are explained. Links between our RQ results and model factors are elucidated, and the dynamic of CG development specific to our findings is explored.

Chapter 6 PHPFFC V2.0 and CG Development

A vital contribution of this study is its validation of Basahih and Kuziemsky's (2017) patient–healthcare provider factors and functions for communication (PHPFFC) model (see Chapter 3 for more detail, p. 46). This chapter illustrates the empirically-supported, context-specific development of common ground (CG) between two user groups. The result is our revised model (PHPFFC V2.0) introduced and discussed in this chapter. The theoretical underpinnings of PHPFFC V2.0 are discussed briefly in section 6.1 Followed by factors and functions for patients–participant (PPs) and healthcare providers–participants (HPPs) entered under four headings; CG factors listed in the model's middle column under the same four headings. Next, an analysis, supported by data, of how these factors converge in a CG development cycle are discussed (see section 6.2.1). We considered the CG development cycle introduced by Kuziemsky & O'Sullivan (2015). Then concerning the CG development cycle in our specific research questions and to the particular case of Sehaty and the Internet (see section 6.2.2).

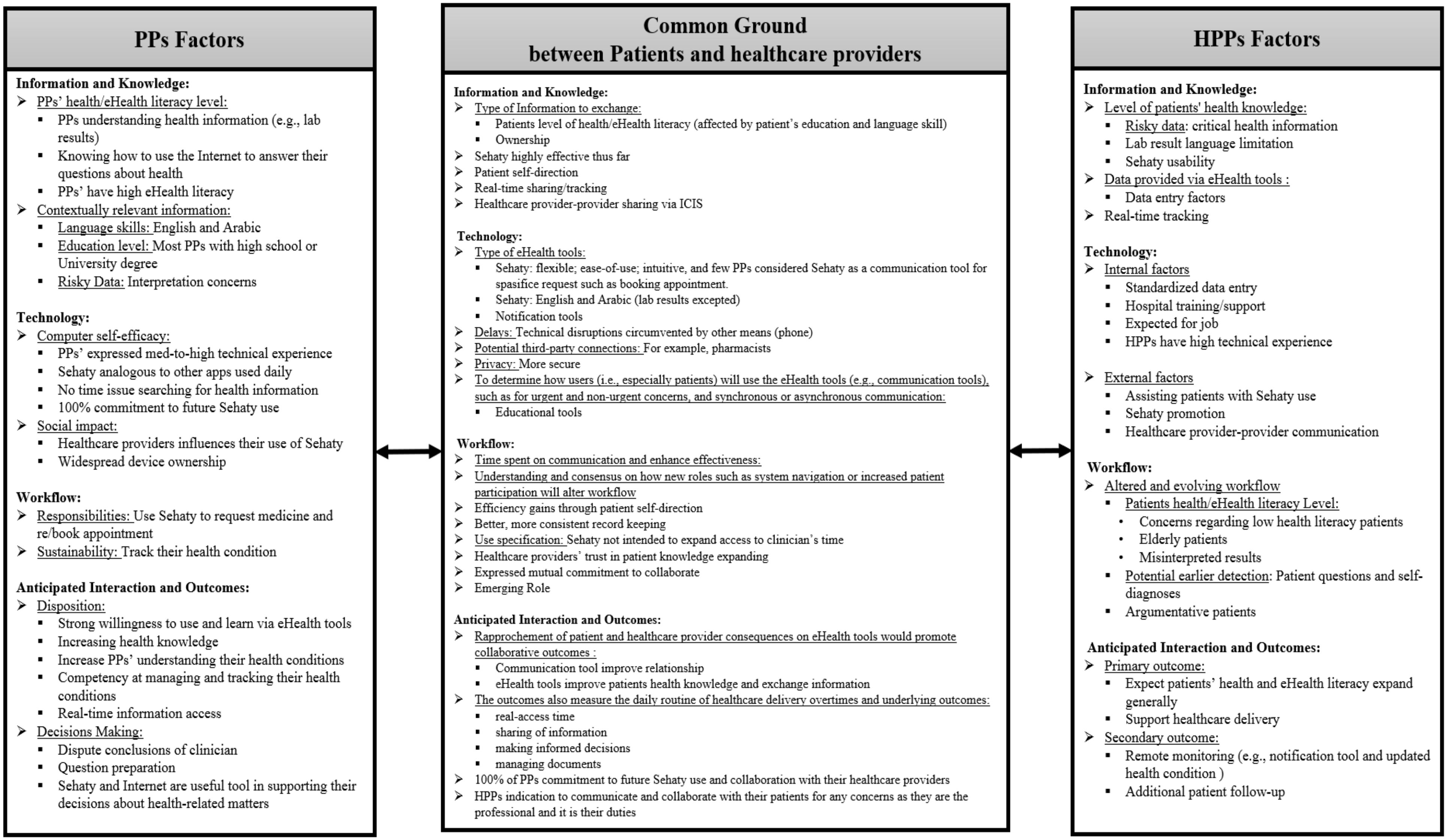
6.1 Theoretical Perspectives and Factor Descriptions

Two of the four headings from the original PHPFFC model –'Technology' and 'Workflow' – were retained for our revised model. The two remaining categories were expanded: 'Information' becomes 'Information and Knowledge,' and 'Outcomes' becomes 'Anticipated Interaction and Outcomes.' Our findings guided and necessitated these modifications. For example, potential complexities in eHealth platforms (e.g., risky data) calls for a distinction between the availability of information and the knowledge outcome. Similarly, our data reveal that the concept of 'outcomes' cannot be treated as static. We find that pre-determined outcomes are difficult to project in the face of relational issues (e.g., anticipated interactions) which refers to expectations (either real or merely perceived) that each party may have about the other's knowledge.

Moreover, representing complex human interactions in a two-dimensional model, while clearly useful, can be very challenging. It becomes even more so when the intent is to classify individual-group factors that, it is hoped, may support proactive CG development and inter-group collaboration in dynamic situations over time. The difference between the two is key to the transition from the initial PHPFFC model (p. 46) to the updated (V2.0) version presented here. At the most basic level, the transition entails an expanded definition of CG – a shift from regarding CG as mere information sharing between parties, to a dynamic process in which CG between groups may be gained, delayed, or even lost, given specific institutional contexts.

Part of capturing this dynamism consists in respecting the fact that perception – as opposed to objectively apprehended reality – pervades many human interactions. Referring to the category "Information and Knowledge," for example, in the case studied here, we are confronted with a higher degree of perception of knowledge (primarily HPP perception of patient knowledge) than might be typical of collaboration between and among professional groups. HPPs' commitment to collaboration is, to a significant degree, secured by incomplete or asymmetrical perceptions of patient knowledge. This, in turn, extends to significant issues such as HPPs' concerns about, among others, inefficient workflow.

A prime example of how the perception of knowledge creates ambiguity regarding workflow is provided by HPP#15, who reported the following when asked how patient use of Sehaty may affect workflow: *"It depends on the patient. It could affect positively and save time, or it could increase the workflow if the patients communicate for a non-urgent issue."* The ambivalence in this statement suggests, at the same time, considerable potential for the CG, and/or the possibility that HPPs' doubts are sufficiently serious as to inhibit CG development.



PPs Factors

Information and Knowledge:
- PPs' health/eHealth literacy level:
  - PPs understanding health information (e.g., lab results)
  - Knowing how to use the Internet to answer their questions about health
  - PPs' have high eHealth literacy
- Contextually relevant information:
  - Language skills: English and Arabic
  - Education level: Most PPs with high school or University degree
  - Risky Data: Interpretation concerns

Technology:
- Computer self-efficacy:
  - PPs' expressed med-to-high technical experience
  - Sehaty analogous to other apps used daily
  - No time issue searching for health information
  - 100% commitment to future Sehaty use
- Social impact:
  - Healthcare providers influences their use of Sehaty
  - Widespread device ownership

Workflow:
- Responsibilities: Use Sehaty to request medicine and re/book appointment
- Sustainability: Track their health condition

Anticipated Interaction and Outcomes:
- Disposition:
  - Strong willingness to use and learn via eHealth tools
  - Increasing health knowledge
  - Increase PPs' understanding their health conditions
  - Competency at managing and tracking their health conditions
  - Real-time information access
- Decisions Making:
  - Dispute conclusions of clinician
  - Question preparation
  - Sehaty and Internet are useful tool in supporting their decisions about health-related matters

Common Ground
between Patients and healthcare providers

Information and Knowledge:
- Type of Information to exchange:
  - Patients level of health/eHealth literacy (affected by patient's education and language skill)
  - Ownership
- Sehaty highly effective thus far
- Patient self-direction
- Real-time sharing/tracking
- Healthcare provider-provider sharing via ICIS

Technology:
- Type of eHealth tools:
  - Sehaty: flexible; ease-of-use; intuitive, and few PPs considered Sehaty as a communication tool for spasifice request such as booking appointment.
  - Sehaty: English and Arabic (lab results excepted)
  - Notification tools
- Delays: Technical disruptions circumvented by other means (phone)
- Potential third-party connections: For example, pharmacists
- Privacy: More secure
- To determine how users (i.e., especially patients) will use the eHealth tools (e.g., communication tools), such as for urgent and non-urgent concerns, and synchronous or asynchronous communication:
  - Educational tools

Workflow:
- Time spent on communication and enhance effectiveness:
- Understanding and consensus on how new roles such as system navigation or increased patient participation will alter workflow
- Efficiency gains through patient self-direction
- Better, more consistent record keeping
- Use specification: Sehaty not intended to expand access to clinician's time
- Healthcare providers' trust in patient knowledge expanding
- Expressed mutual commitment to collaborate
- Emerging Role

Anticipated Interaction and Outcomes:
- Rapprochement of patient and healthcare provider consequences on eHealth tools would promote collaborative outcomes :
  - Communication tool improve relationship
  - eHealth tools improve patients health knowledge and exchange information
- The outcomes also measure the daily routine of healthcare delivery overtimes and underlying outcomes:
  - real-access time
  - sharing of information
  - making informed decisions
  - managing documents
- 100% of PPs commitment to future Sehaty use and collaboration with their healthcare providers
- HPPs indication to communicate and collaborate with their patients for any concerns as they are the professional and it is their duties

HPPs Factors

Information and Knowledge:
- Level of patients' health knowledge:
  - Risky data: critical health information
  - Lab result language limitation
  - Sehaty usability
- Data provided via eHealth tools :
  - Data entry factors
- Real-time tracking

Technology:
- Internal factors
  - Standardized data entry
  - Hospital training/support
  - Expected for job
  - HPPs have high technical experience
- External factors
  - Assisting patients with Sehaty use
  - Sehaty promotion
  - Healthcare provider-provider communication

Workflow:
- Altered and evolving workflow
  - Patients health/eHealth literacy Level:
    - Concerns regarding low health literacy patients
    - Elderly patients
    - Misinterpreted results
  - Potential earlier detection: Patient questions and self-diagnoses
  - Argumentative patients

Anticipated Interaction and Outcomes:
- Primary outcome:
  - Expect patients' health and eHealth literacy expand generally
  - Support healthcare delivery
- Secondary outcome:
  - Remote monitoring (e.g., notification tool and updated health condition)
  - Additional patient follow-up

Figure 7: *Patient–Healthcare Provider Factors and Functions for Communication Model V2.0*

Thus, though it retains the same broad categories, the adapted (V2.0) model includes sub-categories derived from data, which address complexity without forfeiting the generalizability expected from models. The PHPFFC V2.0 model (see Figure 7) illustrates PP factors (see section 6.1.1), HPP factors (see section 6.1.2), and CG between the two (see section 6.1.3). Factors are arranged under four headings, representing four key aspects of the PP–HPP relationship that influence CG development and the potential for collaborative relationships through Sehaty: knowledge and information, technology, workflow, and anticipated interaction and outcomes. Individual-group factors pertain to both limitations and strengths that influence each group's willingness and potential to use eHealth tools.

6.1.1 PPs Factors

The left column in Figure 7 identifies PPs' factors that may affect their intentions to use eHealth tools, such as communication tools. The following subsections introduce the four main categories for patients' factors: knowledge and information, technology, workflow, and anticipated interaction and outcomes.

A. PPs— Information and Knowledge

Information factors in the initial PHPFFC model explained that eHealth literacy and contextually relevant information affect patients' intention to use eHealth tools -- due to education levels and/or understanding of the health information provided via the eHealth tools (Basahih & Kuziemsky, 2017). The authors explained that patients' eHealth literacy would be influenced by their computer literacy, health literacy, ability to interpret health information, level of education, and their technical skills (p. 47)[55]. Besides, in the transition to PHPFFC V2.0, the model demonstrated that PPs health/eHealth literacy level is affected by their understanding of health information provided in the eHealth tools. Increasingly, this is aided by a related ability to use the

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[55] As discussed in Chapter 3, Patient Information Factors

Internet to seek, decipher, and use online information to answer health questions. Our data reveal that PPs' have high eHealth literacy.

Health literacy: Patients' levels of education and their English language skills affected their health literacy. English is the international language used in almost all healthcare organizations. PPs education levels were mid-to-high, and language was not a factor for anything but lab results on Sehaty, which are available in English only. Our data show a significant number (65.4% of PPs) held a university degree, and 82.2% reported that there is no need to present the test results in Arabic, which indicated that they possessed the necessary skills to read, write, and cognitively interpret the health information via eHealth tools.

The eHealth literacy: The authors in the PHPFFC model indicated that patients' computer literacy (technical skill) and their health literacy (interpreting and communicating data within different health contexts) affected their eHealth literacy (Basahih & Kuziemsky, 2017). High eHealth literacy correlates positively intending to use eHealth tools such as Sehaty and the Internet. In the PHPFFC V2.0, all PPs exhibited mid-to-high-level technical skills such as 96.3% of PPs possessed the knowledge required to use the app. The majority of PPs (88.8%) already used online tools to enhance their health knowledge and understand their health condition. A large proportion had confidence in their ability to discern and use the information for personal benefit. For example, 94.4% of PPs indicated they knew where to find helpful health resources on the Internet. Also, almost half the PPs (47.7%) reported that they know how to use the Internet to answer their questions. According to results from our application of the eHEALs[56], PPs' eHealth literacy levels were high (p. 232)[57].

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[56] The eHEALs is a scale developed by Norman and Skinner (2006) to test patients' eHealth literacy

[57] See Table 21 in Appendix 'E'

Contextually relevant information: is another patient factor related to information in the initial PHPFFC model (Basahih & Kuziemsky, 2017). Likewise, in the PHPFFC V2.0, this factor defined in this study as patients' ability to understand and manage the health information related to their illnesses. The ability to understand contextually relevant information is affected by patients' education levels and English competency. Although PPs showed high eHealth literacy, and PPs scored high (88.8%) in terms of knowing how to use information found on the Internet to understand more about their health conditions; however, they were not experts, and problems such as potentially misinterpreting results are highly relevant. The results show that 77.9% of PPs reported that Sehaty allows them to prepare questions for their healthcare providers. We were unable to determine from our data how PPs interpret the health information provided at eHealth tools that leads them to ask questions. In short, patients with high general knowledge may suddenly find themselves uninformed with the onset of specific health conditions.

Broadly, eHealth literacy and contextually relevant information factors in our revised model are consistent with those elucidated in the initial PHPFFC (Basahih & Kuziemsky, 2017) (p. 47)[58]. However, given our empirical data, we problematize knowledge somewhat, showing it cannot be measured on a continuum relative to other factors, such as healthcare providers' workflow. For example, whereas patients with low eHealth literacy may slow HPPs' workflow [e.g., HPP#13 said: "*Explaining some health information to patients with low health literacy … requires extra time*"]; or those with high eHealth literacy but argumentative [e.g. HPP#4: "*… as some patients start arguing with doctors…*"] may either deliver extra efficiencies or create workflow bottlenecks. Further, we acknowledge that patient knowledge levels are patient-reported, adding an element of misperception on patients' part. A significant dimension of contextually

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[58] As discussed in Chapter 3, Patient Information Factors

relevant information from our study pertains to basic language skills. The vast majority of Sehaty content is provided in English and Arabic; however, lab-test results are exclusively in English, putting those speaking Arabic only at a disadvantage. Contextually relevant information in our study also refers to "risky data" on Sehaty – data dealing with complex and/or critical health conditions. This factor is ambivalent in nature: patients may be overwhelmed and confused by such data, or they may use it to formulate useful questions for healthcare providers – depending on education and eHealth literacy levels.

B. PPs—Technology

Computer self-efficacy and social impacts are both technology sub-factors retained from the original PHPFFC model (p. 48)[59]. Basahih and Kuziemsky explained that computer self-efficacy influenced by sub-factors such as technical expertise, perceived usefulness, and ease of use of technology (2017). Similarly, in PHPFFC V2.0, computer self-efficacy is influenced by the time spent in searching for health information (i.e., technical expertise). The Sehaty design is analogous to other apps used in patients' daily lives, engendering a perceived ease-of-use. Ease-of-use, in turn, produces patients' commitment to future use of Sehaty in the expectation that it will prove useful for health tracking. Our data reveal that PPs' expressed mid-to-high technical experience.

Computer self-efficacy: For the institutional context studied here, our results show PPs as having mid-to-high technical abilities, particularly with respect to smartphones – the device most commonly used by patients for Sehaty. This technical level reach due to 96.3% of PPs reported that they have the knowledge required to use this specific application, 87.9% of PPs pointing out, significantly, that Sehaty is very similar with other apps they use daily. Furthermore, a significant

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[59] As discussed Chapter 3, Patient Technology Factors

number (58.9%) indicated that Sehaty has a simple design. 89.7% of PPs used Sehaty when they need to check or track their health status, or/and book an appointment. 75.7% of PPs reported no time issues when searching online for health information. Finally, all PPs agreed that they would intend to use Sehaty in the future, and 98.1% of them reported that they would collaborate with their healthcare providers through online communication tools to improve their health.

Social impacts: Basahih and Kuziemsky explained that social influence and networks are factors that would influence the social impacts in the initial PHPFFC (2017). Here too, in the PHPFFC V2.0, two factors influenced social impact: First, owning a smartphone allows patients to interact with a social network. Our results showed that 100% of the PPs owned a smartphone, demonstrating widespread device ownership. They also reported that they like to use Sehaty or the Internet to learn more about their health conditions and actively become involved in their healthcare decision-making. Second, 44.8% of the PPs said that their healthcare providers encourage them to use Sehaty.

C. PPs—Workflow

In the initial PHPFFC model, patients' workflow factor, Basahih, and Kuziemsky explained that patients needed to define their processes and responsibility to manage their health condition (2017). Here, in PHPFFC V2.0, most PPs in this study recognized that additional personal time is required to expand knowledge of health conditions, and a large majority (75.7%) did not object to investing that time to search online for health information or to using such information to prepare questions for healthcare providers. Thus, PPs gave positive responses in the first of two subcategories under workflow: responsibilities and sustainability explained in the PHPFFC (p. 48)[60].

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[60] As discussed in Chapter 3, Patient Workflow Factors

Responsibility: In PHPFFC V2.0, related to how PPs perceived eHealth tools as useful for managing their health condition. Our data showed that 89.7% of PPs used Sehaty to track their health conditions, request medicine, and book appointments. They felt they had a responsibility to use Sehaty for the aforementioned reasons. Moreover, they expressed curiosity and felt responsible for using the Internet: 86.9% described the Internet as a useful tool for supporting their decisions about health-related matters. Furthermore, 75.7% of the PPs mentioned that they have no concerns about the time spent searching for health information on eHealth tools.

Sustainability: In the initial PHPFFC model, the sustainability of responsibility requires patients to keep track of and manage their health conditions (Basahih & Kuziemsky, 2017). Here in PHPFFC V2.0 model, 89.7% of PPs may feel responsible for tracking their own health conditions; however, eHealth tools' effectiveness over time will depend on a sustained sense of responsibility (Basahih & Kuziemsky's, 2017). In turn, in the PHPFFC V2.0, sustainability will depend on the perceived value of the tool and its adaptation of new features as both end-user groups grow and interact more over time. Our results from the patient data offered indications that PPs intend to remain vigilant about tracking their health conditions in the future. 100% stated that they intend to continue using Sehaty because as 91.6% reported, it offers invaluable assistance in tracking their health conditions.

D. PPs—Anticipated Interaction and Outcomes

Basahih and Kuziemsky's (2017) initial PHPFFC model indicated that using eHealth tools would help patients to improve their health knowledge as well as competency at managing and tracking health condition (p. 49)[61]. However, this is only true to the extent that each party is assured that the other party will use the information exchanged as effectively as possible. In PHPFFC V2.0,

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[61] As discussed in Chapter 3, Patient Outcomes

as Sehaty use expands, patients must recognize a responsibility to consult the system for information that is transmitted routinely. This sense of responsibility must also be sustained if healthcare providers are to feel that communication is being maintained. We expect that sustainability will not be a factor because PPs' strong and favorable disposition toward using and learning from eHealth tools at an increasing rate can be anticipated (e.g., 91.6% of PPs perceived usefulness of eHealth tools). A likely corollary of this is that PPs' preparation of questions will increase, reflected in more targeted queries for clinicians (e.g., 77.9% of PPs felt that Sehaty allows them to prepare questions for healthcare providers). Instead, it may also be anticipated that sustained Sehaty use will result in more communication with healthcare providers due to misunderstandings (e.g., 41.4% of PPs for clarifying health information), and disputes over clinical decisions (e.g., 55.1% of PPs for discussing health concerns or as revealed in the qualitative data 'argumentative patients' by HPP#4). It is possible that as user groups age, their inclination to use new technologies will diminish somewhat (e.g., as revealed from qualitative data indicated). Here, in V2.0, we again subdivided PPs factors according to disposition and decision-making.

Disposition: Regarding disposition, we demonstrated that 89.7% of PPs are generally favorably disposed to tracking health conditions and (91.6% of PPs) seeking new health information through eHealth tools. Those referred to 'competency at managing and tracking their health conditions' in the V2.0 model. We estimated that this strong disposition for eHealth learning is supported by high rates of existing familiarity with technology-based learning. For instance, 96.3% of the PPs reported having the necessary knowledge to navigate Sehaty's simple design, with 87.9% saying it is highly similar to many other applications they use daily. Those referred to 'strong willingness to use and learn via eHealth tools' in the V2.0 model. Given this usability, the PPs perceived benefits rapidly. Whether for single or multi-use purposes, 91.6% of the PPs' agreed that it is important to be able to access health resources, either Sehaty itself or on the Internet more generally, which referred to ‘real-time information accesses in the V2.0 model. We also demonstrated a concomitant belief among the majority (88.8% of PPs) that they know how to apply information from the Internet to enhance their understanding of their health conditions. Referred to ‘increasing health knowledge’, and, more specifically, ‘increasing PPs’ understanding of their health condition’ in the V2.0 model.

Decision-making: eHealth tools support decision-making for patients. 86% of PPs felt that Sehaty increases their ability to learn more about their health conditions. Also, nearly half (47.7%) of the PPs said they know how to interpret and use information from Sehaty and the Internet to answer questions they have about health issues. Those referred to ‘Sehaty and Internet are useful tool in supporting their decisions about health-related matters’ in the V2.0 model. A considerably higher percentage (77.9% of PPs) said that they prepare questions for healthcare providers based on information from eHealth tools. This referred to ‘question preparation’ in the V2.0 model. Although the decision-making function represents a degree of empowerment for PPs, we also showed that some patient’s decisions can be in direct conflict with HPPs’ concerns. For example, as revealed by our qualitative data, patients can also decide to dispute HPPs’ decisions and/or favor information gleaned from the Internet over that from their actual clinicians [e.g. HPP#4 stated: “*I don’t agree with getting health information from the Internet, as some patients start arguing with doctors…*”]. This referred to ‘dispute conclusions of clinician’ in the V2.0 model.

6.1.2 HPP Factors

The right column in Figure 7 identifies HPPs’ factors that may affect their intentions to use eHealth tools, such as communication tools. The following subsections introduce the four main categories for HPPs’ factors: knowledge and information, technology, workflow, and anticipated interaction and outcomes.

A. HPPs—Information and Knowledge

In the initial PHPFFC model, the authors identified two primary information factors: data provided via eHealth systems and patient's health knowledge (Basahih & Kuziemsky, 2017). The authors show that healthcare providers are concerned about the potential for patients with low health knowledge to misinterpret health information; thus, healthcare providers suggested to discuss the health matter with the patients before allowing them to view it via eHealth tools (p. 49)[62]. In PHPFFC V2.0, our data indicated that HPPs concerned about the type of data provided (e.g., risky data) to patients with low health literacy, understanding the lab results (e.g., English skills), or maybe Sehaty usability (e.g., knowing if Sehaty exists). Many HPPs indicated that all information must be presented to patients; however, some HPPs suggested not showing some specific type of data (risky data) before patients meeting with their doctors.

<u>Level of patients' health knowledge [Risky data/critical health information]</u>: HPPs' information and knowledge factors were to some extent mirror images of those identified for the PPs. Although the HPPs recognized Sehaty's ease of use, such as when HPP#6 said"*…Sehaty application is easy to use*", and had much confidence in most patients' ability to expand their health knowledge through such tools. For example, HPP#6 thought: "*Sehaty would be a beneficial tool for patients, as patients gain a greater understanding about their health condition*". However, many expressed candid concerns about patients with low health literacy, such as the expression of HPP#9 "*It depends on the patients...*"

The HPPs viewed the advantage of eHealth tools as being largely dependent on individual patients. Indeed, even for those patients with higher levels of health literacy, HPPs had reservations about the type of data/information that ought to appear on eHealth platforms. We adopted the term

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[62] As discussed in Chapter 3, Healthcare Provider Information Factors

risky data to describe complex medical information, especially that pertaining to a current, critical health situation for patients. While some HPPs characterized full information disclosure as a matter concerning patients' rights, most either harbored strong reservations or suggested certain caveats such as "*bad news*" appearing on Sehaty only after the patient had visited a clinician in person. Therefore, seven HPPs suggested that risky information should not be provided to patients before they visit the hospital: "*No, in terms of risky information, first, it should only be delivered by the physician to the patients directly. Then the risky data can be provided on Sehaty"* (HPP#10).

Level of patients' health knowledge [Lab result language limitation]: A significant number of HPPs indicated that patients have a right to view all health information on Sehaty, including risky details. However, some of them mentioned that the data must be in their language (i.e., in our case, Arabic). For example, "*I would provide all of the patients' health information, including risky information; however, [I would provide] in their language [Arabic]*." (HPP#8). One HPP also indicated that providing lab results exclusively in English would prompt requests for more clarification from patients who might misunderstand medical terms. HPP#2 stated: "*Sehaty provides health information like test results in English, which would be hard for some patients to understand…"*

Level of patients' health Knowledge [Sehaty usability]: Our results show that all HPPs were satisfied with their patients' current use of Sehaty, and they also were confident about the prospects for patient knowledge to be improved through eHealth tools. One HPP (#6) stated plainly that patients' use of Sehaty is a "*good sign*" because patients are pre-educating themselves for clinical visits and treatment management. Another HPP (#13) expected patients to have "*greater understanding*" through increased Sehaty use. These responses reflect and to some extent legitimize the confidence factors derived from the PPs' data. An HPP also anticipated a usage threshold based on patients' technical abilities and/or awareness that the Sehaty application exists. For example, HPP#13 stated: "*... at some point, not all patients are capable of using the application, yet this would be due to their technical experience.*"

<u>Data provided via eHealth systems</u> is another factor that affects HPPs' intentions to use eHealth tools (p. 49)[63]. Basahih & Kuziemsky explained that data provided via eHealth systems, in the initial PHPFFC model, could be generated through e-formal data collection or patient-generated health data where e-formal data collection supported regular clinical duties (2017). In the PHPFFC V2.0, with respect to the platform (Sehaty) and its features, many HPPs identified the need for data entry protocols to improve its efficacy. Outright errors present an obvious problem, and one to be addressed immediately. However, the nature of data entry itself can determine usability and interpretability factors, whether the information is entered in rigidly structured categories or a separate option exists for descriptive, prose-style input. For example, according to HPP#13:

> *"Although we are specialists in understanding patients' health conditions, every health diagnosis depends on the efficiency of the data collector and how the data was entered on the system. That way, other users [healthcare providers] can access information easily and for a better diagnosis, when patients' profiles are completed and properly detailed."*

<u>Real-time tracking:</u> is the final factor we added to the PHPFFC V2.0 model. Earlier, we mentioned that Sehaty is mainly for patients to view and track their health history, as well as to re/book appointments and requested refill medicines. HPPs saw the advantage of Sehaty accessibility that allowed patients to access their health records. Some HPPs recounted from direct experience how much usability will enable patients to access their data and view the lab results, thereby mitigating the need to call or visit the hospital to ask about their health history. For

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[63] As discussed in Chapter 3, Healthcare Provider Information Factors

example, HPP#14 declared:

> *"Sehaty makes patients' lives easy. Sehaty is easy to use, and it allows patients to access their health history. Also, it allows patients to view and book their own appointments without relying on phone calls or bothering coming [to the hospital] in person. And that facilitates our workflow."*

Many HPPs indicated that eHealth tools would provide patients with real-time access to clinical records: "*Sehaty would help my workflow in terms of the accessibility of the Sehaty application from anywhere and at any time"* (HPP#4).

B. HPPs—Technology

The initial PHPFFC model illustrated two types of technology factors which can be internal and external for healthcare providers (p. 50)[64]. The authors explained that some of the internal factors needed by providing training workshops to healthcare providers to ensure their practical eHealth tools' usability (Basahih & Kuziemsky, 2017).

Internal factors: Clear, concise, consistent data entry protocols are critical for healthcare providers within (internally) healthcare facilities. In PHPFFC V2.0, our results show the importance, to HPPS, of standardized data entry protocols to make the best possible clinical decisions regarding treatment. According to HPP#13:*"…every health diagnosis, depends on the efficiency of the data collector and how the data was entered on the system…"*

Also, in our results, HPPs recognized the centrality of technology use to their jobs, and more specifically as part of their duty of due care. All HPPs indicated that they are using the Integrated Clinical Information System (ICIS) for patients care. For example, HPP#14: "*…I use ICIS on my computer at work to [review] document[s]and observe patient progress…*" This referred to 'expected for job' in V2.0 model.

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[64] As discussed in Chapter 3, Healthcare Provider Technology Factors

Hospital information technology (IT) departments and upgrade training sessions support them in this. For example, HPP#7 said: “*Yes, they [the hospital] provide training, courses, and manual documents. Also, I can be up to date using my online training courses provided by the hospital.”* This referred to ‘hospital training/support’ in the V2.0 model

Furthermore, the HPPs reported having strong technical skills directly related to their care requirements. All HPPs described themselves as having a high level of technical skills and used different applications such as iPad, iPhone, and desktop. As HPP#11 stated: “*…I like to know everything related to technology. Especially exploring different types of applications”.*

External factors: The external factors in the PHPFFC model referred to collaboration and communication among healthcare providers or other organizations to support various aspects of healthcare performance (Basahih & Kuziemsky, 2017). In the PHPPFC V2.0, as for external technology factors, the HPPs found themselves having to assist patients with Sehaty use outside of their routine job tasks. For example, HPP#6 said: “*Instructing my patients in how to use it [Sehaty] ….*” They considered promotional campaigns to acquaint patients with Sehaty’s as key to both expanding its use and, ultimately, expediting overall patient efficacy with the tool. As the expression of HPP#13: “*Patients don’t know if Sehaty exists”.* This referred to ‘Sehaty promotion’ in V2.0 model. Finally, healthcare provider–provider sharing of information supports clinical work, such as exchanges between primary care physicians and specialists, or between healthcare facilities and potential, emerging collaborators, such as pharmacists.

> *“We use phone and e-mail with patients. Also, we use phone, pager, e-mail, and WhatsApp [mobile application] with my colleagues.” (HPP#13)*

C. HPPs—Workflow

Basahih and Kuziemsky (2017), in the PHPFFC model, indicated that healthcare providers harbor concerns about altered and evolving workflow when new technologies are adopted (p. 50)[65]. Also, the authors indicated that a text-based communication tool between users might include numerous text messages which could increase healthcare providers' workload. The eHealth tools used in this study did not cover direct communication tools among users. For example, HPP#1 reported: "*Sehaty does not cover all types of work, such as writing a comment or writing patients' diagnoses…"* However, later in the PHPFFC V2.0 model, we talked about the anticipated interaction of healthcare providers once this feature (i.e., a direct communication tool) added to their system in the future (p. 153)[66]. Thus, here our focus is to present the current HPPs' workflow factors. In the PHPFFC V2.0 model, our data also showed that HPPs expected an altered and evolving workflow because of eHealth tools. Whether this means efficiency gains or losses depends on patients.

Patients' health/eHealth literacy level [high]: On the positive side of patients using eHealth tools, HPPs noted that the use of Sehaty for appointment booking and medication tracking would circumvent direct communication, and with it expedite the clerical workflow.

> *"Sehaty makes patients' lives easy. Sehaty is easy to use, and it allows patients to access their health history. Also, it allows patients to view and book their own appointments without relying on phone calls or bothering coming [to the hospital] in person. And that facilitates our workflow." (HPP#14)*

Potential earlier detection [Patient questions and self-diagnoses]: Some HPPs also took the view that eHealth tools hold the potential for achieving, for example, earlier detection of health issues. For example, as revealed from the quantitative data, 41.4% of PPs needed to communicate

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[65] As discussed in Chapter 3, Healthcare Provider Workflow Factors

[66] As discussed in CG Factors – Workflow

with their healthcare providers to clarify health information. Besides, patients with higher levels of health/eHealth literacy can formulate appropriate questions and, in certain cases, articulate insights (possibly self-diagnoses) into their conditions in manners that may lead to faster detection of health problems. For example, HPP#13 reported: "*That [patient' Sehaty usage] will be a good sign that most patients are pre-educating themselves and trying to have a good healthy lifestyle, as well as managing their treatments after discussing it with their doctors."*

<u>Patients' health/eHealth literacy level [low]:</u> On the negative side of patients using eHealth tools, many HPPs were concerned that patients with low health/eHealth literacy, as well as elderly patients, will alter workflow patterns inordinately and negatively. Elderly patients are mostly accompanied by friends or family members who can assist in language translation or result interpretation. As stated by HPP#15: "*We face this issue [i.e., patients with low health literacy] with older people, but sometimes, there is someone with them who can take care of them, and we explain the problem to both of them.*"

The non-elderly patients with low health/eHealth literacy raised concerns among the HPPs about the misinterpretation of information on eHealth platforms, particularly where risky data are involved. For example, HPP#13 said: "*Explaining some health information to patients with low health literacy will be challenging, difficult, and sometimes requires extra time.*"; Or, due to patients misunderstanding the lab result for its language limitation HPP#2 reported: "*Sehaty provides health information like test results in English, which would be hard for some patients to understand…*" These circumstances portend workflow slowdowns and efficiency losses.

<u>Potential earlier detection [Argumentative patients]:</u> In certain scenarios, as some HPPs suggested, high eHealth literacy levels can cause patients to become argumentative, employing information acquired on the Internet. HPP#4 said: "*I don't agree with getting health information*

from the Internet, as patients start arguing with doctors and call us for clarification, and this increases our workflow".

D. HPPs—Anticipated Interaction and Outcomes

Here, according to the PHPFFC model, we also classify the healthcare providers' outcome in two categories: primary and secondary outcomes (p. 51)[67]. Although mediated communication presents significant barriers to developing CG between various parties, some features, such as the reviewability of information, can actually engender information-sharing and collaboration. The HPPs recognized and saw this as a benefit that may offset the problem of interpretability to some degree.

Primary outcomes: In the PHPFFC model, the authors explained that the primary outcomes of using eHealth tools would be improved patient–providers' relationships and supported healthcare delivery tasks (Basahih & Kuziemsky, 2017). In the PHPFFC V2.0 model, among the primary outcomes, the HPPs perceived overall improvements in healthcare delivery as eHealth tools effect better, more consistent, real-time clinical records. For example, HPP#7 said: *"The accessibility to clinical records anytime and anywhere. It [Sehaty] keeps all the documents online; it is better than using and filing papers".* Likewise, our data showed that the HPPs do regard patients' use of eHealth tools as beneficial and likely to expand their overall health literacy. For example, HPP#13 reported that "*[Patients will have] greater understanding*," and in another scenario, HPP#6 mentioned that:" *[Sehaty] improves patients' awareness of their health conditions*".

Secondary outcomes, in the PHPFFC model, Basahih & Kuziemsky indicated that secondary outcomes related to administrative tasks include tracking patients' health conditions,

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[67] As discussed in Chapter 3, Healthcare Provider Outcomes

and, from a patient perspective, an ability for patients to track their health conditions (2017). In PHPFFC V2.0, the secondary outcomes the HPP perspective included the potential for remote monitoring, which entails notification tools and real-time health-condition updates. As revealed from our quantitative data, 99.1% of PPs received alert text messages to their phone, and all of them thought setting a text alert messages via phone encourages them to communicate with their healthcare providers. Follow-up patient monitoring will also be expanded and enhanced because HPPs can easily double-check results, diagnoses, and medication prescriptions at any time according to an earlier indication that eHealth tools keep the clinical records updated and online [HPP#7].

6.1.3 Common Ground Factors

The middle column in Figure 7 describes the types of common ground (CG) factors identified among HPPs and PPs under the four concepts in the PHPFFC V2.0.

A. CG Factors —Information and Knowledge

For CG to develop, PPs and HPPs must either share common views about the purpose and appropriate use of eHealth tools; or, each side must at least believe that the other is using such tools in good faith and to the best of their abilities. Otherwise, we may expect CG development to slow or even cease at the coordinative stage (p. 160)[68].

The initial PHPFFC model illustrated information CG factors: The type of information exchanged (i.e., PGHD and formal health data); and ownership, privacy, and security (p. 52)[69]. Similarly, in the PHPFFC V2.0 model, the data shows that the type of information exchanged, device ownership, privacy, and security, are factors that could affect users' intention to use eHealth tools (e.g., communication tools) at the information and knowledge CG level. Finally, our data

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[68] As discussed in section 6.2 [CG Development]

[69] As discussed in Chapter 3, Information Common Ground

revealed other factors to the development of the common ground: the recognized effectiveness of Sehaty thus far, patient self-direction, real-time sharing/tracking, and healthcare provider-provider sharing information via ICIS (see Figure 7).

<u>The type of information exchanged:</u> Type of information to exchange within the hospital, in the PHPFFC model, the authors showed the importance of mutual agreement on the terminology used in the eHealth systems (Basahih & Kuziemsky, 2017). In the PHPFFC V2.0 model, HPPs reported that patients' diagnoses would be affected by the efficiency of the data entry and the quality of the data, including the level of detail. For example, "… *every health diagnosis depends on the efficiency of the data collector*…" (HPP#13).

Type of information to exchange according to patients' level of health/eHealth literacy [i.e., that could be affected by the patient's education and language skill]: In the PHPFFC model, the authors indicated that the information should be clear, consistent, and understood by patients and healthcare providers (Basahih & Kuziemsky, 2017). In the PHPFFC V2.0 model, nowhere is this need for mutual goodwill more apparent than in the case of knowledge factors. Given an expected asymmetry in health knowledge between healthcare providers and patients, healthcare providers must perceive enough knowledge on the part of patients for the relationship-building (cooperative) phase of CG to take hold concerning Sehaty use. HPPs reported that understanding the data on eHealth tools dependent on the patients, which would be affected by their English language skills, health/eHealth literacy, and the type of the data provided on the eHealth tools. We mentioned several examples of the factors, as mentioned earlier, that reported on different occasions (p. 130 and 138)[70]. For instance, we revealed from the quantitative data that PPs have high eHealth literacy, with 89.7% viewing lab results in Sehaty, and 82.2% of indicating that there is no need to

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[70] As discussed in PPs and HPPs–Information and Knowledge

present the lab results in Arabic. On the other hand, from the qualitative data, we found that HPPs have different opinions regarding providing risky data to patients with low health literacy. For example, the expression of HPP#10: "*No, in terms of risky information… it should only be delivered by the physician to the patients directly…*" Others, such as HPP#8, felt differently: "*I would provide all of the patients' health information, including the risky information; however, [I would provide] in their language [Arabic]*".

HPPs also would clarify any misunderstandings of patients to ensure patients followed the appropriate treatments. HPPs indicated that they would adopt the terms used for health instruction, seeking, as HPP#15 stated, "*the most suitable way*" to achieve patients' comprehension. In other words, where a group's knowledge base unknown and/or verified objectively, we must turn to perceptions at play within the interaction to extrapolate CG factors. The PPs understood that their healthcare providers are committed to conveying challenging information until the patients fully comprehend it, and HPPs accepted this as a requirement they must meet.

<u>Privacy and security:</u> In the PHPFFC model, the writers designated that providing data in the eHealth systems would always increase the privacy risks (Basahih & Kuziemsky, 2017). Nevertheless, they indicated the importance of considering these points as it increases the trust among users. In the PHPFFC V2.0 model, whereas some concerns about privacy and security were indeed expressed, a significant number of HPPs held the view that electronic records pose a lower security risk than do paper records. For example, ten of sixteen HPPs answered "*Yes*" when asked if Sehaty poses less risk to patients' privacy than paper records.

<u>Device ownership and Sehaty highly effective thus far:</u> In our results, ten of sixteen HPPs believed that Sehaty would increase patient healthcare overall. Critically, many arrived at this conclusion through satisfaction with current Sehaty usage, as well as common knowledge that PPs

in this context have high rates of device ownership – observations consistent with Basahih and Kuziemsky's (2017) factors (p. 52)[71]. For example, from the quantitative data, all PPs stated that they have the necessary resources to use Sehaty, and 88.8% of them found that Sehaty helps them to understand their health condition (p. 133)[72]. From the qualitative data, we revealed that all HPPs owned different types of technology, such as iPad, desktop, and iPhone (p. 141)[73]. HPP#6 also stated that "*Sehaty would be a beneficial tool for patients, as patients gain a greater understanding of their health condition"* (p. 138)[74].

Patient self-direction, real-time sharing/tracking, and healthcare provider-provider sharing information via ICIS: We can refer those factors as collaboration actions. Our results show that PPs can self-direct to a certain extent because healthcare providers can potentially preclude information misuse with real-time tracking of patients' conditions. For example, from the quantitative data, 89.7% of PPs reported they track their health conditions, and 77.9% of PPs felt that Sehaty allows them to prepare questions for their healthcare providers for their next visit (p. 130)[75]. From the qualitative data, HPPs also reported that Sehaty would enable patients to track their health data at any time and use it as a self-educational tool. For example, the expressions of HPP#1: "*... accessible at any time…*" and HPP#13: "…*most patients are pre-educating themselves*…" (p. 138 and 143)[76].

The accessibility to the data is also supported the sharing knowledge and clinical files among all HPPs via the Integrated Clinical Information System (known as ICIS) at the hospital. According to HPP#14: "*... I use ICIS on my computer at work...*" (p. 141)[77]. Our data also revealed

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[71] As discussed in Chapter 3, Information Common Ground
[72] As discussed in PPs–Technology
[73] As discussed in HPPs–Technology
[74] As discussed in HPPs–Information and Knowledge
[75] As discussed in PPs–Information and Knowledge
[76] As discussed in HPPs–Information and Knowledge, and Workflow
[77] As discussed in HPPs–Technology

that the opportunity of accessibility allowed patients to share their health information with outside doctors for the second opinion. For example, HPP#5 said: "*... I love it [Sehaty] as I [as a patient] can access it from anywhere, and I can show it to any doctors outside the hospital (or even outside the country) for further consultation."*

B. CG Factors —Technology

In technology CG, Basahih and Kuziemsky (2017) indicated that providing different types of tools to those having technical ability; introducing training workshops for tools' use; and, determining how these tools will be used (e.g., for communication) would be beneficial for end-user (p. 52)[78].

Type of eHealth tools: The initial PHPFFC model indicated that hospitals or organizations must adopt a diversity of eHealth tools to account for potential limitations, possibly caused by poor technical skills (Basahih & Kuziemsky, 2017). Similarly, here in the PHPFFC V2.0 model, our data revealed that the hospital provides both phone and e-mail as direct communication tools between patients and healthcare providers. For example, 78% of PPs used the phones to communicate with their healthcare providers. HPP#13 reported: "*We use phone and e-mail with patients. Also, we use a phone, pager, e-mail, and WhatsApp [mobile application] with my colleagues.*" While it is true that Sehaty not currently operating as a direct communication tool, some 34.6% of PPs (p. 133)[79] and several HPPs reported it is commonly perceived as a tool for indirect communication. For instance, given its appointment-booking feature, HPP#2 said: *"Sehaty would reduce the amount of time needed to contact patients to simply change or cancel appointments…"* (p. 143)[80]. Our results show that both PPs and HPPs enjoy and appreciate appointment booking, cancelling, and rescheduling as an effective time-saving feature. Sehaty

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[78] As discussed in Chapter 3, Technology Common Ground
[79] As discussed in PPs–Technology
[80] As discussed in HPPs–Workflow

usability and design encouraged users with the mid-to-high technical ability to use it. Our quantitative data shows that PPs have mid-to-high technical expertise due to several reasons (p. 133)[81]. For example, 96.3% of PPs possessed the knowledge required to use the application, and 58.9% of PPs felt that Sehaty's simple design encouraged them to use it. Also, from the qualitative data, HPP#1 said: "*[Sehaty] Handy, flexible, accessible at any time. [The] Sehaty application is easy to use*". One concern was the availability of lab results in English only, something that must be mitigated by translation services. Although some patients who do not know English may hesitate to use Sehaty as it shows the lab results in English only as mentioned by HPP#2: "*Sehaty provides … lab results in English…*" (p. 138)[82]. However, this is not the case in our study, as 82.2% of PPs reported no need to present the lab results in Arabic (p. 130)[83].

Notifications generated and disseminated through eHealth tools also align with the priorities of both. The hospital provides different notification tools to patients. 99.1% of PPs reported that they received alert text messages to their phone, and all of them thought it is a useful tool that encourages them to communicate with their healthcare providers. 13.1% of PPs received notification via e-mails, and 66.4% of PPs thought e-mail supports communication. 2.8% of PPs received notification via social networks, and 52.3% of PPs thought is useful to enhance communication. Finally, 4.7% of PPs knew that the hospital provides a text platform, such as a blog or website, that allows them to send and receive messages with their healthcare providers, and 83.2% of PPs thought it would improve their communication.

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[81] As discussed in PPs–Technology

[82] As discussed in HPPs–Information and Knowledge

[83] As discussed in PPs–Information and knowledge

Delays, technical disruptions circumvented by other means (Phone): Although eHealth information is more secure than paper documentation, healthcare providers and patients must have mutual trust that technical interruptions will not hamper clinical activity and information sharing. From the quantitative data, 66.4% of PPs preferred communicating in person if they are unable to receive responses from their healthcare providers via phone. From the qualitative data, we found that the majority of HPPs (10 out of 16) were unconcerned about this factor since former means (such as phones) are used in cases of power outages or Internet service disruptions. Also, the hospital provides HPPs with a training program, and IT supports (p. 141)[84].

Potential third-party connections (pharmacists) and privacy concern (more secure): As we mentioned earlier (p. 146)[85], our data indicated the advantages of Sehaty is its accessibility. Sehaty would enable patients to share health records with outside doctors for the second opinion. Also, 10 of 16 HPPs Sehaty poses less risk to patients' privacy than paper records. The eHealth systems also facilitate communication among healthcare providers within a secure hospital network (i.e., via ICIS) or other departments such as pharmacy. For example, HPP#14 said: *"... mostly I use ICIS on my computer at work to [review] document[s] and observe patient progress, and I also use Pyxis for medication [services]."*

Determination of how users will use eHealth tools: The second factor in technology CG, in the initial PHPFFC model, is the determination of how tools will be used for healthcare communication – i.e., urgent and non-urgent issues, synchronous and asynchronous communication (Basahih & Kuziemsky, 2017). The authors mentioned that it is challenging to obtain the determination of one tool; thus, they advised providing various tools that support communication and satisfying its needs. Similarly in the PHPFFC V2.0 model, it is essential for

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[84] As discussed in HPPs–Technology

[85] As discussed in CG Factors–Information and Knowledge

end-users (especially patients) to understand the type of information shared through various features of the platform in question. For example, urgent care matters should not be addressed via Sehaty's communication feature. HPPs prefer that patients call them back when they experience an urgent matter. For example, HPP#14 reported: "*... sometimes we ask them [patients] to call us back once they have an urgent situation…*" In contrast, Sehaty is ideally suited as educational tool for non-urgent information acquisition. Our data revealed that PPs perceived usefulness of using eHealth tools such as 88.8% of PPs used the Internet, and 86% of PPs felt that Sehaty increased their knowledge about their health condition (p. 130)[86]. Also, HPP#13 said that patients could pre-educating themselves with eHealth systems usage, and HPP#4 mentioned that patients can access their health records from anywhere, and at any time (p. 143 and 145)[87].

C. CG Factors —Workflow

In the initial PHPFFC model, Basahih and Kuziemsky (2017) reported that workflow CG has two main parts: timing and extent of communication activities and understanding how new roles will alter users' workflow.

Timing and extent of communication activities: In the PHPFFC model, workflow CG begins with the mutual understanding of the expectations and limitations of eHealth tool use (p. 53)[88]. For example, patients knowing the difference between an urgent matter and routine matters facilitates proper decision-making with respect to when and how to use certain eHealth tools. Also, the authors mentioned that educational tools such as a library link about health information specifically for patients' conditions would enhance their awareness about the type of questions they might ask (Basahih & Kuziemsky, 2017). In the PHPFFC V2.0 model, our results show that HPPs understood that patients do not object to using their personal time to search for information

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[86] As discussed in PPs–Information and Knowledge
[87] As discussed in HPPs–Workflow and Anticipated Interaction and Outcomes
[88] As discussed in Chapter 3, Workflow Common Ground

through eHealth tools. For example, HPP#6 said: *"The fact that the Internet is everywhere would increase the health curiosity among patients," and, 75.7*% of PPs reported no time issues when searching online for health information. Patients, by contrast, must respect that the presence of an eHealth tool does not automatically increase access to clinicians (use specification), nor can they use these tools as free alternatives to paid healthcare services. This concern grows more acute as more patients take advantage of eHealth tools. For instance, 98.1% of PPs indicate that they are willing to collaborate with their healthcare providers in the future (p. 133)[89].

Efficiency gains through patient self-direction, more consistent record keeping, HPPs' trust in patients knowledge expanding: Efficiency gains are possible through patient self-direction (e.g., 77.9% of PPs formulated questions due to Sehaty use, p. 135)[90], which is partly underpinned—as our data showed—by HPPs' confidence in patients' health literacy expanding. Several HPP#s (e.g., 7, 12, and 13) viewed expanded health knowledge as an essential precondition for streamline workflow. In addition, better, more consistent record keeping enhances patient self-direction. We provided earlier several examples in this matter, e.g., 89.7% of PPs returned to Sehaty to track their health condition (p. 133)[91], and HPPs believed that Sehaty provided updated patients data (p. 130)[92].

Understanding and consensus on how new roles such as system navigation or increased patient participation will alter workflow: In the PHPFFC model, the authors reported that new eHealth tools such as a communication tool would promote teamwork among patients and healthcare providers, and would improve relationships (Basahih & Kuziemsky, 2017). In the PHPFFC V2.0 model, we found other components that could affect patient–healthcare providers'

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[89] As discussed in PPs–Technology
[90] As discussed in PPs–Anticipated Interaction and Outcomes
[91] As discussed in PPs–Technology
[92] As discussed in PPs–Information and Knowledge

communication due to the current use of Sehaty, or by adding a direct communication tool to Sehaty in the future. For example, HPP#14 opinion adding a direct communication tool to Sehaty: *“Yes, having Sehaty as a communication tool would improve the application. Also, adding a communication tool would be a good way to communicate with patients.”* Factors like Sehaty use specification (i.e., Sehaty not intended to expand access to clinician’s time), expressed mutual commitment to collaborate among patients and healthcare providers, and the need for the emerging role.

Sehaty use specification: We explained earlier from our data with some examples that PPs and HPPs agreed that Sehaty is an application for patients’ use (p. 133, 134, 141, and 143)[93]. Also, Sehaty did not have a direct communication tool that allows patients and healthcare providers to communicate. In other words, Sehaty is not intended to expand access to clinicians’ time. Notwithstanding, patients perceived usefulness of Sehaty due to its viewability and accessibility to their health records as well as using specific tools to re/book appointments and a medicine refill (p. 150)[94]. For example:

> *“Sehaty would help my [as a patient] workflow in terms of the accessibility of the Sehaty application from anywhere and at any time. This would reduce the time [I spend on certain tasks (e.g., view lab results)] in terms of contacting the hospital via phone or having to be there in person.” (HPP#4)*

Expressed mutual commitment: Since all PPs perceive usefulness from Sehaty use, all PPs intend to continue using Sehaty, and 98.1% of them are willing to collaborate with their healthcare providers in the future (p. 141 and 145)[95]. On the other hand, HPPs also indicated that they are currently, and will continue to collaborate with their patients. For example, all the HPPs stated that

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[93] As discussed in PPs and HPPs–Technology and Workflow

[94] As discussed in CG Factors–Technology

[95] As discussed in PPs–Technology, and Anticipated Interaction and Outcomes

eHealth tools are an essential part of their jobs (p. 141)[96]. HPPs mentioned several situations where they needed to communicate with their patients (p. 150)[97]. For example, HPP#12 said: "*... to follow up with patients, explain health information, and give them instructions to prepare them for their next visit.*"

Emerging role: Workflow factors are likely to evolve as end-user numbers increase. Thus, we anticipate emerging roles within healthcare facilities in response to workflow concerns. For example, many HPPs suggested the possible need for more data entry specialists; alternatively, HPPs may be assigned to full-time Sehaty monitoring as a strategy for offsetting workflow inefficiencies. For example, HPP#16 reported: "*Adding a two-way communication option via Sehaty is a good idea. However, this new job should be for a capable person who can be available online to answer patients' concerns".* Most promising among our results from a workflow perspective was that the HPPs and PPs overwhelmingly declared their willingness to collaborate in the future.

D. CG Factors —Anticipated Interaction and Outcomes

Basahih and Kuziemsky (2017) conclude that the use of eHealth tools may yield collaborative outcomes as well as improved day-to-day healthcare delivery (p. 54)[98]. In our finding, PHPFFC V2.0, among anticipated interaction CG, there are four mutually reinforcing factors: Using eHealth tools promotes collaborative outcomes, daily routine outcomes, PPs commitments to use eHealth tools for communication to improve their health concern, and HPPs commitments to communicate with their patients as it is their duties.

First, Rapprochement of patients and healthcare providers' consequences on eHealth tools would promote collaborative outcomes: In the initial PHPFFC model, the authors reported that

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[96] As discussed in HPPs–Technology
[97] As discussed in CG Factors–Technology
[98] As discussed in Chapter 3, Outcome Common Ground

eHealth tools would create teamwork (i.e., a collaboration action) between patients - who are updating their health information online - and healthcare providers who are monitoring patients' data (Basahih & Kuziemsky, 2017). They also suggested that the hospital or healthcare providers should provide educational tools to patients to instruct them on how they use eHealth tools and improve their eHealth literacy (i.e., technical skills and health knowledge), which support facilitating and enhancing communication. In the PHPFFC V2.0 we found that:

Communication tool improves the relationship: The results found that both parties use the communication tool to improve the relationship between them. The PPs used different communication tools; 78% used phones, 14% used smartphone e-messages, and 8% used e-mail to communicate with their healthcare providers for various reasons (p. 150)[99]. General health concerns (55.1% of PPs), clarifying health information (41.1% of PPs), and making complaints (26.2% of PPs), top the list of reasons for patient-initiated communication (p. 135)[100]. On the other hand, as we mentioned in the previous section (p. 153)[101], HPPs also needed to communicate or communicate back with their patients for different reasons such as "*to follow up with patients, explain health information, and give them instructions to prepare them for their next visit*" (HPP#12). Or, "*...sometimes we ask them to call us back once they have an urgent situation*" (HPP#14). On a related note, the enhancement of Sehaty's communication tool will permit HPPs to foster this expanding knowledge and take advantage of it to gain workflow efficiencies (p. 143)[102].

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[99] As discussed in CG Factors–Technology
[100] As discussed in PPs–Anticipated Interaction and Outcomes
[101] As discussed in CG Factors–Workflow
[102] As discussed in HPPs–Workflow

The eHealth tools improve patients' health knowledge and exchange information: as indicated in the initial PHPFFC model that educational tools support patient-healthcare providers' communication and improve patients' understanding (p. 54)[103]. Similarly, here, in the PHPFFC V2.0, eHealth tools improve patient's health knowledge and help exchange health information. In the PPs–Information and Knowledge section, we provide some examples of PPs' perception of the usefulness of eHealth tools –to learn more about their health condition and improve their health knowledge (e.g., 88.8% of PPs Sehaty helps to understand their health situation) (p. 130)[104]. Thus, Sehaty and the Internet are considered educational tools that allow patients to educate themselves about their health condition or answer health concerns, and/or devise appropriate questions for clinicians. Also, eHealth tools allow PPs to track their health information and prepare questions to share it with healthcare providers for updating or to answer concerns (p. 135)[105]. On the other hand, in HPPs–Information and Knowledge section, we provide some examples of how HPPs take a positive view of patients' prospects for improving their health knowledge and pre-educating themselves (e.g., as mentioned by HPP#s 7, 12, and 13) (p. 138)[106]. Also, several HPPs reported that eHealth tools supported sharing information with other healthcare providers (p. 146)[107].

Second, the outcome also measures the daily routine of healthcare delivery overtimes and underlying outcome by real-access time, sharing of information, making informed decisions, and managing documents (p. 54)[108] – similar here to those mentioned in the original PHPFFC model. For example, in the PHPFFC V2.0, our data also illustrated that PPs and HPPs noticed the Sehaty provides real-access time to patient's health records (p. 135 and 138)[109]. Also, eHealth tools

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[103] As discussed in Chapter 3, Outcome Common Ground
[104] As discussed in PPs–Information and Knowledge
[105] As discussed in PPs–Anticipated Interaction and Outcomes
[106] As discussed in HPPs–Information and Knowledge
[107] As discussed in CG Factors–Information and Knowledge
[108] As discussed in Chapter 3, Outcome Common Ground
[109] As discussed in PPs–Anticipated Interaction and Outcomes, and HPPs–Information and Knowledge for examples

allowed PPs to share information and make informed decisions about related health concerns due to eHealth tools use (p. 146 and 143)[110]. Finally, HPPs indicated that eHealth tools allow the hospital to manage documents by keep patients' health information records online and updated (p. 145)[111].

Third, <u>100% of PPs commit</u> to future Sehaty use and collaboration with their healthcare providers (p. 133)[112]. Finally, all HPPs indicate that their duty is to <u>communicate and collaborate</u> with their patients for any concerns as they are professional (p. 153)[113].

In conclusion, we illustrated how the initial PHPFFC model used in the transition to representing our data in the PHPFFC V2.0 model and other factors developed from our empirical results. The PHPFFC V2.0 model shows the current empirical factors that affected PPs and HPPs at KFSH&RC in Riyadh. This study examined the CG Factors required and used between PPs and HPPs to reach their current satisfaction level with eHealth use for both groups of users. We developed four main factors (information and knowledge; technology; workflow; and anticipated interaction and outcomes) in our adopted model as the basic requirements for our explanation to produce eHealth-mediated communication tools. The model also explained the value of eHealth tools, such as Sehaty, to support the understanding of CG concepts between PPs and HPPs, for instance, the types of health information that should be exchanged using Sehaty. The following section provides a more in-depth discussion of the CG development that was produced from this study's research questions (RQs).

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[110] As discussed in CG Factors–Information and Knowledge, and HPPs–Workflow [i.e., Argumentative Patients section]

[111] As discussed in HPPs–Anticipated Interaction and Outcomes

[112] As discussed in PPs–Technology

[113] As discussed in HPPs and CG Factors–Workflow

6.2 CG Development:

This section explains the CG development at two different stages. The first is the CG cycle stages, as well as examples of those stages from this study's results (see 6.2.1). The second links the CG concepts of the RQs to the PHPFFC V2.0 model (see 6.2.2).

6.2.1 CG Cycle

As noted, there is a lack of studies dealing with multi-group CG development in general, and none at all for a healthcare context in the KSA. The current study thus does not contest or extend extant empirical studies. Rather, it tests and extends calls for research on multi-group CG development and offers context specific nuance to the theory based PHPFFC model of Basahih and Kuziemsky (2017). The objective of this study is to derive CG factors for two separate groups and explain the dynamic CG development cycle, following the work of Kuziemsky and O'Sullivan (2015). Building on similar work, Kuziemsky and O'Sullivan described the stepwise process of CG development as being part of a collaborative process (2015). CG factors do not emerge randomly, nor do they align spontaneously simply because fundamental requirements, such as language and knowledge, are present. Individual–individual relationships and idiosyncrasies of context shape a highly contingent process through which users develop and share knowledge, and each group mutually perceives a willingness to collaborate.

Describing the advent of PP–HPP collaboration presents unique challenges because the PP–HPP relationship is already collaborative by its inherent nature. Our task was thus to illustrate a process by which some elements of long-standing relationships—characterized, by definition, by large knowledge differentials—were displaced and reconfigured in a form of mediated communication, Sehaty for example in this case. The process is at once cumulative and, sometimes, regressive, an especially pronounced dynamic in the case of the system at the center of this study.

CG develops through three stages, with each building on the shared knowledge established in the previous stage (Kuziemsky & O'Sullivan, 2015). *Coordinative CG* comes first and refers to the establishment of mutual awareness of communication strategies and the importance of coordinating information exchanges. *Cooperative CG* follows and emphasizes relationship building, especially relationships formed as a direct result of shared practices at the coordinative stage. Collaboration in these first two stages is commonly geared toward defining protocols of the communication process itself. Third, *collaborative CG* is reached when established, trusting relationships are secured, and the implementation of agreed-upon practices replaces developing and defining those practices. Studying a different user-group context, Kuziemsky and O'Sullivan (2015) associated this stage with a retreat of formal governance and a higher degree of autonomy for groups and practitioners.

In addition, Kuziemsky and O'Sullivan's (2015) three-stage development cycle has been supplemented with foundational literature on CG. As Clark and Brennan (1991) indicated, grounding changes depending on the medium and as interlocutors' purposes change. Furthermore, purpose and medium change in relation to each other. Thus, in addition to categorizing statements according to a given stage of CG development, we also pinpointed instances where participants altered their grounding strategies on a fundamental level to effect transitions between stages. Moreover, where possible we explained how changes of purpose—how people understand the purpose of eHealth tools (e.g., Sehaty) itself, and how they decide to use it—both within and across the two groups, either expedite or frustrate the development cycle. Tracing these interactions is especially challenging when, as in our case, it is not a simple matter of one set medium being swapped for another, such as phones and e-messaging. By its nature, this study was predicated on participants' speculation about how this relatively new medium might itself be altered to meet purposes that are, in turn, based on pre-existing assumptions by each group regarding the other.

A. Coordinative CG: Examples from the Data

> *"[Sehaty is] a* ***completely accessible*** *health record that is easy to track" (HPP#5)*
> *"[Sehaty will] keep the information* ***updated and available****" (HPP#15)*
> *"****I wouldn't deliver*** *critical health results to them on Sehaty" (HPP#4)*

These three comments offer insights into the coordinative stage of CG development, the stage that "brings people together and provides a governance structure for conversation, networking, and information exchange" (Kuziemsky & O'Sullivan, 2015, p. 233). It is at this stage that fundamental logistical issues are identified and resolved. The first of these statements reflects the most crucial problem of all, namely that given pre-existing relationships between HPPs and PPs, mediated exchange of information (through Sehaty) is both technically feasible and beneficial. The bolded text reveals awareness and confidence that accessibility issues will not inhibit CG development at this stage.

Whereas the first statement relates to the most fundamental aspect of accessibility, the second comment recognizes critical logistical criteria for sustained CG development. Here the emphasis is placed on the maintenance and currency of information afforded by Sehaty. Both, we argue, are first-order preconditions for securing individual commitments to CG, and to a recognition that the process of developing appropriate protocols for Sehaty usage will be worthwhile.

Finally, statement three acknowledges the possible limitations of CG development at the coordinative stage. In this instance, HPP#4 resists the idea that Sehaty might feature critical health information. Nominally, reservations of this nature appear to work against CG, but this was not the case. On the contrary, we assess objections of this nature as crucial expressions of counter-intuition, which are equally crucial to coordinative CG. They are essential to the extent that they invite the sharing of ideas about protocols for possibly circumventing limitations. Several HPPs mentioned standardized data entry protocols, for instance, as key to minimizing misunderstandings and misinterpretations of health records. A clear presentation of information, as HPP#13 noted, maximizes the number of patients who can "*view necessary data that help them generate a proper diagnosis*." This statement is uniquely reflective of CG development because it refers directly to finding ways that patients can share in the same information that healthcare providers themselves have employed in establishing diagnoses. This indicated a two-way arrangement, a relationship that strengthens once knowledge empowers patients to have more involvement in their healthcare delivery.

B. Cooperative CG: Examples from the Data

> *"It is a **good sign** that most patients are **self-educating** themselves" (HPP#3)*
>
> *"We must consider that we are on **our patient[s'] side** and there to help them…We can educate them and provide needed support, so they **remain in contact** with us." (HPP#3)*
>
> *"They can use it to … track their health condition... [It**] increases patients' care**" (HPP#12)*

Cooperative CG follows coordinative and features the establishment of rules and protocols for collaboration—precursors "to forming trust and collaborative culture for problem-solving" (Kuziemsky & O'Sullivan, 2015, p. 233). As we have shown, HPPs in our study have notable confidence in most patients' abilities to be empowered with additional knowledge to take an active interest in healthcare delivery. The first statement refers unambiguously to the perceived benefit of patient self-education. The second statement is equally clear about the link between patient self-education and relationship building, the critical feature of cooperative CG formation. In short, HPPs in our study reflect on patient self-education as more than a personal matter (for patients) but as a building block for relationship development.

Our data also reflect a tacit consideration by HPPs of long-term CG development through an operative theme: self-reliance. As HPP#10 stated, Sehaty will help patients to be "*self-reliable rather than depending on you for every inquiry or help.*" Building on the self-reliance theme, collaboration engendered by patient empowerment can have a positive effect on HPPs' workflow efficiencies, according to HPP#2:

> *"Sehaty would reduce the amount of time needed to contact patients to simply change or cancel appointments, so we can spend more time on another patient's care. Sehaty also helps patients check, update, and track health records. Therefore, Sehaty would also provide lab results to patients when the results are good and there is no need for the patient to contact us back, especially with patients who have high health literacy."*

However, CG development is not necessarily an open-ended practice. Our data showed how, at the cooperative stage, protocols also negotiated for setting limits according to users' expectations and needs. Here, differences of opinion are especially salient because their resolution (or persistence) bears so directly on the nature of relationships that develop at this stage. On the one hand, HPPs are not in complete agreement as a group over the nature of the information to be shared, with concerns about workflow inefficiencies being part of the difference. As HPP#3 reported, *"[communication of challenging information via Sehaty] will negatively affect the workflow*." However, more significant differences of opinion emerge when patients who are armed with information from electronic sources challenge healthcare providers' opinions. HPP#1 noted candidly, "*I don't like it*," and HPP#8 "*considered it a problem*" any tendency for patients to develop contrary opinions.

This division is mostly a matter of emphasis between the notion that information sharing is positive in general and the proposition that information sharing is only positive, given careful determinations about the nature of the information itself. Some HPPs offered decidedly non-collaborative statements as, for example, when blaming patients for difficult issues: "*It is the* *patients' fault [when disagreements arise]*." Similarly, others reasserted the ultimate knowledge differential between patients and healthcare providers: "*…we are specialists in understanding patients' health condition.*"

Significantly, this exposes a cleavage between the pre-existing, traditional relationship between patient and healthcare providers, and the one being reformed and mediated through Sehaty. In short, the nature of relationships developed at the cooperative stage of CG is partly predicated on a shared sense of new possibilities for information exchange, but also on an agreement as to its limitations. Thus, the third statement above, which explains the most elemental purpose for cooperative CG: improved patient care.

C. Collaborative CG: Examples from the Data

*"**I can't ask patients** to not look for health information online." (HPP#15)*
*"[I must] explain the health information to them **anyway**" (HPP#6)*

Collaborative *CG* is the stage at which a degree of trust has been established between parties; relationships have been well established; all protocols developed through the cooperative stage have been implemented (Kuziemsky & O'Sullivan, 2015). Our study identifies that the greatest challenge to CG development concerning Sehaty lies in the disagreement over "risky data" and argumentative patients. However, tensions over this potential limitation to CG development resolved in HPPs' acceptance of a professional duty of healthcare.

Thus, in the healthcare setting studied here, and through the lens of the above tension, we identify critical indicators of collaborative CG development. Crucially, as in the first statement above, HPPs accept the ubiquity of the Internet and the information it delivers. How this acceptance relates to collaborative CG is indicated by other HPPs who acknowledge that misunderstandings must be resolved, no matter what the cause. HPP#6 expresses this in the second statement above. Development of collaborative CG for Sehaty is typified, our data show, by the broad recognition that part of using the tool entails making an extra effort or finding workarounds to difficulties—both driven by the trusting relationships established at the cooperative stage. A distinct and relatively simple *workaround* is for HPPs to "*ask for face-to-face communication.*" In contrast, another is to redirect the patients to other healthcare providers who are better able to assist. Both of these two strategies reflect successful relationship development to the extent that they signal, to both parties, that alternatives are available and will willingly be sought. They also define the collaborative stage outlined by Kuziemsky and O'Sullivan, (2015) to precisely the extent that they are, in effect, autonomous actions undertaken to solve problems and, critically, preserve the initial relationships between PPs and HPPs. The following section illustrates the three RQs' CG more in-depth and links them to the PHPFFC V2.0 model.

6.2.2 CG of the RQs and the PHPFFC V2.0

This study introduces three RQs, which are: RQ1, how do eHealth tools influence healthcare providers' workflow? (p. 99)[114]; RQ2, does increased use of eHealth tools improve healthcare providers' and patients' relationships? (p. 115)[115]; And, RQ3, how do patients' eHealth literacy levels influence their communication with healthcare providers? (p. 124)[116] we answered those questions in Chapter 5. In this section we are exclusively addressing the CG concepts, from PPs and HPPs perspectives, drawing from RQs' results and linking them to PHPFFC V2.0.

A. RQ1: CG Development: Links to the PHPFFC V2.0

1) RQ1: CG – Information and Knowledge

Nearly all PPs (98.1%) signaled both coordinative and cooperative CG of the first order through their expressed willingness to interact with HPPs through online tools to effect improved health outcomes (p. 130)[117]. HPPs shared this coordinative CG; they saw patients' online

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[114] See RQ1's results in section 5.2.2
[115] See RQ2's results in section 5.2.4
[116] See RQ3's results in section 5.2.6
[117] As discussed in PPs–Anticipated Interaction and Outcomes

explorations as a "*good sign*," a revealed awareness that information is expandable and exchangeable (p. 162)[118]. HPPs' coordinative CG was further reflected in the acknowledgment that first, Sehaty has been effective thus far, and second, that it is effective because of patients' education levels and language competency. Cooperative CG was indicated by HPPs' recognition that patients can self-direct their healthcare experience to a certain extent (p. 146)[119]. That is, the HPPs did not insist as specialists on exercising exclusive control over what patients know and how they know it.

With respect to knowledge and information, the abovementioned factors establish that the initial required steps toward collaborative CG have been taken. One potential constraint on this development was indicated by many of the HPPs, who expressed concern that some patients will be unable to interpret complex, critical health information, namely those with little acquired health knowledge (p. 138)[120]. However, this clearly does not preclude information exchange per se for HPPs or, as was shown in our discussion of CG for anticipated interaction and outcomes, offset these constraints (p.156).

2) RQ1: CG – Technology

The PPs own electronic devices and deploy them to acquire and share health information at extremely high rates: 100% own smartphones (p. 133)[121] and nearly 100% already use Sehaty in ways that meet HPPs' general approval (p. 143)[122]. Many HPPs reported that if anything, promotional schemes are necessary to extend the basic awareness of Sehaty's mere existence. These factors, coupled with recognition by both PPs and HPPs that Sehaty is easy to use and accessible, point to coordinative and cooperative CG with respect to technology itself (p. 162)[123].

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[118] As discussed in Cooperative CG: Examples from the data

[119] As discussed in CG Factors–Information and Knowledge

[120] As discussed in HPPs–Information and Knowledge

[121] As discussed in PPS–Technology

[122] As discussed in HPPs–Workflow

[123] As discussed in Coordinative CG: Examples from the data

Smartphone ownership and ease of use, recognized by both groups, secure a mutually shared sense that information is available and readily exchanged through smartphones. One potential barrier to CG development under this heading is the availability of lab results exclusively in English (p. 150)[124].

Finally, technical problems arise in the form of power outages and disruptions to the Internet service (p. 150)[125]. Management of such problems, largely beyond the control of either group in this study, frames cooperative and collaborative CG. The HPPs stated plainly that in worst-case scenarios, the two sides transmit information by existing, tested means, such as telephone.

3) RQ1: CG – Workflow

Coordinative and cooperative steps lead to collaborative CG in one aspect of workflows. HPPs reported that when patients use Sehaty to schedule and reschedule appointments, they save time; 34.6% of PPs shared in this collaborative CG (p. 134, 143, and 150)[126]. Though a relatively small proportion, we suggest that this figure is almost certain to grow, given an expressed 100% commitment to future Sehaty use among PPs. In contrast, workflow concerns—particularly those of HPPs—were complex, and some appeared to work against the advent of CG in this area (p. 156)[127].

Furthermore, most HPPs expressed some degree of concern that less knowledgeable patients will struggle with risky data, resulting in interruptions to workflow, due to HPPs' duty to clarify the health information (p. 143 and 165)[128]. This applies to elderly patients as well, although this concern is mitigated by the common practice of younger family members accompanying

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[124] As discussed in CG Factors–Technology
[125] As discussed in CG Factors–Technology
[126] As discussed in PPs–Workflow, HPPs–Workflow, and CG Factors–Technology
[127] As discussed in CG Factors–Anticipated Interaction and Outcomes
[128] As discussed in HPPs–Workflow and Collaborative CG: Example form the data

elderly relatives on clinical visits. Finally, once armed with information from electronic sources, some patients may interrupt workflows by challenging clinical decisions (p. 135)[129]. On account of these factors and following Clark and Brennan (1991), we suggest that HPPs may perceive high reception and repair costs associated with collaboration and may thus resist collaborative CG in this instance. Cooperative efforts toward use specification—Sehaty must not be used as a replacement for in-person visits—will likely be a critical related step if collaborative CG is to be sustained in this area. However, some of our data indicated that this effect may be offset by efficiency gains through generally improved health records, as well as self-direction by patients with high levels of knowledge whose insights may engender faster clinical determinations (p. 153)[130].

4) RQ1: CG – Anticipated Interactions and Outcomes

This study encountered the strongest indicators of cooperation in this area, leading to collaborative CG. To begin with, a consensus existed among HPPs that the expansion of Sehaty's existing information exchange capacity will improve health outcomes, given PPs' stated commitment to its use (p. 156)[131]. Thus far, the basic technological infrastructure required for cooperative CG is in place and proving effective. Patients can and do seek information of a general nature; Sehaty specifically allows them to monitor their personal health conditions at any time as well as remotely when necessary.

Significantly, many other factors relating to anticipated interaction address the abovementioned constraints on CG under the three previous headings. Referring to the most common and damaging among them—the misinterpretation of risky data—the HPPs signaled a

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[129] As discussed in PPs–Anticipated Interaction and Outcomes
[130] As discussed in CG Factors–Workflow
[131] As discussed in CG Factors–Anticipated Interaction and Outcomes

collective commitment to a duty of due care irrespective of patient misunderstandings (p. 141)[132]. Several HPPs reported that no information can remain misunderstood. Regardless of situational workflow slowdowns, most clarified that all information must be conveyed effectively "*no matter what*." This entails a few select strategies, depending on the individual, all of which support the assertion that cooperative relationships develop into collaborative CG, especially in the case of anticipated interaction (p. 156)[133]. Some achieve development by changing grounding references, which is, repeating explanations using different vocabulary and syntax until patients achieve comprehension (Clark & Brennan, 1991). Others explained that they make repeated contact with confused patients using different methods (e.g., phone) until matters are settled. Some indicated that they extend the collaboration by finding other HPPs who may be better suited to offering the required explanation. All of these are compelling verifications of collaborative CG having been reached in this instance. Patients can see that the relationship has developed to the point that the expectation of immediate, helpful re-engagement is fully justified.

Similarly, many HPPs suggested that a direct-communication feature be added to Sehaty for faster responses and engagement, especially in critical health situations (p. 143)[134]. On its face, this is a gesture of collaborative CG that in practice holds the potential for reducing formulation, reception, understanding, and repair costs associated with mediated communication (Clark & Brennan, 1991). Ultimately, these may be interpreted in part as employment retention measures by healthcare providers. This cynical perspective, however, does not obviate the reality in practice, which is that mutually beneficial collaborative CG is achieved between groups that openly express their desire to collaborate in any case.

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[132] As discussed in HPPs–Technology
[133] As discussed in Factors–Anticipated Interaction and Outcomes
[134] As discussed in HPPs–Workflow

B. RQ2: CG Development: Links to the PHPFFC V2.0 model

1) RQ2: CG – Information and Knowledge

Under this heading, we observed strong indicators of both cooperative and collaborative CG. Whereas HPPs were concerned about mediated communication with patients who have low health knowledge, the data showed their full commitment to alter their descriptions as required, as well as to provide comprehensible explanations to patients to whatever extent necessary. To a considerable extent, this reflects conscious adjustments to grounding references by the healthcare providers (Clark & Brennan, 1991). One HPP referred to the use of "*clearer words*," whereas another spoke of finding "*the most suitable way*."

Most of the HPPs made clear that they readily adopt other means, such as phone, in cases of misunderstood information on Sehaty. We suggest that adjusted grounding references and the circumvention of Sehaty strongly indicate some calculation of the grounding costs described by Clark and Brennan (1991). In addition, most of the HPPs appeared to understand that the potential for misunderstanding by patients would result in added costs, especially in terms of formulating the information in the first place (formulation costs), as well as slow patient response (delayed costs; that is, potentially slow responses to critical health situations). In short, in the case of patients with low health knowledge, the HPPs signaled their commitment either to bearing some of the grounding costs associated with mediated communication or circumventing such costs with strategies that effect the desired outcome.

2) RQ2: CG – Technology

Mutual acknowledgment of Sehaty's ease of use along with PPs' high usage rates indicate both user groups' cooperative stance toward relationship-building. PPs consent to a relationship in which healthcare providers provide the optimal care available and maintain the most organized, secure records possible—two significant advantages of Sehaty recognized by both user groups.

Our data indicated some fully collaborative CG. However, for such collaboration to increase and be sustained, PPs must understand that some uses of the tool are optimal, such as booking appointment and receiving notifications, whereas others place unnecessary strain on the system, such as queries about non-urgent matters.

Moreover, the clearest evidence of collaborative CG in terms of the technology itself is apparent, such as HPPs' enthusiasm for sharing information with other healthcare providers to improve healthcare outcomes. Also, the HPPs were most collaborative in their clearly signaled commitment to circumventing technical disruptions associated with power supply and Internet infrastructure (p. 150)[135]. According to all HPPs, neither delays nor misunderstandings are tolerable because they handled both with other communication means, such as phone and/or in-person meetings. This aligns precisely with Kuziemsky and O'Sullivan's (2015) example of collaborative CG, as indicated by a shared awareness that direct engagement remains an option when technology falters. Once again, with reference to the work of Clark and Brennan (1991), the formulation, delay, and repair costs often associated with mediated communication are accounted for by other means and supported by neither group. Finally, although we necessarily rejected H1 (p. 114)[136], the PPs were satisfied with those variables most directly relevant to the question of the patient–healthcare provider relationship—the ability to book appointments at any time and receive real-time notifications (p. 134 and 150)[137].

3) RQ2: CG – Workflow

Workflow concerns are generally significant, especially for employees in resource-limited healthcare systems. Both groups expressed a fundamental and explicit commitment to collaboration through Sehaty's use. Patients who have low health knowledge and require

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[135] As discussed in CG Factors–Technology

[136] See H1 Results

[137] As discussed in PPs–Workflow and CG Factors–Technology

additional assistance do not affect HPPs, who accept such problems as part of their job and actively seek means of providing such assistance. In any case, most of the HPPs anticipated that patient health knowledge will improve, ensuring that this constraint will—if anything—erode (p. 135, 138, and 156)[138].

The PPs' willingness to spend time obtaining health knowledge through eHealth tools (active self-direction) would enhance collaborative CG and, as our data indicated, streamline clinical practice and diagnosis in many cases. Better, more secure record keeping facilitated by Sehaty underpins this collaborative CG considerably. Both groups perceived that on balance, Sehaty serves a vital purpose and that its use is, by definition, beneficial (cooperative CG).

For PPs and HPPs to remain on collaborative CG (thereby strengthening their relationship) with respect to workflow, both must understand emerging roles and extend collaborative behaviors. For example, in the event that use specification is unclear and PPs expect expanded access to clinicians' time via Sehaty, it may be anticipated that additional HPPs will be hired and assigned to handling Sehaty issues full time. There is no doubt that current healthcare practitioners would embrace such an emerging role; however, patients will be required to expand their cooperative and collaborative efforts to include new roles.

4) RQ2: CG – Anticipated Interaction and Outcomes

A general rapprochement between PPs and HPPs was indicated through their expressed commitment to collaboration. Our data gave no indication that either group doubted the advantages of Sehaty and the relationship-building potential it holds. Cooperative CG is well established in this sense. Prospects for sustained collaborative CG on Sehaty use, and thus the relationship itself, rest in part on mutual signs that interaction is not only expected but largely ensured. In turn, this

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[138] As discussed in PPs–Anticipated Interaction and Outcomes, HPPs–Information and Knowledge, and CG Factors–Anticipated Interaction and Outcomes

depends on mostly unpredictable changes to the dynamic as features are added to Sehaty, or as more patients seek its existing benefits.

Both groups expressed interest in the addition of a direct-communication chat feature that would, by definition, enlarge collaborative CG since healthcare providers would be able to offer clarification to patients who are increasingly health literate. This may, however, engender a paradoxical over-collaboration, or attempted collaboration, because patients expect more access to healthcare providers. For this collaborative exchange to be maintained, other features of the platform must continue to function effectively as usage rates grow. Just as important is that already established CG in those areas remains or grows. For example, the real-time functionality of Sehaty cannot be compromised with more traffic on the platform, nor can the effective management of health records or ability to make increasingly informed decisions be diminished, because they relieve pressure from areas where too much collaboration is sought.

C. RQ3: CG Development: Links to the PHPFFC V2.0 model

1) RQ3: CG – Information and Knowledge

Up to this point, terms such as trust and knowledge have been presented as synonymous with CG to some degree. RQ3 reorients these terms and places them explicitly in Q4 (p. 123)[139], hypothesizing that the CG development cycle it produces both understanding and trust. We have established that patients willingly spend their personal time in search of additional health knowledge. Although some do not develop sufficient knowledge to understand many health issues, a crucial conclusion from our data is that patients undertake the search for knowledge in good faith. HPPs' allusions to argumentative patients were mostly anecdotal and stand out for their dramatic nature; however, such circumstances were acknowledged to be rare. The HPPs clearly

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[139] See Q4 Results

recognized the personal efforts of patients as being cooperative and collaborative because they are generally made for the sake of formulating knowledgeable questions (p. 130)[140]. Healthcare providers' trust is thus a created, not presupposed, outcome of grounding in communication.

2) RQ3: CG – Technology

In Q3 we theorized that HPPs' intention to use eHealth tools for communication (with patients) would decline in relation to the type of data (risky data) available (p. 117)[141]. We rejected this in part because such concerns were not regarded as inherent to the technology itself, but rather connected to patients' knowledge levels (p. 119)[142]. Conversely, most HPPs recognized and appreciated Sehaty's role in increasing patients' health knowledge, as our data have shown. Continued use of Sehaty is thus part of the solution to the constraints it otherwise presents in low-knowledge cases. Indeed, as Clark and Brennan (1991) illustrated, mediated communication of this variety offers the benefit of reviewability to both user groups. In fact, technology CG is, somewhat paradoxically, secured in these cases as HPPs intensify efforts to ensure patients' comprehension. Furthermore, patients are assured that their misunderstandings will not reduce healthcare providers' use of Sehaty, because the latter (HPPs) make efforts to circumvent the system temporarily, as required, but not permanently. Challenging information does not obscure the recognized virtues of the technology, which buttress the cooperative and collaborative CG discussed in previous sections.

Referring to our question RQ3, patient knowledge affects communication with healthcare providers, but does not work against CG. In this instance, the stepwise development of CG entails a side-step of the technology itself as a conscious strategy for solidifying collaborative CG.

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[140] As discussed in PPs–Information and Knowledge

[141] See Q3 Finding

[142] See Q3 Results

3) RQ3: CG – Workflow

Our data showed that HPPs' apprehension about workflow inefficiencies do not harm the PP–HPP relationship (p. 153 and 156)[143]. The PPs and HPPs enjoy coordinative, cooperative, and collaborative CG in general with respect to Sehaty. The HPPs implied that patients can fail to comprehend complex information just as often in face-to-face interactions. Resolving a misunderstanding of Sehaty-based information is no more time intensive than resolving one within a clinical setting.

4) RQ3: CG – Anticipated Interaction and Outcomes

We found that although high health literacy can improve and expedite health outcomes through Sehaty use, the opposite was not true—low rates do not ultimately hinder HPPs' practice or reduce patients' comprehension. The difference lies in HPPs' duty of due care, as well as their recognition that they must achieve patients' comprehension irrespective of how misunderstandings are created in the first place. The PPs signaled their collaborative efforts with time commitments and high usage levels of a tool (Sehaty) that the HPPs regarded as expanding health knowledge. The HPPs signaled their collaborative efforts by altering their grounding strategies or temporarily circumventing Sehaty entirely as required.

HPPs further signaled collaborative CG by identifying the need for careful, systematic data entry with enhanced patient comprehension in mind. They have been doing this by anticipating and encouraging emerging roles, such as additional healthcare providers who may specialize in monitoring Sehaty. Therefore, in the future, the current user groups will need to extend the CG factors in our model to encompass other groups.

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[143] As discussed in CG Factors–Workflow and CG Factors–Anticipated Interaction and Outcomes

In this chapter, we discussed in detail the PHPFFC V2.0 model and its principle factors as derived from our data. Besides, using key elements from our findings, we described the dynamic CG development cycle using Kuziemsky and O'Sullivan's (2015) three categories. Finally, we systematically described links, for both user groups, between our model's factors and each of our three RQs. The following chapter presents a summary of this study, how some of our results were related to this study's literature review, as well as limitations and recommendations for future research.

Chapter 7 Discussion

This chapter summarizes the study’s findings and situates it concerning the extant studies discussed in Chapter 2 (see section 7.1 for the background and summary of the research, and 7.2 for the discussion and interpretation). Section 7.3 discussed our findings on the base of theoretical implications. Furthermore, in section 7.4, we discussed the next step that the Ministry of Health (MOH) in the Kindom of Saudi Arabia (KSA) should consider when building an eHealth tool such as a mobile health application. Finally, limitations are addressed (section 7.5), and some fruitful avenues for future research are introduced (section 7.6).

7.1 Background and Summary of the Research

The KSA is committed to adopting eHealth tools across its healthcare system. It is envisioned that individual patients and healthcare providers will be connected through eHealth tools, but the KSA’s healthcare facilities and organizations (public and private) will be mutually linked in this way. This study dealt explicitly with patient–healthcare provider exchange, although some potential implications for institutional linkages were also identified.

We employed quantitative (from patients) and qualitative (from healthcare providers) data in a mixed-methods analysis that addressed recognized shortcomings in scholarship dealing with eHealth tools. Hu (2015) offered an extensive review of the literature and noted a lack of integrated studies engaging multiple user groups. Individual group factors such as patient satisfaction (Beard et al., 2012) and healthcare providers are concerned about workload (Lusignan et al., 2014; Seto et al., 2010; Bae & Encinosa, 2016) have been given critical treatment. Financial cost issues in relation to technology implementation have also been studied (Choo et al., 2016); however, as Dohan and Tan (2014) made clear, theoretically rich accounts of dynamic, multi-group factors are scarce.

We offered a partial answer to this call by offering the patient–healthcare provider factors and functions for communication (PHPFFC) model, which presented patient and healthcare provider factors in opposition, and then established a “set of common functions for the development of” CG between them (Basahih & Kuziemsky, 2017, p. 123). The present study was the first to adopt the PHPFFC model for use in a context-specific empirical study. Chapter 5 examined and presented our data according to four assertions questions and a hypothesis corresponding to three research questions (RQs). From these, we derived factors relevant to eHealth tool usage unique to patient and healthcare provider factors independently.

Chapter 6 illustrated a presentation of our data-derived factors in a revised version of the PHPFFC, which we called the PHPFFC V2.0. All factors (for individual user groups and common ground [CG]) are categorized and presented under four headings: Information and Knowledge, Technology, Workflow, and Anticipated Interaction and Outcomes. This revised model addresses our overall question: Are challenges that people may face while using eHealth tool such as Sehaty related to the usability of the specific mobile application, or are they related to patient characteristics such as patients’ eHealth literacy, as well as to the impact of eHealth usage on healthcare providers’ workflow? We concluded that difficulties result partly from objective factors associated with each group independently. Also, arising from the dynamic anticipated interaction through each individual from each group (i.e., members of given group identity), and attach to subjective perceptions of each.

Drawing on Kuziemsky and O’Sullivan (2015), in Chapter 6, we interpreted derived factors and correlations in terms of common ground (CG) development cycle that follows a stepwise path through coordinative, cooperative, and collaborative stages. We tested correlations for group factors to establish CG factors necessary for the effective use of eHealth tools in the KSA. We also concluded each discussion of RQ results and linked it to the PHPFFC V2.0 by explaining how factors relevant to each RQ indicate CG development.

7.2 Discussion and Interpretation

In this section, we offer descriptions of CG findings, and our three RQs and explain the implications of this thesis concerning each.

7.2.1 Interpretation for RQ1: How do eHealth tools influence healthcare providers' workflows?

Due to the fact that scientific measurement of workflow rates over time was beyond the scope of this thesis, we elected to focus on participants' perceptions and anticipated outcomes. Our quantitative evidence supports the fundamental propositions regarding technical proficiency. The PPs responded favorably to Sehaty ease of use; 96.3% knew how to use the tool, with 87.9% noting its similarity to other applications they used daily; furthermore, 100% planned to use Sehaty in the future. Additionally, patients generally showed a favorable disposition towards using electronic platforms for health purposes. Favorable disposition, coupled with patients' high levels of education (65.4% held a university degree), supports our assumption of an increase in eHealth literacy rates among patients. Hoffman-Goetz et al. (2014) found that already-informed patients are more likely to seek and use collaborative tools to interact with healthcare providers.

Consistent with studies such as one by the Institute of Medicine (as cited in Finn, 2015), the healthcare providers in our study harbored some reservations about communication mediated through eHealth tools (see also, Beard et al., 2012; Rodriguez et al., 2011; Wald et al., 2007). In this study, many healthcare providers also objected, for example, to the presence of risky data on Sehaty. Healthcare providers' concerns about workflow inefficiencies factored into many of these studies. Most healthcare provider concerns are expressed as unverified anecdotes or hypothetical cases. Lacking longitudinal studies to test and verify anecdotal concerns of this sort, we developed

RQ1 to assess healthcare providers' general perceptions of patients and the latter's overall potential to use eHealth tools in a manner that is *likely* to deliver streamlined workflows.

To the extent that healthcare providers believe efficient use of eHealth tools depends on patients' health/eHealth literacy, we sought their (healthcare providers') assessment of these issues specifically. Healthcare providers were overwhelmingly satisfied with patients' use of Sehaty to date; few cases of actual workflow slowdowns were reported. Most importantly, healthcare providers in our study perceived the generally high education levels among patients; and were also aware that patients had responded favorably to Sehaty's easy-to-use interface. Healthcare providers widely held the view that patient use of eHealth tools is a "*good sign*" because it had already broadened some patients' health knowledge and is assumed to continue doing so.

Indeed, most healthcare providers recommend and welcome the addition of a direct-communication feature for Sehaty, one that will expand patient–healthcare provider communication. We interpreted such willingness in itself as evidence that the healthcare provider's trust that Sehaty will affect workflow efficiencies in the future. Paradoxically, more communication may improve workflows because, as Hoffman-Goetz et al. (2014) found, many patients become less reliant on their healthcare providers through such means. This also signaled an assumption among healthcare providers in our study that information shared with knowledgeable patients will result in inefficiencies, consistent with Wald et al. (2007).

A key implication of RQ1 findings is our demonstration that the qualitative measure, 'perception,' can be employed as a suitable (though not perfect) workaround for the problem of insufficient research on workflow rates. When asked generic questions about new eHealth tools, healthcare providers show a bias towards hypothetical examples of workflow inefficiencies. Finally, as reflected in our model's first CG category, data from RQ1 revealed strong signals from both sides to collaborate concerning navigating eHealth tools in the future. This is consistent with Rodriguez et al. (2011) and Masys et al. (2002) when their studies described the term of 'active coping' of patients who use eHealth tools and communicate with their healthcare providers, as a form of collaboration (see p. 55)[144].

7.2.2 Interpretation for RQ2: Does increased use of eHealth tools improve healthcare providers and patients' relationships?

Our key finding for RQ2 was that increased use of eHealth tools improves the patient–healthcare provider relationship, where the latter is defined mainly as a mutual trust that each will uphold their obligations as such tools implemented (consistent with Mitnick et al., 2010; Keller et al., 2011). Although our p-value calculations for H1 — that patient satisfaction with healthcare will increase with their use of eHealth tools — cast some doubt over this conclusion, several dependent variables expressing satisfaction did correlate. For instance, patients found it "beneficial" to receive messages through eHealth tools. Receiving messages (notification tools) also is a form of CG development that enhances the coordination of services (Dorr et al., 2007; Fuks, Raposo, Gerosa, Pimental, & Lucena, 2008).

The strongest indicators emerged from Q2 — healthcare providers' understanding of patients' conditions will improve with the use of eHealth tools. Factors related to technical disruption were relatively rare, allowing well trained and supported (through the IT department and upgrade training on electronic platforms) healthcare providers to deploy eHealth tools as a necessary aspect of their jobs.

When data entry issues are precluded by effective and standardized protocols, healthcare providers agreed that eHealth tools affect better medical documentation, and thus enhanced real-time knowledge of patient conditions. This entails communication access, follow-up procedures,

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[144] As discussed in section 3.2.1.

and information-sharing among healthcare providers. Therefore, eHealth tools facilitate and improve healthcare providers' ability to observe a duty of due care, and by extension, improve the patient–healthcare provider relationship despite our findings for H1. This finding similar to Unertl et al. (2012) when described the advantages of the health information technology (HIT) system for healthcare providers (p. 22)[145].

Extrapolating our RQ2 findings to our PHPFFC V2.0 model, we addressed some concerns about maintaining old communication strategies reported by Kuziemsky and O'Sullivan (2015) and Levinson et al. (2010). As seen in our model's CG column, existing communication methods (telephones) are used readily in cases of technology disruption. Furthermore, we provided a context-specific example of initiation behavior described by Zillich et al. (2015). Through their acceptance of eHealth technology as a necessary part of their jobs, healthcare providers signal their embrace of additional measures that facilitate the discovery of others' (patients') needs, tacitly indicating trustworthiness within the relationship. Such trustworthiness solidified in clinical contexts as healthcare providers' knowledge of patient conditions is, as we have shown, improved through eHealth tools. Then, as we defined it, the patient–healthcare provider relationship improved through eHealth tools' because they are shown to enhance knowledge and thus partly underpin healthcare providers' duty of due care. Trustworthiness is enhanced as healthcare providers signal their professional embrace of such tools.

Our findings in this area have counterintuitive implications. Whereas p-value calculations for H1 indicate that eHealth tools do not enhance patient–healthcare provider relations, we show that the nature of the relationship, measured by other indirect criteria, may be measured. Healthcare providers' compliance with codes of professional conduct, at times necessitating the use of eHealth

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[145] As discussed in section 2.2.2

tools, is de facto proof that the relationship improved through the use of such tools.

7.2.3 Interpretation for RQ3: How do patients’ eHealth literacy levels influence their communication with healthcare providers?

This question turned up some of our most compelling findings with implications for CG. Patients and healthcare providers alike use communication tools for varied reasons, although the variation was more on the patient side. Some merely wish to book appointments, whereas others only wish to view test results, and others seek a combination of uses that would benefit from direct communication should a messaging feature be added. When it comes to patients seeking risky health data on Sehaty, healthcare providers generally had misgivings. This was especially true in terms of patients with low health/eHealth literacy. We thus discussed healthcare provider dissatisfaction with the data/information on Sehaty and examined this phenomenon through Q3.

Here, many healthcare providers again identified patients as a critical variable in the exchange of risky data. Education and health literacy factors were commonly cited, although one healthcare provider mentioned low income as a complicating factor. Other healthcare providers considered some data to be so critical as to not belong at all on Sehaty. Although this was a minority opinion, many cited patients’ rights as a reason for full disclosure. Thus, we registered some genuine dissatisfaction among healthcare providers, either regarding the nature of specific data alone or the question of providing challenging information for all patients. However, as Q3 asks, does this result in healthcare providers having less intention to use eHealth tools in the future?

The answer, overwhelmingly, was no, and we based this on two critical factors guided by our data. Most critically, healthcare providers in our study revealed that a lack of comprehension on the part of patients could not be considered a barrier to effective healthcare delivery. The majority expressed an understanding that they must find ways of communicating information to a patient until that patient comprehends, whether in person or via an electronic platform. There simply is "*no choice*," as one put it. This necessitates anything from rewording information until it is conveyed effectively, to knowing other healthcare providers' capabilities to redirect the patient with optimal effect. Thus, a crucial CG factor emerges here, with significant implications for future studies of this kind: patients trust that their healthcare providers will deliver information until it is understood. However, an anticipated interaction element also emerges to the extent that patients feel they redirected, as needed, effectively, and efficiently.

Finally, through Q4, we revealed that communication CG increases healthcare providers' trust and patients' understanding. Healthcare providers' trust patient technical ability and health knowledge is a function first and foremost of language: Sehaty is available in English and Arabic for all information except lab results. Thus, healthcare providers have confidence that Sehaty will not impede patient understanding on account of language skills. Furthermore, healthcare providers understand that a high percentage of their patients already use information from eHealth tools to expand their knowledge and formulate questions in pursuit of expanded knowledge.

Our findings in this section offer an essential counterpoint to studies suggesting that healthcare providers will tend to underuse eHealth tools with which they do not fully agree. Explicit statements of dissatisfaction should not be conflated with the intent to reduce usage. Collaborative practice is not precluded when, as we have shown, eHealth tools support the observance of professional standards.

7.2.4 CG Findings

CG factors are critical for patients' understanding. For example, patients know that their healthcare providers are committed to persisting in cases where certain health information is difficult to comprehend. This means, among other things, that phone call or in-person meeting, will be required by the healthcare provider in cases where information on eHealth tools like Sehaty is not comprehended. By extension, this engenders another CG factor, namely that patients perceive healthcare providers' behavior initiation practices as information that is shared among providers to effect full understanding, irrespective of the communication tool in use.

As noted earlier, one of the most commonly identified factors — HPP workflow — is the least studied and most difficult to verify empirically. Still, essential and applicable conclusions can be drawn through the process of identifying the CG development cycle. Kuziemsky and O'Sullivan (2015) described a CG continuum, along which *coordinative* CG (a basic agreement that information-sharing is a good thing), precedes *cooperative* CG (an explicit focus on relationship-building), and eventually moves to *collaborative* CG (a shared sense that either party can actively pursue contact with the other to address and/or resolve issues). Important connections, otherwise, not easily drawn, are made when Kuziemsky and O'Sullivan's (2015) work complemented with the pioneering work of Clark and Brennan (1991).

In identifying these development stages through the data, we often yielded tacit evidence of factors, such as workflow, that were not directly soluble. Referring to RQ1, for example, HPPs were explicit about the potential for low health knowledge to inhibit workflow. However, in addition to denoting coordinative and cooperative CG, HPPs' reflections on eHealth tools usage and prospects for the expansion of patient knowledge, which are positive, revealed a perception that workflow efficiencies are likely to be found (in the case of Sehaty usage). A similar finding was obtained for RQ3, where, for example, we found explicit evidence that HPPs may prefer not dealing with low-knowledge patients via eHealth tools because of concerns about workflow inefficiencies. However, when the issue is viewed through the lens of the patient–healthcare provider relationship, not only do HPPs not reject eHealth tools usage (Sehaty and the Internet) out of hand but also their alteration of grounding strategies to address low-knowledge issues solidify communication CG in other areas.

7.3 Theoretical Implications

This study's vital contribution is its validation of the PHPFFC model provided by Basahih and Kuziemsky (2017). The transition from the initial PHPFFC to PHPFFC V2.0 entails an expanded definition of CG—a shift from regarding CG as a completed outcome, to analyzing it as a dynamic process through four headings: information and knowledge, technology, workflow, and anticipated interactions and outcomes. For example, the transition addresses the concept of eHealth tools that provide information sharing between end-users, explained in the PHPFFC model, to a dynamic process in the PHPFFC V2.0, by which CG between patients and healthcare providers may be gained, delayed, or even lost, given specific institutional contexts. In short, the PHPPFC V2.0 is a bridge between conceptual and practical concepts.

Our work is part of a growing field of studies seeking to understand CG development through mediated communication (p. 160)[146]. We make our contribution to CG theory is made by exploring the loss of immediacy that is characteristic of mediated communication in the context of medical institutions, where issues of trust and emotional aspects of communication are greatly magnified. For example, in the PHPFFC V2.0, trusting relationships occur at the collaborative CG stage when patients and healthcare providers agreed upon practices (p. 156)[147], for using communication tools to understand the health conditions (p.146 and 153) [148]. The collaborative CG stage is established when the patient–healthcare provider's relationship develops through implemented at the cooperative stage (e.g., healthcare providers' explanation of the misunderstanding to patients). In turn, these stages both follow the coordinative stage, in which end-user groups become aware of, and agree upon the value of establishing communication strategies (p. 150)[149].

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[146] As discussed in CG Development

[147] As discussed in CG Factors–Anticipated Information and Outcomes

[148] As discussed in CG Factors–Information and Knowledge and Workflow

[149] As discussed in CG Factors–Technology

We also go beyond the first-order concern about technical jargon, studied by Mitnick et al. (2010), by addressing the key issue of perception between patients and healthcare providers. Communication and CG are not all-or-nothing phenomena, nor are they built merely as a result of exchanges that are objectively observed as "successful"; they are built, and sometimes lost, based on mutual perceptions that may or may not be accurate. We have taken a novel approach to studying the issue of perception by triangulating it with two additional themes: workflow and relationships.

We found that when asked directly about concerns regarding workflow inefficiencies, healthcare providers appear to overemphasize fears that are based on anecdotal evidence that mediated communication will create workflow bottlenecks. However, when asked indirectly about patients' eHealth literacy (a key criterion for successful mediated communication), for example, we found that healthcare providers' views are considerably more positive. In the PHPFFC V2.0, HPPs Workflow, the healthcare providers expected an altered and evolving workflow depending on the patients' level of health/eHealth literacy and how patients' earlier detection to health information via eHealth tools would increase or decrease healthcare providers' workflow (p. 143)[150]. Ultimately, we found that the prospects for CG development around an eHealth tool are more dependent on subjective and social factors such as emotional responses to health information and workflow issues, by patients and healthcare providers respectively, than has been expressed in the literature. This point is borne out most clearly in our finding from Q3, under RQ3, where we show that healthcare providers' dissatisfaction with the nature of information on eHealth tools does not reduce their intention to use such tools (p. 119)[151]. Moreover, in the PHPFFC V2.0, CG factors (Workflow), the healthcare providers recognize that patients do not object to using their

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[150] As discussed in HPPs–Workflow

[151] As discussed in Q3: Results

personal time seeking health information via eHealth tools (p. 153)[152]. Thus, Basahih and Kuziemsky's (2017) study, as well as this study, suggested providing educational tools, such as a library link, about health information specifically concerning patients' conditions that would enhancing their understanding regarding the type of questions they might demand.

Our work has similarly novel implications for CG theory through our deeper look at the nature of relationships. Much literature in this area has treated relationships as personal/emotional in nature, established as spontaneous, mutually recognized experiences accumulate. Alternatively, impersonal relationships are routinely understood as those between professional groups having more or less similar levels of professional knowledge and legitimacy (Kuziemsky & O'Sullivan, 2015). We have shown another type, by problematizing "relationship" in a healthcare setting in critical ways. First, the patient–healthcare provider relationship is an extremely old one, having certain culturally recognized features, most notably a significant power differential and substantial difference in relevant knowledge/expertise. Thus, to speculate about future patient–provider relationships is to engage with a highly circumscribed, pre-existing relationship. Our findings address this, showing that the term relationship must be understood more broadly, as more than a personal feeling of rapport. In maintaining their professional commitments to a duty of care, healthcare providers foster strong relationships irrespective of personal sentiment; it is possible for patients and healthcare providers to have poor personal rapport and still have a healthy relationship in the strictest terms.

We see this most clearly in our findings, in the PHPFFC V2.0, about healthcare providers' willingness to suppress frustrations when patients fail to understand information. Although healthcare providers show some concerned about patients' views, some specific data (e.g., risky

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[152] As discussed in CG Factors–Workflow

data) at eHealth tools (p. 138)[153], they recognized the importance of technology use in their jobs (p. 141)[154]. Indeed, observing their duty of care was widely regarded as a factor that overcame any frustrations with shortcomings related to technology. HPP#6 captured this notion when saying, "*[I must] explain the health information to them anyway*." (p. 165)[155]. Healthcare providers also recognized that communication tools promote teamwork with their patients (p. 143)[156]. Consequently, healthcare providers' sense of responsibility would arises since they are the specialists (p. 138)[157]. Also, healthcare providers saw the significance of communication with patients to improve the comprehension about their health situations (p. 156)[158]. In short, researchers seeking to understand mediated communication in healthcare settings must be cognizant of the ways in which the concept of a relationship cannot be imported directly from other contexts.

To develop the PHPFFC V2.0, we expand on factors presented in the initial PHPFFC with data that offers insights into the dynamics of CG development. Here we highlight some of the distinguishing factors explored in the PHPFFC V2.0 that were not mentioned part of the initial PHPFFC.

Our data revealed the importance of English language skills for patients' use of health/eHealth terms in eHealth tools. Wald et al. (2007) introduced a website (i.e., http://www.noah.cuny.edu) that provides the health information in both English and Spanish (p. 20)[159]. Abdallah & Albadri (2010) reported that the second official language in the KSA is English (p. 36)[160]. Our data showed that 43% of PPs knew both English and Arabic and 15% of them filled

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[153] As discussed in HPPs–Information and Knowledge
[154] As discussed in HPPs–Technology
[155] As discussed in Collaborative CG: Examples from the Data
[156] As discussed in CG Factors–Workflow
[157] As discussed in HPPs–Information and Knowledge
[158] As discussed in CG Factors–Anticipated Interaction and Outcomes
[159] As discussed in section 2.2.1
[160] As discussed in section 2.3.3

out the questionnaire in English (p. 88)[161]. However, English proficiency considered low, as is the KSA ranked 98 [162] among the other 100 countries in 2019. Although 82.2% of PPs stated there is no needs to present the lab results in English, 17.8% of PPs requested the test results to be given in Arabic (p. 88) [163]. On the other hand, from the qualitative data, HPPs concerned about providing the lab results in English for patients who don't understand English, resulting in increased workflow. HPP#2 said: "*Sehaty provides health information like test results in English, which would be hard for some patients to understand. Also, it would increase our workflow through having to clarify the health terms"* (p. 91)[164]. Thus, this study emphasizes hospitals that are adopting eHealth tools for patients to use must provide all the health information in their primary language.

The other main concern we explored is what we refer to as "risky patient data" such as critical health results. The PHPFFC dealt with this obliquely, referring to patients misinterpreting health information via eHealth tools (p. 49)[165], but it was not explored as extensively as it is here. Many studies have drawn connections between the extent and nature of information on eHealth tools and patients' emotional feelings or provided to argumentative patients that would be affected by their health/eHealth literacy level (Ross et al., 2005; Wald et al. 2007). For example, patients with low eHealth literacy have the potential to misinterpret health information (Ross et al., 2005). On the other hand, patients with high eHealth literacy can develop opinions that may be hard to overcome (Wald et al., 2007). Our data show, as manifested by HPP#13, that experienced patients need emotional support when they talk to their healthcare providers (p. 101)[166]. Additionally, one

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[161] As discussed in PPs' Understanding of Health Knowledge Provided Through eHealth Tools

[162] Wikipedia contributors. (2020c, August 13). *EF English Proficiency Index*. Wikipedia. https://en.wikipedia.org/wiki/EF_English_Proficiency_Index

[163] As discussed in PPs' Understanding of Health Knowledge Provided Through eHealth Tools

[164] As discussed in The eHealth Tool Usage from the HPPs' Perspective

[165] As discussed in Healthcare Provider Information Factors

[166] As discussed in How HPPs Currently Communicate with PPs

of the identified factors in the initial PHPFFC model is that patients with critical health conditions could benefit from eHealth tools (e.g., communication tools) to manage their health conditions (p. 49)[167]. For instance, we mentioned that in Street et al. (2009), patients with cancer managed their pain better through instant communication with healthcare providers.

The above factors—emotional concerns and full information disclosure to patients (including risky information)—are critical for patients managing their health and achieving proper treatments and clinical goals. In the PHPFFC V2.0, we identified different opinions regarding risky data from the healthcare providers' perspective. A significant number of HPPs indicated that patients have the right to disclose their health data. Others had different feeling, HPP#8 stated that risky data and lab results must be in the patients' primary language. Also, seven HPPs suggested risky data should be provided through eHealth tools only once patients had completed their visit with their healthcare providers (p. 91)[168]. According to Mitnick et al. (2010), providing patients with clear and sufficient information would increase their emotional preparedness and confidence. Thus, the scientific contribution here is "the timing" or "when." It is essential to present all data belonging to patients via eHealth tools; however, our data disclosed that the data should only be provided if and when an upcoming visit with a clinician is imminent.

Finally, empirical studies reveal obstacles that may arise during the coordinative stage that derive from the cultural context in which they occur. For example, despite offering many options to facilitate communication (150)[169], culture like the KSA, security concerns may leave some users unsatisfied with the current structure of eHealth tools (Abdallah & Albadri, 2010). Therefore, in the PHPFFC V2.0, we recognized that some PPs are not fully satisfied with the use of eHealth

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[167] see Patient Outcomes
[168] see HPPs' Perceptions of Sehaty Data and Barriers to Its Use
[169] As discussed in CG Factors–Technology

tools and preferred to go in-person to solve their concerns; 66.4% of PPs preferred communicating in-person when otherwise unable to receive responses from their healthcare providers via phone. Thus, 78.5% of PPs' communication with healthcare providers is done via phone to re/book appointments (p. 156)[170]. According to our qualitative data, this could be due to patients did not knowing that Sehaty exists (p. 141)[171].

Regarding the healthcare providers' side, a number of studies indicated that many of them concerned that giving eHealth tools to patients (e.g., for communication) would increase their workload (Lusignan et al., 2014; Seto et al., 2010; Bae & Encinosa, 2016). Also, in the initial PHPFFC, we explained that the increased workload could occur due to the numerous text-based messages while communicating with their patients for detailed responses (Basahih & Kuziemsky, 2017). Our data in the PHPFFC V2.0 also revealed that HPPs had concerns about increased workload is due to two matters: patients having low health literacy; and, adding a communication feature to Sehaty in the future. We offer some examples of these two concerns (p. 146 and 153)[172]. For example, HPPs disclosed that they are satisfied with the patients' current use of Sehaty, which has resulted in reduced HPPs' workflow. However, HPPs indicated that relies on the patients' levels of health/eHealth literacy. Many HPPs anticipated and argued that adding communication tools would possibly increase the workload because of additional discussions with patients; thus, they suggested that the hospital should include a Sehaty specialist to answer patients' concerns.

In conclusion, there is a critical balance between wary patients and a perceived increase in workflow among HPPs. Striking this balance is essential to ensuring the provision of professional or high quality of healthcare delivery. We showed, in our PHPFFC V2.0, that these factors are best

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[170] As discussed in CG Factors–Anticipated Interaction and Outcomes

[171] As discussed in HPPs–Technology

[172] As discussed in CG Factors–Information and Knowledge and Workflow

addressed at the coordinative level –marketing campaigns and promotion are essential to establishing a shared sense that information technology is capable of aligning patient and provider interests. For its part, the hospital must explore and resolve issues related to patients' tendency to revert to phone usage and prefer in-person clinical visits. This is essential to facilitate and/or reduce patient communication via phone or in-person. To facilitate this, the hospital should create an eHealth tools support center and/or hire specialists who can answer or manage patients' health concerns. This step would reduce any unanticipated interaction for the eHealth tool's end-users due to its performance.

7.4 What Should the MOH in KSA Consider when Building eHealth Tools?

The next steps for mobile technology in KSA healthcare, many jurisdictions around the world are seeking to measure the effects of eHealth tools in their respective health sectors. Such information has implications for understanding healthcare delivery, budget management, error reduction, and more (MOH, 2009). The status of eHealth tools' usage varies between sub-national jurisdictions, and indeed between nation-states. The KSA case must be understood in the context of the country's overall growth and development over the past decade. In its Ninth and Tenth Development Plans (2010-2014), the KSA committed, respectively, to develop a "knowledge economy" and making substantial infrastructure investments, with healthcare prioritized as part of the latter (Neamh et al., 2018). Though clearly a positive development, this significant expansion in infrastructure has caused unforeseen problems. As many new healthcare facilities were built, healthcare responsibility became distributed increasingly beyond the ministry of health. Some 40% of the country's healthcare is now in the hands of other government ministries (Interior), the military, or universities (Neamh et al., 2018). This has caused general confusion, duplication of services, and difficulty in keeping unified patient records. The future of eHealth technology in the KSA is thus promising, yet very uncertain. Uniform implementation of technology will be challenging, and so we need a similar surge in research designed to understand and help guide technology adaptation and the collaborative practices that enable it.

Though seemingly limited in scope (one eHealth tool, in one hospital), our study is, given the KSA's extremely varied context, the very type of research that will be required if locally adapted eHealth tools are to be integrated into regional, or even national systems. As our study has shown, many future researchers will find the importance of simplicity and usability in application development. Sehaty's ease of use is mostly responsible for patients' overwhelming (100%) intent to use the application in the future. Studies show that if this is to be sustained, appropriate educational tools are needed to ensure the continued usability of given eHealth tools.

The future of eHealth technology in the KSA will simultaneously benefit from current CG research while providing unparalleled opportunities for further study. Valuable insight from this study reminds researchers that patients and healthcare providers are already involved in a pre-existing relationship to which a degree of differential power is inherent. This alters how CG and collaborative practice develop. Misunderstanding this unique context may hamper the adaptation of tools, such as Sehaty, with the potential to build capacity and sustain resilience in KSA's healthcare system. Existing CG may need to erode – as we show, concerning healthcare providers accepting increased argumentation from patients – before apps like Sehaty can be implemented on the new collaborative ground. Closely related, the nature and function of communication features embedded in eHealth tools can either enhance or, potentially, hamper the patient–healthcare provider relationship.

CG development within KSA health facilities will increasingly extend to encompass emerging roles beyond such facilities. For example, private sector app designers and coding experts could collaborate to address patient–healthcare provider issues in the design and architecture of new apps (e.g., setting limits on possible communication tools within apps). In other words, CG must be developed between/among a growing number of stakeholders. In turn, this will call upon researchers to study and, ideally, help guide CG development as multiple parties express more and more outcome expectations: better health outcomes, streamlined workflows, reduction of patient–healthcare provider argumentation, improved eHealth literacy, and profitability.

7.5 Limitations

Nearly all studies of this nature can benefit from a larger data sample. Although we feel that sufficient evidence has been presented and our conclusions are amply supported, a larger sample group may result in slightly modified conclusions being drawn. This study was certainly constrained by institutional limitations and was thus limited to results pertaining to patients and healthcare providers in a single, government hospital located in the KSA’s capital city. Privately operated institutions and those in areas outside the relatively wealthy and well-educated Riyadh city are not reflected here. In a similar vein, a cross-sectional approach that can account specifically for differences in class, gender, and ethnicity, among others, is necessarily absent from this study.

Furthermore, while recognizing the estimable benefits of using, as we did, a randomly selected participant pool, a study drawing from a group of healthcare providers and their own patients would surely produce findings that were compelling in a different way. In the least, this would permit a researcher to test the correspondence between healthcare providers’ perceptions and the actual characteristics and capabilities of patients. A researcher seeking to use such a participant group would, moreover, find it easier to enlist the assistance of a given facility’s human resource department to take advantage of all employee contact information available in one location.

Finally, this study was limited by the lack of systematic research into healthcare providers' workflow and workload levels. This is important to precisely determine the extent to which healthcare workers' workflow is the factor with the most direct implications for the economics of healthcare provision, not only in the KSA but anywhere. Out of necessity, we have offered insights into healthcare providers' perceptions of future workflow patterns based on their understanding of patients' eHealth literacy and overall health knowledge — an approach we consider helpful and even necessary to produce faster reflections that may help the KSA anticipate changing roles for tools such as Sehaty.

7.6 Future Research

Our study is a first and crucial step toward much needed empirical examination of the use of eHealth tools in the KSA. Moreover, we hope to shape theoretical approaches to studies of this kind by presenting the first empirically based adaptation of the PHPFFC. However, for a more complete picture of implications of eHealth tool usage in the KSA and elsewhere, more research must be conducted. Many fruitful avenues for further research are available. First, because so much research in this field hinges on cost efficiencies and healthcare provider workloads, systematic studies that attempt to quantify changes over time will be critical.

Second, user groups such as "patients" and "healthcare providers" are hardly homogenous across an entire country. Thus, a cross-sectional study that extends beyond the hospital used, and indeed beyond Riyadh, would test our findings in key areas; education levels and existing technology usage, for example. A study that incorporates healthcare facilities in rural and semi-rural areas, for instance, would prove highly useful. Given the dynamic nature of communication through eHealth tools, we must anticipate how eHealth tools such as Sehaty will alter patient and healthcare provider behavior and alter themselves across heterogeneous user groups.

On the other hand, longitudinal studies must also be initiated. Again, given the expectation that eHealth tools and the people who use them will change over time in a highly dynamic process, tracking such changes in as many contexts as possible is critical. Our study provides one excellent justification for such studies: the relationship between health literacy and contact between patients and healthcare providers is, as of yet, uncertain over time. As it stands, relatively lower health literacy levels result in greater demands on healthcare providers' time. However, there is potential for patients with higher literacy to engage more as more information is made available.

On another front, the potential exists for role specification issues to arise on a broader scale. For example, if patients begin to use "free" Sehaty-type tools as substitutes for clinical visits, there will be implications for the existing private-care market in the KSA. We may require studies of emerging actors, internal and external, and their impacts on the evolving dynamic discussed. Internally, Sehaty usage beyond a certain level may call for full-time employees to be assigned exclusively to Sehaty monitoring. Externally, Internet service healthcare providers' role is magnified as disruptions become increasingly less tolerable as an increasing amount of information is exchanged electronically.

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Appendix A: Other Scenarios (Literature Review)

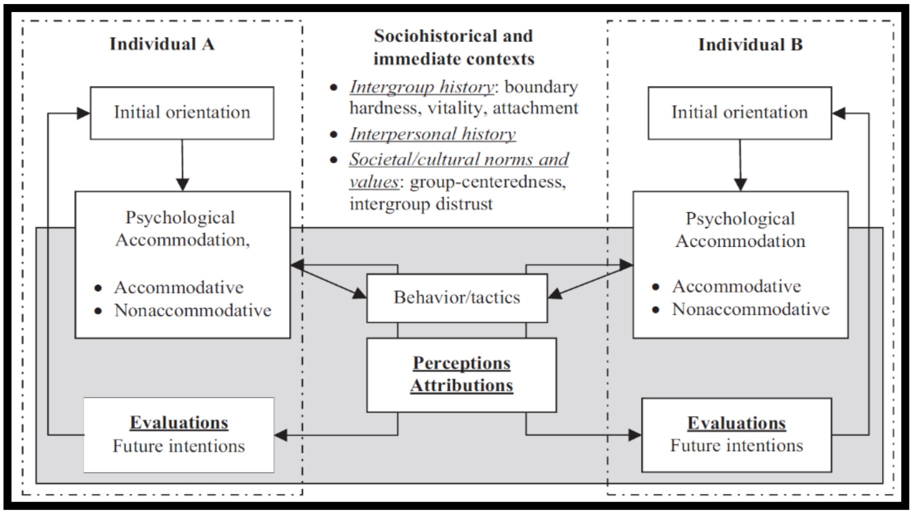

Figure 8: *The Intergroup Process Model of Communication Accommodation Theory (Giles, 2016)*

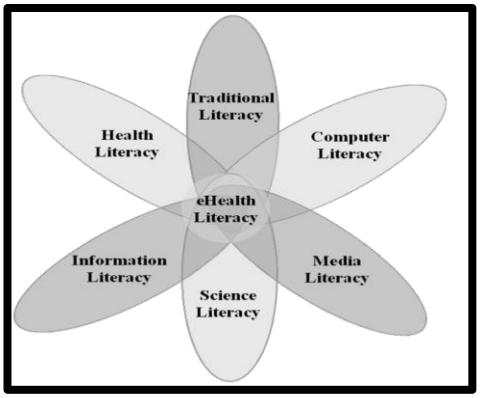

Figure 9: *eHealth Literacy Lily Model*
(Norman & Skinner, 2006)

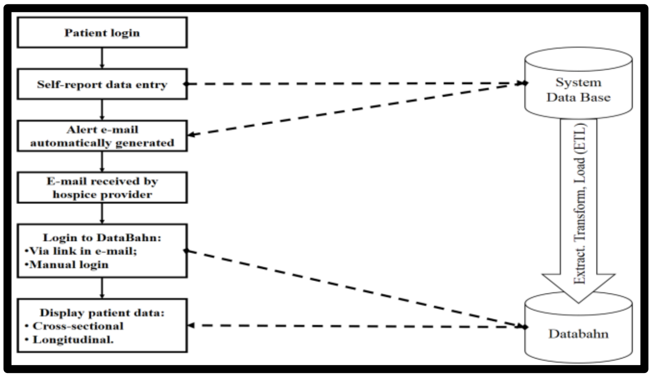

Figure 10: *Flowchart for Communication Process from Patient Login to Healthcare Provider Viewing of Summary Patient Data*
(Dy et al., 2011)

Table 12: *Healthcare Resources in the KSA (MOH, 2009)*

Health Resource	Total Number in the KSA
Hospitals	406
Beds	554,306
Doctors	54,306
Nurses	110,858
Dentists	7,355
Medical Assistants	59,618
Pharmacists	14,943

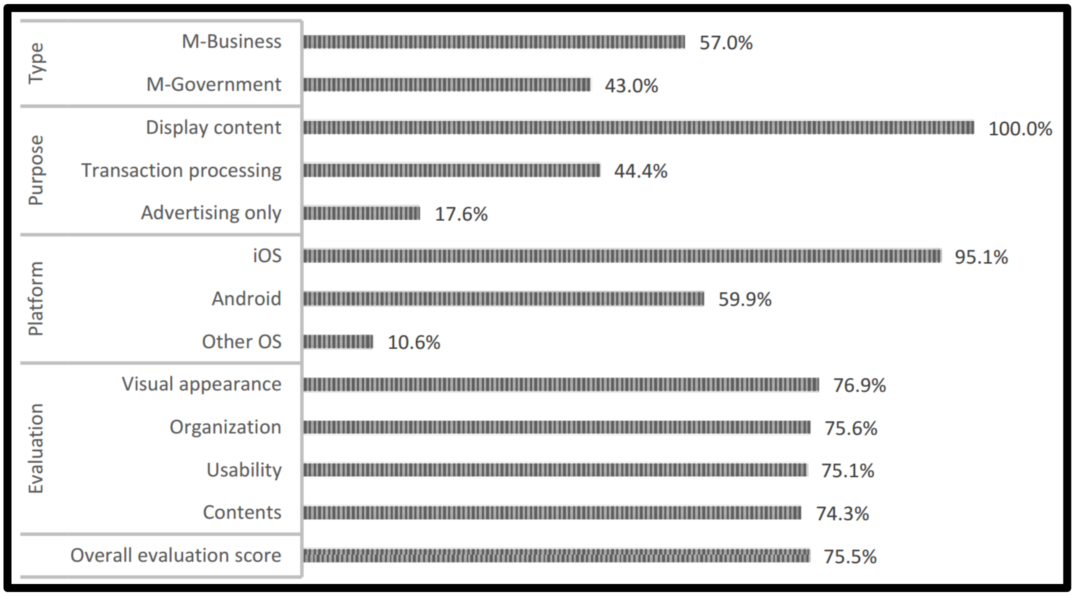

Figure 11: *Mobile Computing Trends in the KSA*
(Alotaibi, 2014)

Appendix B: Other Scenarios (Methodology)

Table 13: *Research Agenda*

Phase #	What	Role
I	a) Developing research method	The researcher
	b) Composing questionnaire	
II	a) Contacting collaborators	The researcher, KFSH&RC's ethics departments [i.e., via Dr. Bandar Alkhudairi], and main supervisor
	b) Obtaining necessary permits from authorities (KFSH&RC's ethics applications)	
	c) Preparing ethics board application from Ottawa University	The researcher, Ottawa University's ethics board departments, and main supervisor
III	a) On-site research at KFSH&RC in Riyadh, Kingdom of Saudi Arabia b) Preparing and distributing online forms	The researcher
IV	a) Data entry and first validations to clean up non-valid data b) **Quantitative approach:** Statistical analysis and hypothesis testing for H1 c) **Qualitative approach**: Visualization and interpretation of results	
V	a) Writing the results and discussion chapters b) Finalizing the PhD dissertation c) Defending the PhD dissertation	The researcher and main supervisor

Table 14: *Research Timeline*

When	What	Who
Feb 30, 2016- March 7, 2017	Start the research proposal	Researcher
	Start composing the questionnaire and interview questions and how to test them	The researcher and main supervisor
	Create participant consent forms.	
March 8–28, 2017	Finish the research proposal	
March 31, 2017	Submitted the following documents to the thesis committee: 1- Executive summary of the research proposal 2- Progress Reports 3- Complete research proposal and send it to the thesis committee	Researcher and thesis committee
April 6, 2017	Research proposal defense.	
April 24, 2017	Submitted the final version of the research proposal	Researcher and Dr. Bandar Alkhudairi
May 1- Oct 1, 2017	Collect the authorization letter from the hospital after getting approval from their thesis committee	
	Prepare ethics board application for University of Ottawa Ethics Board	Researcher Supervision by supervisor and Dr. Bandar Alkhudairi
	Obtained the necessary forms from ethics: • **KFS&RC Ethics:** File #: H09-17-02, received on Oct 13, 2017; closed on Oct 12, 2018 • **Ottawa University:** File #: ORA/934/38, received on May 29, 2017; closed on April 28, 2018 **Next steps begin after we get approval from the ethics board.**	
Nov 15, 2017 – Feb 15, 2018 **Times:** 9:00am–12:00pm and 4:00pm–10:00pm	• Start study trip to Kingdom of Saudi Arabia • Prepared and distributed the online form • Visited the hospital to collect data in the waiting room • Scheduled interview times with healthcare providers • Data collection and entry at the same date of collection	The Researcher
March 15, 2018 – August 3, 2018	• First validations to clean up non-valid data • Visualization and interpretation of results • Statistical analysis and Hypotheses testing	
The researcher must suspend the term of Fall 2018 due political situation between Canada and the Kingdom of Saudi Arabia		
Jan 5, 2019 – Jan 21, 2020	Finish writing the results chapter and submitted to thesis committee	The researcher and main supervisor
Feb 4, 2020	Finish writing dissertation and submitted to thesis committee	Researcher, thesis committee, and the examiner.
July 22, 2020	Dissertation defense.	
August 22, 2020	**Study completed**	

Table 15: *Instruments Used to Measure Quantitative Variables*

Variable	Q#	Instrument	Resources
Developing Patient Questionnaire			
Demographic Information (i.e., gender, age, education, marital status, employment status, and economic status)	**1-7**	Developed by the researcher. They developed by the researcher based on three out of four phases techniques introduced by Castillo-Montoya (2016). **Source:** Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-830. Retrieved from: https://search-proquest-com.proxy.bib.uottawa.ca/docview/1806967398?accountid=14701	
Sehaty Use	**8-9**		
Technical Abilities and Social Influence	**10 (sub 1-15)**	Unified Theory of Acceptance and Use of Technology **(UTAUT)**	• Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478. • Khechine, H., Lakhal, S., Pascot, D., & Bytha, A. UTAUT model for blended learning: The role of gender and age in the intention to use webinars. *Interdisciplinary Journal of E-Learning and Learning Objects*, 2014, 10(1), 33–52.
eHealth Literacy	**11 (sub 1-10)**	Electronic Health Literacy Scale **eHEALS**	Hoffman-Goetz, L., Donelle, L., & Ahmed, R. (2014). *Health literacy in Canada: A primer for students.* [In Chapter 6, pp. 101-121].Canadian Scholars' Press, Toronto, Canada.
Communication	**12-25**	Developed by the researcher. They developed by the researcher based on three out of four phases techniques introduced by Castillo-Montoya (2016). **Source:** Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-830. Retrieved from: https://search-proquest-com.proxy.bib.uottawa.ca/docview/1806967398?accountid=14701	
Workflow	**26-27**		
Conclusion	**28-29**		

Table 16: *Instruments Used to Measure Qualitative Variables*

Variable	Q#	Instrument	Resources
Developing Healthcare Provider Interview Questions			
Personal Background	**1**	Developed by the researcher. They developed by the researcher based on three out of four phases techniques introduced by Castillo-Montoya (2016). **Source:** Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-830. Retrieved from: https://search-proquest-com.proxy.bib.uottawa.ca/docview/1806967398?accountid=14701	
Technical Background	**2**		
Use of Sehaty Application	**3**		
	4	Likert-type Attitude Scale **(Likert-type)**	Moody, L. E., Slocumb, E., Berg, B., & Jackson, D. Electronic health records documentation in nursing: Nurses' perceptions, attitudes, and preferences. *Computers, Informatics, Nursing*, 2004, 22(6), 337–344.
Information Satisfaction with Sehaty	**5-9**	Developed by the researcher. They developed by the researcher based on three out of four phases techniques introduced by Castillo-Montoya (2016). **Source:** Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-830. Retrieved from: https://search-proquest-com.proxy.bib.uottawa.ca/docview/1806967398?accountid=14701	
Communication	**10-14**		
Patients' Factors	**15-18**		
Workload	**19-23**	**Paper Survey**	Kittler, A., Pizziferri, L., Volk, L., Jagannath, Y., Wald, J., & Bates, D. Primary care physician attitudes towards using a secure web-based portal designed to facilitate electronic communication with patients. *Journal of Innovation in Health Informatics*, 2004, 12(3), 129–138.
Conclusion	**24-25**	Developed by the researcher. . They developed by the researcher based on three out of four phases techniques introduced by Castillo-Montoya (2016). **Source:** Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-830. Retrieved from: https://search-proquest-com.proxy.bib.uottawa.ca/docview/1806967398?accountid=14701	

Table 17: *Codebook for Questionnaire Variables*

Note: ‘#’ = Number; ‘PP’ = Patient-Participant, ‘S’ = Sehaty.

#	Sub Q#	Code	Data of Variable	Description
Demographics				
1		**GENDER**	Male = 0 Female = 1	The value is 1 for *female* and 0 for *male*.
2		**AGE**	18-28 years’ old= 23 29-39 years’ old= 34 40-50 years’ old= 45 51-60 years ‘old= 55 60+ years old= 70	Candidates below the age of 18 have presumably not filled in forms. I picked an average in each age group. (18+28)/2=23 as the average.
3		**EDUCATION_TIME**	No schooling completed= 0 Not completed high school = 6 High school diploma = 12 Bachelor’s degree = 16 Master’s degree = 18 Doctorate degree = 21 Other = 14 (Note; The other option changed to be ‘Diploma’ according to participants responses)	The value is the number of years needed to complete the selected level of education in the Kingdom of Saudi Arabia (KSA). [***Source****: Mihael Al (2015). Education in Saudi Arabia. Accessed March 14, 2017. Retrieved: http://oura.ca/wp-content/uploads/2015/07/Admissions6.pdf*].
4		**LANGUAGE**	English = 0 Arabic = 1 Both = 2	Arabic is the main language in the KSA. Thus, a PP who picked *Arabic*, means the person cannot speak English. There is a value of 1 for a person who answers ‘*Arabic*’, a value of 2 who answers ‘*Both*’—meaning the person speaks English and Arabic—and a value of 0 if the person can speak *English* only.
5		**SINGLE**	Single, never married= 0 Married = 1 Divorced= 2	A value of 0 for ‘*Single’* for participants who select *single*, a value of 1 for *married*, and a value of 2 for *Divorced.*
6		**UNEMPLOYED**	Unemployed = 0 Student = 1 Retired = 2 Employed = 3 Self-employed = 4	A value of 0 for people who answer *unemployed*, 1 for *Student*, *2 for Retired*, 3 for *Employed* and 4 for *Self-employed.* The researcher classified ‘*Other’* field according to the participant’s response. For example, who write housewife means unemployed.
7		**INCOME**	No income = 0 Less than 2000 SR= 1000 2000–5000 SR = 3500 5000–10,000 SR = 7500 10,000–15,000 SR = 12,500 15,000–20,000 SR = 17,500 More than 20,000 SR = 40,000	The given values are the average amount of each income grouping.
Technical Abilities and Social Influence				
8		**S_TIME_USE**	Never = 0 1-3 times a week= 1 3 or more times a week = 2 when I need to check, or track my health status and when my appointment is close by= 3	Derived from “How often do you use Sehaty?” We have selected a value of 0 for PPs who answered ‘Never’ and a value of 1 for other responses, such as 1 to 3 times or more. **Note**: all PPs should use Sehaty application for this study.
9	**9**	**S_PE**	Derived from “You feel confident using Sehaty because…” To discover the ‘ease of use’ component, we will look at why the PPs is using Sehaty application. Since this question is providing multiple answers, thus, this variable contains different variables. The researcher will classify ‘*Other’* field according to the PP’s response. SIMPLE_DESIGN, OTHER_EASY_TO_USE, OTHER_ENGOURGED, FAMILIAR_TECH’ variables were determined according to PPs’ responses. Overall, we will deal with this question as ‘Yes’ and ‘No’ question to not have missing values when PP chose some of them.	
	9.a	**SIMPLE_DESIGN**	Yes = 1 No = 0	Value of 1 for a PP who did agree that Sehaty has a simple design, and 0 for who did not.
	9.b	**OTHER_PE**		Value of 1 for PPs who wrote “*Easy to access or easy to use*” at the ‘*Other’* field, and a value of 0 for who did not.
	9.c	**OTHER_ENGOURGED**		A value of 1 for participants who wrote “ *I like it to track my health; I like to review my health records, and it is faster; The goal is to track my health information; I like to use it to track my health information on time; It is an approach to track my health information; The technology it in our pocket; To get the benefit from it; I like it to track my health condition; I’m using the similar application but for diabetes condition.*” at the ‘*Other’* field, and a value of 0 for who did not.
	9.d	**FAMILIAR_TECH**		Value of 1 for PPs who did agree that they use Sehaty due to the familiarity of using technology, and 0 for who did not.
10	**(1-5)**	**Perceived Usefulness**		
10	**1**	**S_PU_UNDERSTAND**	Completely Agree = 2 Somewhat Agree = 1 Neutral = 0 Somewhat Disagree = -1 Completely Disagree = -2	Derived from “I find Sehaty useful to help me understand my health condition.” Different values are based on the perceived usefulness of Sehaty to improve patients’ understanding of their health condition.
10	**2**	**S_PU_V_MEDICAL**		Derived from “Using Sehaty enables me to view my medical reports.” Different values are based on the perceived usefulness of Sehaty in enabling patients to view their medical reports.
10	**3**	**S_PU_LEARN**		Derived from “Using Sehaty increases my ability to learn about my health condition.” Different values are based on perceived usefulness of Sehaty to increase patients’ ability to learn about their health condition.
10	**4**	**S_PU_INFORMED**		Derived from “Using Sehaty allows me to prepare questions for my next visit.” Different values are based on perceived usefulness of Sehaty to inform patients and generate questions for their next visit to their healthcare provider.
10	**5**	**S_PU_TRACK**		Derived from “Using Sehaty enables me to track my health status more quickly.” Different values are based on perceived usefulness of Sehaty to track patients’ health status quickly.
10	**(6-9)**	**Perceived Ease of Use**		
10	**6**	**S_PE_RESOURCES**	Completely Agree = 2 Somewhat Agree = 1 Neutral = 0 Somewhat Disagree = -1 Completely Disagree = -2	Derived from “I have the resources necessary to use Sehaty.” Different values for people who perceived Sehaty as easy to use because they have the necessary resources to use it.
10	**7**	**S_PE_KNOWLEDGE**		Derived from “I have the knowledge necessary to use Sehaty.” Different values for people who perceived Sehaty as easy to use because they have the necessary knowledge to use it.
10	**8**	**S_PE_NOT_COMPATIBLE**		Derived from “Sehaty is not compatible with other systems I use.” Different values for people who perceived Sehaty as easy to use if Sehaty is not compatible with other systems.
10	**9**	**S_PE_ASSISTANCE**		Derived from “A specific person is available to offer me assistance with Sehaty.” Different values for people who perceived Sehaty as easy to use based on assistance available to users.
10	**(10-12)**	**Social Influences**		
10	**10**	**S_SI_BEHAVIOR**	Completely Agree = 2 Somewhat Agree = 1 Neutral = 0 Somewhat Disagree = -1	Derived from “People who influence my behavior think I should use Sehaty.” Different values for people whose behavior is influenced by others.
10	**11**	**S_SI_IMPORTANT_PEP**		Derived from “People who are important to me think I should use Sehaty.” Different values for people who use Sehaty because they are influenced by people who are important to them.

10	**12**	**S_SI_HEALTH_CARE_PEP**	Completely Disagree = -2	Derived from "My healthcare provider has been encouraging me to use Sehaty." Different values for people whose healthcare providers have influenced them to use Sehaty.
10	**(13-15)**	**Intention to Use Sehaty**		
10	**13**	**S_I_INTENDED_USE_FUT**	Completely Agree = 2 Somewhat Agree = 1 Neutral = 0 Somewhat Disagree = -1 Completely Disagree = -2	Derived from "I intend to use Sehaty in the future." Different values for people who are intending to use Sehaty in the future.
10	**14**	**S_I_PREDICT_USE_FUT**		Derived from "I predict I will use Sehaty in the future." Different values for people who are predicting they will use Sehaty in the future.
10	**15**	**S_I_PLAN_USE_FUT**		Derived from "I plan to use Sehaty in the future." Different values for people who are planning to use Sehaty in the future.
eHealth Literacy				
11	**1**	**INT_HEALTH_DECISIONS**	Very Useful= 2 Useful= 1 Unsure = 0 Not Useful= -1 Not Useful at All= -2	Derived from "How useful do you feel the Internet is in helping you make decisions about your health?" Different values for people based on how useful they feel the Internet is in helping them make health decisions.
11	**2**	**INT_HEALTH_RESOURCES**		Derived from "How important is it for you to be able to access health resources on the Internet?" Different values for people who perceive the Internet as important for finding health resource.
11	**3**	**INT_KNOW_HEALTH_RESOURCES**		Derived from "I know what health resources are available on the Internet." Different values for people who know where to find health resources on the Internet.
11	**4**	**INT_WHERE_HELPFUL_RESOURCES**		Derived from "I know where to find helpful health resources on the Internet." Different values for people who are able to find helpful health resources on the Internet.
11	**5**	**INT_HOW_HELPFUL_RESOURCES**		Derived from "I know how to find helpful health resources on the Internet." Different values for people who know how to find helpful health resources on the Internet.
11	**6**	**INT_ANSWER_HEALTH_QUESTIONS**		Derived from "I know how to use the Internet to answer my questions about health." Different values for people who are able to answer their health questions via the Internet.
11	**7**	**INT_USE_OF_HEALTH_INFORMATION**		Derived from "I know how to use the health information I find on the Internet to help me." Different values for people who know how to use the health information on the Internet to help them.
11	**8**	**INT_SKILLS_EVALUAT_INFORMATION**		Derived from "I have the skills I need to evaluate the health resources I find on the Internet." Different values for people who have skills to evaluate health resources on the Internet.
11	**9**	**INT_TELL_HIGH_LOW_HEALTH**		Derived from "I can tell high-quality health resources from low-quality health resources on the Internet." Different values for people who can recognize the difference in quality of health resources on the Internet.
11	**10**	**INT_CONFIDENT_HEALTH_DECISIONS**		Derived from "I feel confident in using information from the Internet to make health decisions." Different values for people who are confident in using health information from the Internet to make health decisions.
Communication				
12	**12**	**TYPE_OF_COM_TOOLS**	Derived from "What type of communication tools do you like to use to communicate with your healthcare providers at the hospital?" PPs' entries are the value. Since this question is providing multiple answers such as "Phone, E-mail, Text-Based, Sehaty, and Other." Thus, this component contains different variables. Moreover, we renamed the '*Other*' variable to '*IN_PEARSON*'. '*IN_PEARSON*' variable created according to participants' responses such as "In -person via the ER department; and/or via someone who works at the hospital". Overall, we will deal with this question as '*Yes'* and '*No'* question to not have missing values when participants chose some of them.	
	12.a	**PHONE**	Yes = 1 No = 0	Value of 1 for PPs who did select such communication tool, and 0 for those who did not.
	12.b	**E_MAIL**		
	12.c	**TEXT_BASED**		
	12.d	**SEHATY**		
	12.e	**IN_PERSON**		
13-14	**Alert Text Messages**			
13		**RECEIVED_TEXT_ALERT**	Yes = 1 No = 0	Value of 1 for PPs who received a text alert message via phone, and 0 for those who did not.
14		**SETTING_TEXT_ALERT_SUPPORT_COM**		Value of 1 for PPs who thought setting a test alert messages via phone for specific services encourages them to communicate with their healthcare providers, and 0 for those who did not.
15-16	**E-Mail**			
15		**E_RECEIVED_E_MAIL**	Yes = 1 No = 0	Value of 1 for PPs who received e-mail from healthcare providers, and 0 for those who did not.
16		**E_SETTING_E_MAIL_SUPPORT_COM**		Value of 1 for PPs who thought e-mail support communication with healthcare providers, and 0 for those who did not.
17-18	**Social Networks**			
17		**SN_RECIVED_MESSAGES**	Yes = 1 No = 0	Value of 1 for PPs who received a notification via social networks from healthcare providers, and 0 for those who did not.
18		**SN_SUPPORT_COM**		Value of 1 for PPs who thought that social networking could improve their communication with healthcare providers. And, 0 for those who did not.
19-20	**Text-Platforms**			
19		**SN_THERE_IS_TEXT_FORM**	Yes = 1 No = 0	Value of 1 for PPs who knew there is a text platform such as a blog that allows them to send messages to and receive messages from healthcare providers. And, 0 for those who did not.
20		**SN_TEXT_FORM_SUPPORT_COM**		Value of 1 for PPs who thought that a text platform such as a blog could improve communication with their healthcare providers. And, 0 for those who did not.
21-22	**Education Tools**			
21	**21**	**ET_TYPE**	Derived from "What educational tools do your healthcare providers offer?" PPs' entries are the value. Since this question is providing multiple answers, such as "Library link, Video tutorial, and Other." Thus, this component contains different variables. However, the *'Other'* variable contains different responses. Therefore, we created different variables according to PPs' response at the '*Other'* field which are "POSTERS, AT_MY_VISIT, BROCHURES, and I_DONT_KNOW. Overall, we will deal with this question as '*Yes'* and '*No'* question to not have missing values when PPs chose some of them.	
	21.a	**LIBRARY_LINK**	Yes = 1 No = 0	Value of 1 for PPs who have selected such an education tool, and 0 for those who have not.
	21.b	**VIDEO_TUTORIAL**		
	21.c	**POSTERS**		
	21.d	**I_DONT_KNOW**		
	21.e	**BROCHURES**		
	21.f	**AT_MY_VISIT**		'AT_MY_VISIT' contain different similar responses *(e.g., as at my visit and training course).* Value of 1 for PPs who have answered that they get variable health education at their visit, and 0 for those who did not.
22		**ET _SUPPORT_COM**	Yes = 1 No = 0	Value of 1 for PPs who think education tools could support their communication with their healthcare providers.
23-25	**Communication in Action**			
23	**23**	**CA_COM_FREQUENCY**	Derived from "When you have an appointment coming soon, how often do you communicate with your healthcare providers?" PPs' entries are the value. Since this question is providing multiple answers, such as Since this question is providing multiple answers, such as Never, 1 time after my last visit, 2 times after my last visit ...etc. thus, we created different variables to test the frequency. Overall, we will deal with this question as '*Yes'* and '*No'* question to not have missing values when PPs chose some of them.	
	23.a	**NEVER**	Yes = 1 No = 0	Value of 1 for PPs who have selected such frequency time to communicate with their healthcare providers at the time of their appointments, and 0 for those who did not.
	23.b	**@1_TIME_AFTER**		
	23.c	**@2_TIMES_AFTER**		
	23.d	**@3_MORE_AFTER**		
	23.e	**@1_TIME_BEFORE**		
	23.f	**@2_TIME_BEFORE**		
	23.g	**@3_MORE_BEFORE**		
24	**24**	**CA_COM_REASONS**	Derived from "For what reason(s) do you usually communicate with healthcare providers?" PPs' entries are the value.	

			Since this question is providing multiple answers, such as *for health concerns; to book, cancel, or reschedule an appointment; to complain; clarifying health information, and other*. However, the ‘*Other*’ variable contains different responses. Therefore, we created different variables according to PPs’ response to the ‘*Other*’ field which is ‘OTHER_REASON_REQUEST_MED’ for a response such as to request a medicine. Also, we created ‘OTHER_REASON_NEVER_COM ‘variable to other PPs’ responses that said they never tried the communication tools for any reason. Overall, we will deal with this question as ‘*Yes*’ and ‘*No*’ question to not have missing values when PPs chose some of them.	
	24.a	**CONCERNS**	Yes = 1 No = 0	Value of 1 for PPs who have selected reasons to communicate with healthcare providers, and 0 for those who have not.
	24.b	**APPOINTMENT**		
	24.c	**COMPLAIN**		
	24.d	**CLARIFYING_INFORMATION**		
	24.e	**OTHER_REASON_NEVER_COM**		
	24.f	**OTHER_REASON_REQUEST_MED**		
25	**25**	**CA_RE_COM**	Derived from “When you call or try to communicate with your healthcare providers and you are unable to reach them, what do you do?” PPs’ entries are the value. Since this question is providing multiple answers, such as *go see them in person, try again …etc. and Other* field. However, the ‘*Other*’ variable contains different responses. Therefore, we created a variable according to PPs’ response to the ‘*Other*’ field which is ‘OTHER_NOT_APLICABLE’ for a response such as to never did or not applicable. Overall, we will deal with this question as ‘*Yes*’ and ‘*No*’ question to not have missing values when participants chose some of them.	
	25.a	**SEE_IN_PERSON**	Yes = 1 No = 0	Value of 1 for PPs who have selected way as to recommunicate with healthcare providers, and 0 for those who did not.
	25.b	**TRY_AGAIN_PHONE**		
	25.c	**TRY_AGAIN_DIFFERENT_TOOL**		
	25.d	**CHANGE_HOSPITAL**		
	25.e	**OTHER_NOT_APLICABLE**		
Workflow				
26		**W_DIFFICULT_UNDERSTAND_COM_HP**	Yes = 1 No = 0	Value of 1 for PPs who have difficulty in understanding their health condition which could impact their decision to use communication tools with their healthcare providers, and a value of 0 if it does not impact their decisions.
27		**W_ONLIN_HEALTH_TIME**		Value of 1 for PPs who thought that using communication tools while looking for health information online could be time-consuming, and a value of 0 for those who did not.
Conclusion				
28		**C_WILLING_IN_THE_FUT**	Yes = 1 No = 0	Value of 1 for PPs who are willing to collaborate with their healthcare provider via communication tools in order to improve their health, and a value of 0 for those will not.
29	**P_CONCLUSION**			
	SUGGESTIONS		Derived from “Do you have any other concerns of suggestions regarding the Sehaty Application?” PPs entries are the value. Since this open-end question requested participant’s entry, therefore, we created variables according to PPs’ response. Overall, we will deal with this question as ‘*Yes*’ and ‘*No*’ question to not have missing values when PPs chose some of them.	
	1	**NOTHING**	Yes = 1 No = 0	PPs entries are the value. Value of 1 for a participant who wrote such a suggestion and a value of 0 for those who did not.
	2	**IMAGES_PROBLEM**		
	3	**RESULTS_PROBLEM**		
	4	**REQUEST_ARABIC**		
	5	**ADD_CHAT_OPTION**		
	6	**IMPROVE_APPOINTMENT**		
	7	**ADD_PRINT_OPTION**		
	8	**OVERALL_GOOD_APPLICATION**		
	9	**APPLICATION_PROBLEM**		
	10	**IMPROVE_S**		
	11	**ADD_ET**		
	12	**ADD_COM_TOOLS_MED**		

Table 18: *RQ1 Example of Pre-Coding*

RQ1	**How do eHealth Tools Influence Healthcare Providers' Workflow?** **Note**: 'S' = Sehaty, 'P' = Patient, 'PU'= Perceived Usefulness, 'HP" = Healthcare Providers, 'COM' = Communication, 'INFO' = Information, 'H' =Hypotheses, "Q" = Questions, 'SQ' = Sub-Question, & '#' = Number	
Q1	Rates of patient-participants **(PPs)' general technical proficiency** and **existing Sehaty usage**, coupled with **improving eHealth literacy rates**, will lead healthcare provider-participants **(HPPs) to anticipate streamlined workflows**, if not reduced workloads.	
Rate of Ps' general technical proficiency & use of Sehaty from HPs perspective		
SQ#	**Themes**	**Code**
7	Feeling about Allowing Ps to Access Data in S	S_DATA_HP_FEELING
12	P's Socially Influenced by HPs	HP_INFLUENCE_P
13	S helped HPs to Communicate Effectively with their Ps	HP_S_COM_EFFECTVELY
15	P's Access Online	P_ACESS_ONLINE_HEALTH_INFO
22	HP's Overall Satisfaction Ps Using S	HP_OVERALL_SATISFACTION_P_USE_S
Rate of Ps' eHealth literacy of Sehaty from HPs perspective		
5	Quality of Health Info Provided at S	S_QUALITY_HEALTH_INFO
8	**Type of Health Info to be Provided to Ps**	TYPE_HEALTH_INFO_TO_P
8.a		RISKY_DATA_HEALTH_INFO
9		TYPE_HEALTH_INFO_NOT_TO_P
14	Ps' Understanding of their Health Condition	P_UNDERSTANDING
15	Ps' Gathered Different Opinion Online	P_OPINIONS_ONLINE
21	P's Misinterpreted Health Info	P_USE_S_HP_WORKLOAD
Rate of HPPs to anticipate streamlined workflows		
2.e	Assistance Availability	ASSISTANCE_SUPPORT
4.a	S Helped to Hinder Ps' Care	S_HELP_P_CARE
6	S Helped in Diagnosing Ps	S_DIAGNOSESE_P
11	Communication Reasons	COM_REASONS_P
16	P's Perceived Usefulness of Sehaty - Workflow	P_PU_S_HP_WORKFLOW
17	Ps' with Low Health Literacy	P_LOW_HEALTH_INFO_COM
18	HPs Situation to Play with Ps who Misinterpreted Health Infor at S	S_AFFECETD_HP
20.a	Communication Efficiency - Workflow	HP_COM_P_EFFICIENCY
20.b	Communication Quality - Workflow	HP_COM_P_QUALITY
21	P's Misinterpreted Health Info from S - Workload	P_USE_S_HP_WORKLOAD
23	Training & Workshop	HP_TRANING_WORKLOAD

Table 19: *Full Interview Inductive Coding*

Note: 'S' = Sehaty, 'P' = Patient, 'HP' Healthcare Provider, 'HPP" = Healthcare Providers-Participant, 'COM' = Communication, 'INFO' = Information, 'TECH' = Technology, 'HOS' = Hospital, 'SYS' = System			
Themes	**Code**	**Key Words**	**Memo**
Technology Experience			
Q2-a: How would you describe your technological skills/ability? Note: Healthcare Providers Technical Skills			
TECH_SKILL	**SKILLED**	Excellent; Competent and skillful; Very good; I can easily adapt to the new technology.	HPPs explain their technical skills as excellent and good. HPPs admit that the verity of technology is beneficial as they used it for work, such as for data entry.
	TECH_IMPORTANT	I like to know everything related to technology; Exploring different types of applications; Technology is very beneficial; I must be able to use technology to work at the hospital; I use it for data entry as an example.	
Q2-b: What types of technology do you use most often? Note: Types of Technology Healthcare Providers Use			
HP_TYPE_TECH_USE	**COMPUTER**	Computer.	HPPs status that they use computer and cellular phones at most of their daily time. Integrated Clinical Information Systems (ICIS) is a hospital system used by King Faisal Hospital and Research Center (KFH&RC). HPPs indicated that they use ICIS as a primary hospital's tool for data entry, view, and track patients' health records. Some HPPs also status that they use the PYXIS system to request medication. PYXIS system is "Enterprise Solution (ES) from Becton Dickinson (BD) to help transform their medication management process"[173].
	CELL_PHONE	Cellular phone; cell phone; Phone.	
	OTHER_TECH	Any types of technology; iPad, desktop, and iPhone; Briefly everything such as PCs, laptop, and wireless communication, …etc.; Software applications in the hospital setting, Sehaty mobile application, WhatsApp application; mostly, I use "ICIS" on my computer at work to document and observe patient progress, I also use "PYXIS" for medication..	
Q2-c: What do you think about the information system used in your hospital? Note: Healthcare Providers' Opinion about Hospital's System			
HOS_SYS_USEFUL	**USEFUL**	Excellent; Developed. Especially now, Helpful; Very useful.; Good; Somehow good; It is ok.; Helpful for Ps and HP; Very useful; Through Info-Gate, it's easier to reach any application or information regarding the hospital, Ps, or HPs.	HPPs indicated that the hospital provides them an excellent health information system. The hospital information system (i.e., Info-Gate) is an easy system "to reach any application or information regarding the hospital's Ps and HPs" (HPP#14). However, some other HPPs indicated that the hospital system needs improvement and need to solve its problem such as "slow or loss of Internet connection" (HP#13).
	CONCERN	Good but could be improved more; Yet in some applications, we need to focus more on some of the links' issue; Usually, problems occur because of slow or loss of Internet connection.	
Q2-d: What can you tell me about the types of problems with your hospital system? Note: Types of Hospital System's Problem			
HOS_SYS_PROBLEM	**SLOW**	The Internet is slow; Function slowly; The System is slow. Hangs; Freezes; Down, rarely though; Sometimes electricity shuts down.	HPPs indicated that they faced different types of system problems—for example, slow Internet connection, system down, or freezes, and electricity down. Once the power is down, "computers shut down as well" (HPP#7). HPPs indicated that some feature of the system has an issue such as the security system, online booking, "poor infrastructure and design as well as heavily congested lines (wire's, wireless)" (HPP#10). As a result, Ps' status that these issues caused a delay in health reports also tricky for the doctors and staff "to document or order medications" (HPP#14). On the other hand, an HPP said, "Internally between colleagues there isn't much problem and systems are good. However, when we communicate with Ps, it becomes hard to reach them. Thus, sometimes, they usually contact them by phone" (HPP#4).
	CONCERN	When we communicate with Ps, sometimes it becomes hard to reach them; Usually, we contact Ps by phone when the system is down or for faster response; We have problems booking appointments; Some specialist are not really qualified to use the system; The main systems and security system need to improve; Only works on Windows computer systems; Poor infrastructure, poor design, heavily congested lines (wire's, wireless); Difficult for the doctors to document or order medications; this applies to the staff too; We have a delay in reports.	
Q2-e: Would you say your hospital provides a computer-friendly environment, with adequate training and assistance to support the clinical information systems? **Note:** Healthcare Providers' Opinion about Hospital Provides a Computer-Friendly Environment, Adequate Training, and Assistance.			
ASSISTANCE_SUPPORT	**SUPPORT**	Training, courses, and manual documents; online training courses; There are no workshops but training systems; Some courses for that in the training development center, especially in how to use the "ICIS" program; Always there for help.	HPPs stated that the hospital provides them with training, online training, courses, manual documents, and support all the time. Especially, preparation for the ICIS program. On the other hand, one HPPs agreed the need for more suitable technology for health information. Also, an HPP stated that there is a lack of workshops. Moreover, HPPs indicated that the training support available for HPs only.
	NOT_SUPPORT	No	
	CONCERN	Consider new and more suitable technology.	
Use of Sehaty Application			
Q3-a: How often do you use Sehaty? Note: Healthcare Providers Frequency Use of Sehaty.			
HP_S_FREQUENCY_USE	**ONCE_NEEDED**	I use it when: I need it as a patient; connect to the hospital; See my health history; I'm on leave; Rarely; When I need it; Request medication; Book appointments; View a family member information.	HPPs indicated that they use the Sehaty application at different frequency-time such as once need it, always, sometimes (i.e., 2-3 a month), or when they are away from the hospital. Also, HPPs stated the reasons for using the Sehaty application, such as to track and check their health history, book appointment, or review health records for independent/family members.
	SOMETIMES	2-3 times a month; Sometimes, for follow up or check on my health condition or appointments; Roughly, once a week; 3 times a week, at least.	
	ALWAYS	A lot for lab results; A lot. All of my health information is detailed in there. I like to use it, especially when I'm away; Always.	
	AWAY	When I'm on leave; I'm away.	
Q3-b: For what reasons? Note: Healthcare Providers' Reasons to Use Sehaty			
HP_REASONS_USE_S	**FOLLOW_UP**	Follow up on my health condition; Track my health information; Accessing my own file; Checking appointments and lab results; Test results.	HPPs explained different reasons to use the Sehaty application, such as to request medicine, book appointment, lab/test results, and follow up on their health information. Moreover, HPPs indicated that they use Sehaty to follow up on the health condition for their independent family members. HPP#6's needed to instruct their Ps on how to use the Sehaty application.
	ME_FAMILY	Check my family members' appointments and lab results; Request medication for myself or my dependent family members.	
	APPOINTMENT	Check my family members' appointments and lab results; For a personal appointment.	
	RESULTS	Test results; Lab results.	
	HELP_P	Instructing my patients in how to use it	
	MEDICINES	Medicine; Request medication; Medication request.	
Q3-c: What did you especially like about your experience with Sehaty? Note: Healthcare Providers Like to Use Sehaty Because …			
HP_LIKE_S	**ACCESSIBILITY**	Handy, flexible, and accessible at any time; Easy to access; I can use it anytime and anywhere; Follow up with my appointments; Allows patients to access their health history; View and book their own appointments without relying on phone calls or bother coming in person; I can show it to any doctors outside the hospital (or even outside the country) for further consultation.	HPPs stated the usefulness of Sehaty application regarding its simplicity, accessibility, ease of use, and provides complete health information. HPPs indicated that Sehaty allowed them to access their health information anywhere and anytime. HPP#14 mentioned that Ps also could get the benefit of Sehaty as "it allows Ps to view and book their appointments without relying on phone

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[173] **Source**: file:///C:/Users/jack/Downloads/DI_King-Faisal-Hospital_WP_EN.pdf

	EASY_USE	Easy to use; How easy and accessible it is.	calls or bother coming in person.”
	SIMPLE	Organized and simple. It is excellent; Awesome application.	
	COMPELET_FILE	It is a mobile health record; It provides everything; It is included all my health history; I don’t have to ask for my health information via phone or in-person; I just view it online.	
Q3-d: Now, what do you dislike about using Sehaty? Note: Healthcare Providers Don’t Like to Use Sehaty Because …			
HP_DISLIKE _S	**MISSING_FEATURE**	Sehaty does not cover all types of work, such as writing a comment or writing Ps diagnoses; Not allow HP to view Ps’ health record without P’s consent and only face-to-face; For work, I like to use the computer “ICIS” system; I wish Sehaty is available for all Ps and not only exclusive to our hospital; It would be great if they can somehow make Sehaty a public mobile health resource.	HPPs indicated some problems with Sehaty, such as slow application or system down. Also, a few HPPs suggested that the hospital could include some features to update and developed the Sehaty application. For example, add a direct-communication tool [comment option] to write comments to Ps and a function to diagnoses Ps through Sehaty. Other HPPs indicated that the old system via the use of the computer was easy to access and print documents.
	NOT_ACCESSIBIL_ FOR_HP	Sehaty does not allow you to view patients’ health records without P’s consent and only fact-to-face.; As for work, I can’t communicate with Ps via Sehaty.	
	NOTHING	Nothing bad; I don’t have one; So far, nothing is wrong with it; Nothing to mention; For most of the part! none, so far;	
	S_PROBLEM	Too slow and downtime; To print test results, I need to use the “ICIS,” it Needs some improvement and updating some information in a timely manner.	
Q3-e: What kind of help is readily available when you experience problems with Sehaty? Note: Kind of Support Available for Sehaty			
HELP_S	**CALL**	Call technical support; Information Technology (IT) departments; Dial-up “0” for technical assistance; Contact the administrative departments; the Healthcare Information Technology Affairs (HETA), which is the IT departments at the hospital.; is always someone available to help.	According to HPP#14, “there is always someone available to help.” HPPs mentioned that they call the help center, administration desk, or Healthcare Information Technology Affairs (HETA) once they find any technical problem with Sehaty. Although, some HPPs indicated that they never had an issue with Sehaty. Moreover, an HPP mentioned that usually when there is a problem with Sehaty the solution is to restart the system as the problem caused by the connection.
	TRY_FIX	Restart the system; Usually a connection problem.	
	NEVER	I never had a problem with Sehaty before; Never happened before,	
Q4-a: In what ways, does Sehaty help or hinder your patient care? Note: Sehaty Help or Hinder Patients Care			
S_HELP_P_CARE	**HELP**	Ps follow up and track their health condition from anywhere and at any time; Request appointments; Facilitate things. For example, it is a sort of communication tool where Ps can book appointments online via Sehaty; Help quite a lot; Ps do not have to contact us for a specific service such as view their health history; Could help in increases Ps’ awareness about their health condition; Available in Arabic or English; Track health condition; As a result, increases Ps care.	HPPs indicated some advantages of Sehaty application. Sehaty is reachable to Ps, where they could increase Ps’ awareness of their health. Moreover, an HPP indicated that Sehaty could be a communication tool once patients request an appointment. The points mentioned above could reduce HP’s workflow [time] in term of using Sehaty to access information or book an appointment. On the other hand, HPPs indicated that Sehaty is an application for Ps’ use. Thus, HPPs use Sehaty as a P. Therefore, HPPs stated that they did not have an experience with Sehaty to diagnose Ps.
	NOT_APPLICABLE	Not part of my job; Not applicable; I have not yet experienced it with Ps.; Not applicable to use it as a doctor; I just use it as a P.	
Q4-b: In what ways has Sehaty helped you to improve clinical records? Note: Sehaty Improve Clinical Records			
S_IMPROVE_ CLINICAL_RECORDS	**P_FOLLOW_UP**	Yes, it helps to check, update, and track health records via patients.	HPPs indicated that Sehaty could help in Ps’ care. HPPs stated the idea of having P’s health record completed, updated, accessible, and available at anytime and anywhere will help Ps to track and follow up on their health condition. Also, an HPP indicated that health records could be safe in Sehaty. An HPP also noted that Sehaty could reduce the time for workflow when Ps decided not to contact them back. For example, according to HPP#2: "Sehaty could show lab results to patients who have high health literacy, without the need to contact us back if the results are good." Few HPPs indicated that they use ICIS to take care of Ps.
	HP_REDUCE_TIME	Sehaty could reduce the time used to contact Ps to edit or cancel appointments without delays; Show lab results to Ps without the need to contact us back if the results are excellent [for Ps who have high health literacy].	
	UPDATED	All P’s information will be updated on the website, which is linked to the mobile version; Since we are moving to paperless systems, all Ps information will be updated on the web; This app will help.	
	ACCESSIBILITY	Completely accessible; Easy to track.	
	COMPELET_FILE	Better than using and filing papers; Making all the records available online.; Documents all health procedures; Since we are moving to paperless systems, all phone information will be updated on the web; This app will help;	
	SECURE	Clinical records will be safer on the system.	
	NOT_APPLICABLE	Not applicable; Not applicable; not applicable for doctors’ view, we use ICIS.	
Q4-c: Do you think Sehaty poses less of a threat to patients’ privacy than paper records? Note: Sehaty Privacy Concern			
S_ PRIVACY	**THREAT**	Open and easy to access via hackers; Not really fully safe somehow easy to access.	Some HPPs indicated that the hospital has a reliable security system and moving from paper-format to electronic-format is safer. Although Sehaty keeps Ps’ information confidential, however, some HPPs concerned about the hacking issues and the risk of hackers releasing some sensitive information. Moreover, other HPPs believe that both methods, the paper, and electronic formats could be at risk in terms of privacy. Also, some HPPs indicated that they don’t have technical information to be sure about the privacy risk.
	SAFE	Yes; Hard for other people to access it; The hospital has a good security system; Keeps Ps’ info confidential; Paper-format records can be read by everyone working at the hospital. Sehaty, on the other hand, is just accessible by patients with a secure password; Somehow yes, there is always a risk with any method used to keep records and documents safe, this applies on either formats paper or software.	
	NOT_SURE	Not very sure about this; Especially when there are a lot of people who can easily hack anything; Maybe; Somehow yes, there is always a risk with any method used to keep records and documents safe, this applies on both formats paper or software; Maybe. I’m not an IT person.	
Q4-d: In time, do you think Sehaty will ultimately lead to improved patient care? Note: Sehaty Improved Patient Care			
S_IMPROVE_ P_CARE	**IMPROVED**	Yes; It will be nice if we can access Ps’ health records directly via phone, but usually, we use ICIS; Help Ps to rely on themselves to track their own health condition; Track health’ information; Improves Ps awareness of their health condition; Patients could understand their health condition when they follow their health status on Sehaty, and that saves them time.	All HPPs believed that Sehaty could support Ps’ care as it increases P’s awareness and understanding of their health condition by tracking their health information. This could save time.
Information Satisfaction of Sehaty			
Q5: What is your opinion regarding the quality of health information provided by Sehaty? Note: Healthcare Providers’ Opinion of the Quality of Health Information at Sehaty			
S_QUALITY_ HEALTH_INFORMATION	**AGREED**	Very good; Good; Excellent; Ok; I like all health information provided by Sehaty, it covers everything; Acceptable.	All HPPs accepted that Sehaty provides quality health information for Ps. However, some HPPs noted that Sehaty’ health information could more be improved in terms of quality and simplicity. Moreover. HPP#8 indicated that “for some Ps might need more health knowledge.” Other HPPs meant to provide the test results in Arabic.
	NEEDS_IMPROVEMENT	For some Ps might need more health knowledge; There is always a way to improve quality and simplicity of info; The results in English.	
Q6: How does the data in Sehaty help you with health diagnoses and potential adjustments for patients? Note: Sehaty Helps Diagnoses Patients			
S__HELP_DIAGNOSES	**NOT_APPLICABLE**	We don’t use it to check patients’ health records, but it is nice that all patients’ health records are updated and online; Not applicable; Not my job; I never use it for Ps care; Only we use ICIS for diagnoses.	All HPPs indicated that Sehaty is an application for Ps’ use only. For example, to track and view their health information. Moreover, HPPs showed that they use ICIS for P’s diagnoses and any health concern. Thus, HPPs assigned that they don’t have access to Ps’ file via Sehaty. However, some HPPs agreed with
	CLARIFICATION	Results and diagnosis viewed and updated via ICIS at any worktime; Every health diagnosis always depends on the efficiency of the data	

		collector. That way, other users can access information easily when P's profiles are completed and adequately detailed; Sehaty Ps use only.	the idea of having accessibility to P's health information through Sehaty, which would manage to update health information at the spot, as a result, would improve the diagnoses. Moreover, the type of data provided via Sehaty or ICIS is depended on HPs. For example, did the HPs update the data into the system more accurate and detailed?
Q7: What are your views about allowing patients to access the data on Sehaty? Note: Healthcare Providers' Views of Allowing Patients to Access data on Sehaty			
S_HP_FEELING	**HP_AGREED**	Must allow; Excellent; Good; Right.	All HPPs agreed about allowing Ps to access their health data via Sehaty for many reasons. HPPs believed that when Ps can view their health information, that could increase Ps' health knowledge and awareness, which provides reassurance to them. Besides helping Ps to manage and prepare themselves for treatment, thus generating a proper diagnosis.
	HP_REASONS	Reassurance; Increase health knowledge; & Health awareness; Manage treatment; Generate proper diagnosis.	
Q8: What are your views about the type of health information that you are willing to provide to your patients via Sehaty? **Note:** Types of Health Information Healthcare Providers' Willing to Provide to Patients			
TYPE_HEALTH_INFO_TO_P	**ALL_TYPE**	All information; All with attention; The data belongs to Ps and should be provided to them; It is ok as long as Ps understand the health information and doesn't need explanation; All data that support the working diagnosis; All types as lab test, medication, general information such as contact information, name, vitals, and MRI; All for follow up.	Most HPPs agreed about the type of current info provided via Sehaty to be view by Ps. Information types such as general info (i.e., as contact information, name) and health information as the lab test, medication, vitals, and MRI. HPPs also indicated that Ps have the right to know their health condition. However, other HPPs designated that not all types of info should provide it to Ps with low health literacy or income. Thus, HPPs suggested offering the kind of info that supports the working diagnosis with attention. Also, some HPPs indicated that the health info provided at Sehaty is in English. Thus they suggested that Sehaty should give it in Arabic.
	NOT_ALL_TYPE	Somewhat I don't agree to show health information [Risky data] for some Ps with low health literacy and low income; All with attention; It is ok as long as Ps understand the health information and doesn't need explanation.	
	SUGGESTION	All but everything is in English this could be hard for some Ps to understand; I would provide it in their language (Arabic).	
Q8-a: In regards to critical health results (bad news about a health condition), would you provide this information to your patients using Sehaty? **Note:** Healthcare Providers' Opinion to Provide Critical Health Results to Patients			
CRITICAL_HEALTH_INFO	**AGREED**	They will know it anyway; I would, as for myself I would like to see my results; Ps need to know their conditions before we explain due to late appointments; Ps rights.	Most of the HPPs agreed to provide critical information via Sehaty to Ps for many reasons, such as it is their right, they will know it anyway, or to cooperate to treat their health condition. However, some HPPs don't agree to provide critical information to Ps as it will depend on the Ps condition or their health literacy. Few HPPs suggested that good or bad health information should be delivered to Ps by the physician first. Therefore, HPPs showed some concerns about Ps' behavior, such as "Ps could complain or cooperate. Some Ps feel the need to argue with doctors, and some would understand and move to treatment" (HPP#13) in the term for critical information. Also, HPP#15 stated: "At least I [HP] can write a note in Sehaty stating that P needs to visit a doctor as soon as possible."
	NOT_AGREED	Critical health results; Not to all Ps (Ps with low health literacy); I don't agree; Should only be provided by the physician to the Ps directly first; Depends the Ps and his/her condition; Usually the doctor is the one who provide bad or good news to Ps.	
	CONCERN	Depends on the patient and his/her condition (maybe?); Not provide kind of news (Critical health information) until they visit their doctors; Write a note in Sehaty stating that Ps needs to visit a doctor as soon as possible; Depend on the Ps. Ps can complain or cooperate. Some Ps feel the need to argue with doctors, and some would understand and move to treatment.	
Q9: What kinds of health information would you not share with patients via Sehaty? Note: Healthcare Providers' Opinion of the Types of Health Information Not to Share with Patients			
TYPE_HEALTH_INFO_NOT_TO_P	**ALL_TYPE**	Nothing; All should be clear to them; They have the right to know all kind of info; Nothing to mention.	Most HPPs agreed to provide all types of information to Ps as they have the right to know and to help them to follow up. However, some HPPs indicated that they are not willing to share critical, risk, lab, and MRI's results to Ps. Other Ps designated that receiving health information depends on Ps health literacy. Therefore, some HPPs suggested that some or/and all info should be provided via physicians initially before the info would be available online.
	SUGGESTION	Any info that is not discussed by the physician to the Ps; It is the Ps right to know everything unless it should be discussed and explained in more detailed manners by the physician; Meet a doctor before the info would be available online; Depends on Ps health literacy; HPs should write a comment in a comment box request Ps to contact them.	
	RISKY_DATA	Critical conditions; Risk results; Labs result, and MRI.	
Communication			
Q10: What kind of communication tools does the hospital provide for you to communicate with your patients? Note: Communication Tools Provides at the Hospital			
HOS_COM_TOOL	**PHONE**	Phone; Cellular phone.	According to HPPs, the hospital provides different communication tools with Ps such as via phone, cellular phone, and e-mail. The hospital also offers an interpreter for those Ps who cannot speak Arabic and distributes flyers (brochures) at Ps visit. HPP#13 assigned using a WhatsApp application to communicate with colleagues.
	E_MAIL	Email (upon request).	
	OTHER_COM_TOOLS_HOS	Pager, WhatsApp (mobile application) with my other HPs; Flyer (brochure) at the Ps visit; If a Ps doesn't speak Arabic an interpreter is available.	
Q11: So, have you communicated with your patients between visits for any reason? Please explain. Note: Reasons to Communicate with Patients			
COM_REASONS_P	**APPOINTMENTS**	Via phone in regard appointments; When we have negative health results.	HPPs indicated several reasons to contact Ps via communication tools (e.g., phone). HPPs communicate with Ps for specific services or requirements such as to explain or modify health info, or/and for appointments' services (i.e., schedule appointments). HPPs also explained some needs to communicate with Ps, such as physicians' requests to guide and prepare Ps for the next visit, pick up medication, update health info, follow up with a health condition, or review Ps' health status. Also, other HPPs indicated that s/he usually communicates Ps at Ps' visits (i.e., verbally). Only one HPP designated that his/her job was not related to Ps' care; thus, no experience with patient's communication.
	SPECIFIC_SERVICE	Specific requirement; Explain or modify health info; Medicine and test results; Guide them through diagnostic imaging results; Instruct and prepare them for their next visit; Yes, if the doctor asks us to call them.	
	FOLLOW_UP	Remind them for a specific service; Update their health info or about family members' condition; Follow up.; Sometimes I have to contact a P more than once to follow up with health condition or review health information.	
	NOT_APPLICABLE	No, we communicate with patient verbally in person; Not applicable.	
Q12: When you communicate with patients, does this influence them to communicate back to you? Note: Healthcare Providers Influences Patients to Communicate Back			
HP_INFLUENCE_P	**INFLUENCED**	Yes.; Sometimes.; Happens a lot.; Sometimes, because we support some Ps financially or for homecare.; to support Ps when they talk to their doctors; Sometime, if the doctor going for emergency leave or the doctor need to see them early, we ask the Ps to call back urgently.	Most HPPs explained the reasons for Ps to call them back. A social worker described the needs of Ps to call them back, such as to support them financially. Other HPPs explained that some Ps need support when they talk to their physician. Other HPPs requested participants to call back for an urgent matter. Only one HPP indicated that Ps don't call him/her back. One HPP whose job not required to communicate with Ps.
	NOT_INFLUENCED	No	
	NOT_APPLICABLE	Not applicable	
Q13: What about the Sehaty application, does it allow you to communicate effectively with your patients? **Note:** Does Sehaty Allows Healthcare Providers to Communicate with Patients Effectively			
HP_S_COM_EFFECTIVELY	**NOT_SURE**	I don't know but I don't think so; Sehaty communication tools are basic and meant to be for Ps to understand their health condition; Never tried that yet.	Most HPPs do not know if Sehaty provides a communication tool for Ps. However, some HPPs indicated that booking an appointment through Sehaty could be a way of communication but not a direct-communication tool (i.e., a chat service). Also, Sehaty provides a "contact us" option where patients could find the hospital contact information such as e-mail, phone, and hospital address.
	APPOINTMENT	The e-messages from Sehaty only for appointments; Requesting an appointment kind of communication; But there is not chat services in Sehaty; Request medication.	
	AWARENES	But some Pts do not know about Sehaty.	
	USABILILTY	Also, I don't think this will work with all Ps because they vary in their use of technology and smart devices. Not all Ps can use Sehaty application.	

	CONTACT_US	There is "Contact us" option. Where they can find phone, e-mail, and hospital address information.	
Q13-a: If no, do you feel that Sehaty should provide communication tools to facilitate correspondence with your patients? **Note:** Do Healthcare Providers Think Sehaty should Provide Communication Tools			
HP_THINK_S_COM_TOOLS	**AGREED**	Yes; Somewhat yes as a communication option; Extremely recommended that; A more user-friendly communication application available would support Ps; Application can be improved to better serve Ps with communication.	Most HPPs indicated that communication tools with the Sehaty application are a good idea. HPPs explained communication tools via Sehaty will be user-friendly options to Ps that serve them better. Also, some HPPs indicated having a communication tool via Sehaty could request a specialist who will be "available constantly online to answer P's question" (HPP#16), and this will employ a job opportunity.
	NOT_GOOD	No.	
	JOB_OPPORTUNITIES	A specialist should be to answer Sehaty question; Why not but for this will need to employ more people. It is going to be a new job/Call center that requires capable people who available constantly online to answer P's questions.	
Q14: What do you think of Sehaty in terms of increasing patients' understanding of their health conditions? Note: Would Sehaty Increases Patients' Understanding			
S_IMPROVE_P_HEALTH_LITERACY	**IMPROVE**	Ps would understand their health situation; Improved Ps health info; Increase Ps' knowledge; Ps advantage that allows them to track their health condition such as weight and diabetes concerns; Increases health awareness; Good application for medical info; Technology helps Ps to understand their condition in a new friendly manner.	Most HPPs indicated that Sehaty could improve Ps' understanding of their health condition and health awareness in a new friendly manner. However, some HPPs indicated that improve health knowledge would depend on P's health literacy. Also, HPP#14 said: "It's never like meeting the doctor and understanding health condition directly from him/her in person."
	P_LITERACY_AFFECT	Depends on the P's health's literacy; Some Ps it is an advantage that allows them to track their health condition ; But for others Ps basic info can be hard to understand; Never like meeting the doctor and understanding health condition directly from him/her in person.	
Patients Factors			
Q15: What do you think of patients developing different opinions about their health treatment based on what they have read online? **Note:** Healthcare Providers' Opinion on Patients developed Different Opinion from the Internet			
P_OPINIONS_ONINE	**DON'T_AGREE**	I don't like it; I don't agree.	HPPs indicated that Ps have the right to access the Internet, and that increase Ps' curiosity. Some HPPs agreed that the Internet could improve Ps' health knowledge, awareness, as well as counts as a self-education tool. However, most HPPs agreed on P's responsibility for the information they got from the Internet. Furthermore, HPPs assigned that they are specialists and have the experience; thus, Ps should not rely on the Internet.
	AGREE	Internet is accessible by everyone; Increases their health knowledge; It is ok; increase their health awareness and that is positive; It is a good sign; self-educating themselves; trying to have a good health lifestyle; managing their treatments; They can, why not; Ps has the right to agree or refuse their treatment plan.; It is Internet age. I can't ask patients to not look for health info online.	
	PROBLEM	Ps' fault, mistakes and responsibility; Argue with doctors; Curiosity; Problem.	
	P_LETERACY_AFFECT	Ps' responsibility to ensure that they understand their health condition; some suggested treatments on the Internet are not necessarily suitable to every P's case.	
	P_REQUIR_CLARIFY_HP	Ps start coming to ask about their health inquiries; our experience we know what the best for them; I'll try to clarify the information according to their condition. At the end, we are specialists with experience.	
Q16: When patients perceive Sehaty as a useful tool and use it to communicate with you, how do you feel that could affect your workflow? **Note:** Patients Perceive Usefulness from Sehaty could Affect Healthcare Providers Workflow			
P_PU_S_HP_WORKLOAD	**INCREASE_WORKLOAD**	Add work; Communication is good but chatting with Ps could cause a problem; Negatively affect the workflow; Annoying and could increase workload; Increase the workflow if they patients communicate for non-urgent issue; It could increase the workload unless there is a special employee as mentioned before.	Some HPPs indicated that adding a direct-communication tool to Sehaty could increase the workload as required sometimes to answer, especially for nonurgent manner. On the other hand, some HPPs noted that adding a direct-communication tool to Sehaty could save time in terms of reducing face-face appointments. Also, HPPs explained that inserting a direct-communication tool could facilitate communication in an urgent situation. All over, HPPs suggested that the hospital should have a support call center or specialists who can answer Ps' inquiries via Sehaty.
	DECREASE_WORKLOAD	Help my workflow by reducing face-face appointment; The workflow might be much easier as we can reply to physician feedback. But I don't think that is an option yet; Affect positively and save time.	
	SUGGESTION	Technical support call center for that; A specialist who can control Sehaty application for communication tools; Affect positively to our workflow if there are specialists for that; Could increase the workload unless there is a special employee as mentioned before.	
Q17: What are your views about communicating with patients who have low health literacy? **Note:** Healthcare Providers' Views in Communicating with Patients who have Low Health Literacy			
P_LOW_HEALTH_INFO_COM	**HARD**	Hard to explain some health conditions to Ps with low health literacy; Regardless, they have the right to know; Challenging and difficult. We work in two steps one is to help them be aware of their condition, another is to help them treat and take care of themselves; We face this issue with older people.	Some HPPs indicated that sometimes they find difficulty in communicating with older people or Ps with low health literacy. Some HPPs reported that when they notice challenging to explain health problem to Ps, then HPs try to define Ps issue more simply. Also, some HPPs indicated when dealing with older Ps; usually, there is someone (i.e., relative) to help Ps to understand their health condition. Moreover, HPPs noted that sometimes they got physicians' advice, try to communicate face-to-face with Ps, or work to try to make the communication simpler and more effective as it is their job to ensure P's understanding of their health condition.
	EASY	Easy with Ps with high health literacy; We face this issue with older people but there is always someone with them who can take care of explaining to them.	
	HP_REQUIR_CLARIFY	Explain the health information to them anyway; I will try to explain his/her specific health condition best way possible; If possible I prefer to ask for face-to-face communication; Ps literacy should not prevent us from helping them; Doctor will be more effective in communication with Ps who have high health literacy; Happens a lot but I'll keep my communication simple and effective; Explain in clear words.	
Q18: What role do you expect to play in a situation where patients have misinterpreted health information because of information they accessed via Sehaty? **Note:** Role to Play when Patients Misinterpreted Health Information via Sehaty			
S_MISINTERPREATED_ROLE_PLAY	**HP_REQUIR_CLARIFY**	Correct the info or write a note at Ps' comments box if possible; Ps always call back and I explain; Redirect him/her to the right person; Clarify the info and help them understand; Clear the misconceptions up and provide real help; More explanation will be required; Talk to them at as simple as needed by their level of comprehension; Consider us that we are on our patient side; Educate them and provide needed support; Ps remain in contact with us; Contact Ps primary physician for more clarification.	Most HPPs emphasized that they would support Ps when needs more clarification. HPPs reported that they would try to correct, explain, and clarify any misinterpreted by Ps' understanding. An HPP said that s/he would "try to talk to them at as simple as needed by their level of comprehension" (HPP#11). Other HPP indicated that Ps with low understanding would be redirected to the right specialist (i.e., physicians).
	NOT_APPLICABLE	Not applicable.	
Workflow			
Q19: Generally, what are your expectations regarding how Sehaty affects you personally? Note: Sehaty Affects Healthcare Providers' Life Style			
S_AFFECTED_HP	**AFFECTED**	Positive effects and more awareness; Self-independence; Helps to reconsider the priorities; Documented and gives time to work on other things since it is accessible anytime and anywhere; Phone call is easier; Increase the knowledge and awareness; Know health condition in more detailed; Help Ps to be self-reliable rather than depending on you [HP] for every inquiry or help; Less stress and more time; Positive effects.	HPPs indicated that the Sehaty application affected their lifestyle positively. For example, saving their time by accessing their health information, thus reconsider the priorities. As well as for Ps, Sehaty helped Ps to be more self-independence or self-reliable rather than depending on others. Besides, Sehaty provided Ps with detailed health information, thus increases awareness.
	NO_AFFECTED	Not much yet.	

Q20: As a result of patients' use of Sehaty, what do you think is the impact on your overall workload? Note: Patients Use Sehaty would Impact Healthcare Providers Workload			
P_USE_S_HP_WORKLOAD	**NO_AFFECT**	No; Not affecting.	HPPs indicated that for now (current), if Ps use Sehaty, which will not affect their HPs' workflow. On the other hand, some HPPs noted that using Sehaty could lessen the workload.
	AFFECT	Maybe, will ease the load; Reduce the workflow; Make our work less in specific services such as appointment.	
	NOT_APPLICABLE	Not applicable.	
Q20-a: How do you feel about the efficiency of communication with your patients? Note: Efficiency Communication with Patients			
	EFFICIENCY	Not bad; Good enough; Ok; Good but at some point; Since Sehaty started, communication decreased specifically with prerequisite medication or refill, and booking appointments.	Some HPPs indicated that the hospital provides them with a useful and practical communication system with Ps. However, some HPPs noted that the efficiency of the communication with Ps, with low health literacy, is weak or hard as it required time. On the other hand, HPP#14 said: "Since Sehaty started, communication decreased specifically with prerequisite or medication refill". Other HPPs indicated that the hospital provides a particular employee for communication.
	TIME_CONSUMING	Problem with Ps who miss understand; Sometime, explaining health info takes time; Hard, it required times.	
	NOT_EFFICIENCY	Low; Not always; Not all Ps are capable of using the application yet.	
	NOT_APPLICABLE	There are special people for that.	
Q20-b: How do you feel about the quality of communication with your patients? Note: Quality of Communication with Patients			
HP_COM_P_QUALITY	**SATISFIED**	Normal; Good; Satisfying; Ok; Not bad.	Some HPPs indicated that the hospital provides a variety of communication tools—for example, phone and e-mail. Also, an HPP noted that the quality of communication with the Ps depends on P's technical ability and Ps' health literacy (HPP#8).
	NOT_SATISFIED	Depends on Ps technical ability and Ps' health literacy; Need lots or more to improvements.	
Q21: Based on your past experiences with Sehaty, would a patient's misinterpretation of health information received via Sehaty affect your workload? **Note:** Patient's Misinterpretation of health Information Received via Sehaty			
P_PU_S_HP_WORKLOAD	**AFFECT**	Yes; Indeed; Maybe.	Some HPPs had an experience where Ps misinterpret health information received via eHealth tools but not necessary via Sehaty. Some HPPs indicated that Sehaty does not affect their workflow. Other HPPs assumed that Sehaty would affect their workflow.
	NOT_AFFECT	No; Not via Sehaty; Not applicable.	
Q22: How would you rate your overall satisfaction with your patients' use of Sehaty? Note: Overall Satisfaction with Patients' Use of Sehaty			
HP_OVERALL_SATISFACTION_P_USE_S	**SATISFIED_S_USE**	Very good.; 8/10.; I agree; Good.; I love it; I encourage other to use it.; I like it.; Ps could understand their health conditions in more details.; Satisfied.; I truly appreciate it; most people are happy with it; could improve Ps' health awareness.; 75%.; Excellent and I recommend it.	Almost all HPPS showed overall satisfaction with Ps' use of Sehaty. Some HPPs assigned that Ps happy using Sehaty. Only one HPP has 50% of total satisfaction.
	NOT_SATISFIED_S_USE	Rate 50%	
Q23: What do you think of implementing training programs at your hospital on how to use the Sehaty application? **Note:** Implementing Training Programs at the Hospital on How to Use Sehaty			
HP_TRANING_WORKLOAD	**NO_NEED**	All Ps can use Sehaty application; Easy to use; No need; It is a simple application.	HPPs have a different opinion on implementing training programs at the hospital for the Sehaty application. Some other HPPs noted that there are no needs for the training program as Sehaty is a simple application and easy to use. On the other hand, some HPPs indicated training workshops would be beneficial for some Ps, and they might be interested in attending a workshop or training program. Also, some HPPs suggested that instead of having a training program is to provide Ps with a video tutorial or printed guideline, which will reach the same purpose. An HPP also suggested having a training program for only Ps with a disability, such as poor vision, …etc.
	AGREE	Good idea; Why not; Important and needed; Ps interested to attend such a workshop; Helpful; Ps want to learn and maybe interested in a training program.	
	SUGGESTION	Video tutorial (for Sehaty use); Printed guideline would serve better; Only Ps with disabilities, Poor vision for example, would need one-to-one training.	
Conclusion			
Q24: If you had the ability to change anything about the Sehaty program, what would you make different? Note: Changes would Improve Sehaty			
TO_IMPROVE_SEHATY	**LANGUAGES**	They could provide test results in Arabic language as well as other languages; Add Arabic language for medical terminology so Ps can understand it more.	HPPs suggested some features that could improve the Sehaty application. For example, HPPs proposed translating the test results and medical terminology in Arabic and other languages. Also, some HPPs suggested adding a direct communication tool (e.g., text or chat box), library link (i.e., for medical health terms), as well as allowing HPs to access Ps' files via Sehaty. Moreover, some HPPs recommended working more on feedback's comments and ease the registration procedures.
	DIRECT_COM_TOOL	Add a direct communication tool with P (e.g., text box).	
	HP_ACCESS_P_FILE_S	All HPs should have a link via Sehaty to access Ps' file.	
	LIBRARY_LINK	Add a library link to Sehaty to explain medical terms.	
	FEED_BACK	Working on the feed-back.	
	EASE_REGISTRATION	Making registration process easier.	
Q25: Okay, you have been very helpful. Are there any other thoughts you would like to share with us to help us understand your opinions of the usefulness of the Sehaty application? Anything at all you would like to add? Note: Opinions of the Usefulness of Sehaty			
OPINIONS	**S_EXSITING**	Sehaty application should be in every communication channel [media]; Increase awareness about Sehaty.	An HPP indicates that Sehaty should be "in every communication channel such as media" (HPP#10) to increase the Sehaty existing. Also, HPPs agreed about the usefulness of Sehaty; thus, HPPs suggested that Sehaty should be a united application that all hospitals in the KSA provide it. Also, HPPs assigned that the hospital should have [HP experts] in teaching how to use Sehaty to help Ps get the benefit from it, as well as [HPs specialist] to answer Ps' questions via Sehaty.
	ACCESSABILITY_OUT_HOS	I hope this application be available for all hospitals in the kingdom.	
	JOB_OPPORTUNITY	Provides more than one HP to be experts in Sehaty application, how people can use it, answering Ps' concern.	

Table 20: *An Example of the RQ1's Inductive Coding (i.e., PPs' Technical Proficiency and use of Sehaty)*

RQ1	**How do eHealth Tools Influence Healthcare Providers' Workflow?** ***Note****: 'S' = Sehaty, 'P' = Patient, 'PU'= Perceived Usefulness, 'HP" = Healthcare Providers, 'COM' = Communication, 'INFO' = Information, 'H' =Hypotheses, 'SQ' = Sub-Question, & '#' = Number*			
Q1	Rates of patient-participants **(PPs)' general technical proficiency** and **existing Sehaty usage**, coupled with **improving eHealth literacy rates**, will lead healthcare provider-participants **(HPPs) to anticipate streamlined workflows**, if not reduced workloads.			
Rate of PPs' general technical proficiency & use of Sehaty from HPPs perspective				
Q#	**Themes**	**Code**	**Key words**	**Memo**
7	**HPPs' perspective on Ps using eHealth Tools**	**HP_AGREED**	Must allow; Excellent; Good; Right.	All HPPs agreed about allowing Ps to access their health data via Sehaty for many reasons. HPPs believed that when Ps can view their health information, that could increase Ps' health knowledge and awareness, which provides reassurance to them. Besides helping Ps to manage and prepare themselves for treatment, thus generating a proper diagnosis.
		HP_REASONS	Reassurance; Increase health knowledge; Health awareness; Manage treatment; generate proper diagnosis.	
12		**INFLUENCED**	Yes.; Sometimes.; Happens a lot.; Sometimes, because we support some Ps financially or for homecare.; to support Ps when they talk to their doctors; Sometime, if the doctor going for emergency leave or the doctor need to see them early, we ask the Ps to call back urgently.	Most HPPs explained the reasons for Ps to call them back. A social worker described the needs of Ps to call them back, such as to support them financially. Other HPPs explained that some Ps need support when they talk to their physician. Other HPPs requested participants to call back for an urgent matter. Only one HPP indicated that Ps don't call him/her back. One HPP whose job not required to communicate with Ps.
		NOT_INFLUENCED	No	
		NOT_APPLICABLE	Not applicable	
13		**NOT_SURE**	I don't know but I don't think so; Sehaty communication tools are basic and meant to be for Ps to understand their health condition; Never tried that yet.	Most HPPs do not know if Sehaty provides a communication tool for Ps. However, some HPPs indicated that booking an appointment through Sehaty could be a way of communication but not a direct-communication tool (i.e., a chat service). Also, Sehaty provides a "contact us" option where patients could find the hospital contact information such as e-mail, phone, and hospital address.
		APPOINTMENT	The e-messages from Sehaty only for appointments; Requesting an appointment kind of communication; But there is not chat services in Sehaty; Request medication.	
		AWARENES	But some Pts do not know about Sehaty.	
		USABILITY	Also, I don't think this will work with all Ps because they vary in their use of technology and smart devices. Not all Ps can use Sehaty application.	
		CONTACT_US	There is "Contact us" option. Where they can find phone, e-mail, and hospital address information.	
15		**DON'T_AGREE**	I don't like it.; I don't agree;	HPPs indicated that Ps have the right to access the Internet, and that increase Ps' curiosity. Some HPPs agreed that the Internet could improve Ps' health knowledge, awareness, as well as counts as a self-education tool. However, most HPPs agreed on P's responsibility for the information they got from the Internet. Furthermore, HPPs assigned that they are specialists and have the experience; thus, Ps should not rely on the Internet.
		AGREE	Internet is accessible by everyone; Increases their health knowledge; It is ok; increase their health awareness and that is positive; It is a good sign; self-educating themselves; trying to have a good health lifestyle; managing their treatments; They can, why not; Ps has the right to agree or refuse their treatment plan.; It is Internet age. I can't ask patients to not look for health information online.	
		PROBLEM	Ps' fault, mistakes and responsibility; Argue with doctors; Curiosity; Problem;	
		P_LITERACY_AFFECT	Ps' responsibility to ensure that they understand their health condition; some suggested treatments on the Internet are not necessarily suitable to every P's case.	
		P_REQUIR_CLARIFY_HP	Ps start coming to ask about their health inquiries; our experience we know what the best for them; I'll try to clarify the information according to their condition. At the end, we are specialists with experience.	
22		**SATISIFIED_S_USE**	Very good.; 8/10.; I agree; Good.; I love it; I encourage other to use it.; I like it.; Ps could understand their health conditions in more details.; Satisfied.; I truly appreciate it; most people are happy with it; could improve Ps' health awareness.; 75%.; Excellent and I recommend it.	Almost all HPPS showed overall satisfaction with Ps' use of Sehaty. Some HPP assigned that Ps happy using Sehaty. Only one HPPs has 50% of total satisfaction.
		NOT_SATISFIED_S_USE	Rate 50%	

Appendix C: Patients Questionnaire

(English Version)

[Ottawa University:** File #: ORA/934/38, received on May 29, 2017; closed on April 28, 2018; **KFS&RC Ethics:** File #: H09-17-02, received on Oct 13, 2017; closed on Oct 12, 2018**]

Dear Participant,

***This is** Eman Basahih, a PhD student at the University of Ottawa, in Canada.*

This data is for research purposes only. This questionnaire will help us understand how satisfied you are with the Sehaty application and how it affects your communication with physicians at the hospital.

I would like to assure you that this is an anonymous survey and the information will be confidential.

***Eligibility:** You qualify to participate in this questionnaire if you are 18 years old and above. If you have been treated at this hospital for 6 months and above.*
If you are a new patient or younger than 18 years of age, you cannot take part in this survey.

*This is the **paper version** of the survey, which you can **submit** back to the researcher (if present) or to the hospital department receptionist. If you cannot finish the questionnaire while waiting, you can take the hard-copy home with you and submit it to the receptionist ‘on your next visit. The final date of data collection is: ___________.*

You can also complete the survey electronically at www._________________.
*It takes **20–30 minutes** to complete this questionnaire.*

Please begin…

NOTE: *For each of the following boxes, please choose a random number from 1-49. Do not use a number more than once. Please take note of these 6 numbers, which will be your identifier for future correspondence. If, for example, you should decide to withdraw from the study, you will need to tell us this number and we will remove this form from the study.*

Please identify six numbers in the following box. Pick numbers from (1-49):

☐ ☐ ☐ ☐ ☐ ☐

Demographic

1. **Gender:**
   ○ Male
   ○ Female

2. **Age:**
   What is your age group?
   a 18–28 years’ old
   b 29–39 years’ old
   c 40–50 years’ old
   d 51–60 years’ old
   e 60+ years old

3. **Education:**
   What is the highest degree or level of school you have completed? ***If currently enrolled, indicate the highest degree received.***
   a No schooling completed
   b Not completed high school
   c High school diploma
   d Bachelor’s degree
   e Master’s degree
   f Doctorate degree
   g Other: ________

4. **Language:**
    - English
    - Arabic
    - Both
    - Other: ________
5. **Marital Status:**
    - What is your marital status?
        - a Single, never married
        - b Married
        - c Widowed
        - d Divorced
        - e Separated
        - f Other: ________
6. **Employment Status:**
    - Are you currently:
        - a Self-employed
        - b Employed
        - c A student
        - d Unemployed
        - e Retired
        - f Other: ________
7. **Economic Status:**
    - What is your monthly income?
        - a No income
        - b Less than 2000 SR
        - c 2001-5000 SR
        - d 5001-10,000 SR
        - e 10,001-15,000 SR
        - f 15,001-20,000 SR
        - g More than 20,001 SR

Technical abilities and Social Influence

8. How often do you use Sehaty application?
    - 1–3 times a week
    - 3 or more times a week
    - When I need to check, or track my health status, book an appointment)
    - Other: ________________
9. You feel confident using the Sehaty application because:
    - You are familiar with technology
    - Simple design
    - Other: __________________
10. **Please indicate how much you agree or disagree with the statements using the scale on the table. Please select one response for each statement.** [174]

#	Statements	Completely Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Completely Agree
Perceived Usefulness						
1	I find Sehaty useful to help me understand my health condition.	**1**	**3**	**4**	**5**	**7**
2	Using Sehaty enables me to view my medical reports.	**1**	**3**	**4**	**5**	**7**
3	Using Sehaty increases ability to learn about my health condition.	**1**	**3**	**4**	**5**	**7**
4	Using Sehaty allows me to prepare questions for my next visit.	**1**	**3**	**4**	**5**	**7**
5	Using Sehaty enables me to track my health status more quickly.	**1**	**3**	**4**	**5**	**7**
Actual Use						
6	I have the resources necessary to use Sehaty.	**1**	**3**	**4**	**5**	**7**
7	I have the knowledge necessary to use Sehaty.	**1**	**3**	**4**	**5**	**7**
8	Sehaty is not compatible with other systems I use.	**1**	**3**	**4**	**5**	**7**
9	A specific person is available to offer me assistance with	**1**	**3**	**4**	**5**	**7**

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[174] **Sources:**

- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478.
- Khechine, H., Lakhal, S., Pascot, D., & Bytha, A. UTAUT model for blended learning: The role of gender and age in the intention to use webinars. *Interdisciplinary Journal of E-Learning and Learning Objects,* 2014, 10(1), 33–52.

	Sehaty.					
Social Influences						
10	People who influence my behavior think I should use Sehaty.	**1**	**3**	**4**	**5**	**7**
11	People who are important to me think I should use Sehaty.	**1**	**3**	**4**	**5**	**7**
12	My healthcare provider has been encouraging me to use Sehaty.	**1**	**3**	**4**	**5**	**7**
Intention to use Sehaty						
13	I intend to use Sehaty in the future.	**1**	**3**	**4**	**5**	**7**
14	I predict I will use Sehaty in the future.	**1**	**3**	**4**	**5**	**7**
15	I plan to use Sehaty in the future.	**1**	**3**	**4**	**5**	**7**

The eHealth Literacy

11. **Please indicate the usefulness of the information on the Internet, using the scale on the table. Please select one response for each statement.**[175]

#	Statements	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
1	**How useful do you feel the internet is in helping you making decisions about your health?**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
2	**How important is it for you to be able to access health resources on the Internet?**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
3	**I know what health resources are available on the Internet.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
4	**I know where to find helpful health resources on the Internet.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
5	**I know how to find helpful health resources on the Internet.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
6	**I know how to use the Internet to answer my questions about health.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
7	**I know how to use the health information I find on the Internet to help me.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
8	**I have the skills I need to evaluate the health resources I find on the Internet.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
9	**I can tell high quality health resources from low quality health resources on the Internet.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful
10	**I feel confident in using Information from the Internet to make health decisions.**	Not Useful at All	Not Useful	Unsure	Useful	Very Useful

Communication

12. What type of communication tools do you like to use to contact with your healthcare providers at the hospital? (Check all that apply)
    - ☐ Phone
    - ☐ E-mail
    - ☐ Text-based platform
    - ☐ Sehaty
    - ☐ Other: ___________
13. Have you received an alert message via email, phone text message, social media or other for a specific service (e.g., appointment or medication refill)?
    - ○ Yes
    - ○ No
14. Do you think that setting alert messages for specific services help you to communication or collaborate with your healthcare provider?
    - ○ Yes
    - ○ No
15. Have you ever received some electronic messages from your healthcare providers?
    - ○ Yes
    - ○ No

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[175] **Source:** Hoffman-Goetz, L., Donelle, L., & Ahmed, R. (2014). *Health literacy in Canada: A primer for students* [In Chapter 6, pp. 101-121]. Canadian Scholars' Press, Toronto, Canada.

16. Do you think that electronic messaging systems improves your communication with your healthcare providers?
    - ○ Yes ○ No
17. Have you ever received a notification via social networking from healthcare providers?
    - ○ Yes ○ No
18. Do you think that notification via social networking improve your communication with your healthcare providers?
    - ○ Yes ○ No
19. Does your healthcare provider text platform such as blog where you can send and receive messages?
    - ○ Yes ○ No
20. Do you think that text platforms improve your communication with your healthcare providers?
    - ○ Yes ○ No
21. What educational tools does your healthcare provide? (Check all that apply.)
    - ☐ Library link
    - ☐ Video tutorial
    - ☐ Other: _____________
22. Do you think educational tools improve your communication?
    - ○ Yes ○ No
23. How often do you communicate with your healthcare providers?
    - ☐ Never
    - ☐ 1 time after my last visit
    - ☐ 2 times after my last visit
    - ☐ 3 or more times after my last visit
    - ☐ 1 time before my appointment
    - ☐ 2 times before my appointment
    - ☐ 3 or more times before my appointment
24. For what reason(s) do you usually communicate with your healthcare providers? (Check all that apply, and be specific if you check the other box.)
    - ☐ For health concerns (e.g., new symptoms arise)
    - ☐ To book, cancel, or reschedule an appointment
    - ☐ To complain
    - ☐ To clarify my health information (e.g., questions related to online health information)
    - ☐ Other: __________
25. When you call, or try to communicate with your healthcare providers and you are unable to reach them, what do you do? (Check all that apply)
    - ☐ Go see them in person
    - ☐ Try again and again
    - ☐ Try again by using a different tool (e.g., use Sehaty)
    - ☐ Change hospitals (to seek better healthcare services)
    - ☐ Other: ____________________

Workflow

26. Do you find it difficult understanding your health conditions which results in or encourages you to use communication tools for healthcare providers?
    - ○ Yes ○ No
27. Do you find that looking online for health information is time consuming?
    - ○ Yes ○ No

Conclusion

28. In the future, are you willing to collaborate with your healthcare provider (e.g., using communication tools) in order to improve your health?
    - ○ Yes ○ No
29. Do you have any other concerns or suggestions regarding the Sehaty application?

This is the end of the survey. Thank you very much for your participation.

Appendix D: Interview Protocol for Healthcare Providers

(English Version)

[Ottawa University:** File #: ORA/934/38, received on May 29, 2017; closed on April 28, 2018; **KFS&RC Ethics:** File #: H09-17-02, received on Oct 13, 2017; closed on Oct 12, 2018**]

Participant #: ___________	Date: __________________
Start Time: ____________	Interviewed by: __________
Stop Time: _____________	Observed Gender: ________

Hello again[176], my name is **Eman Basahih**. I'm a full-time student at the University of Ottawa in Canada. May I ask you, what name would you like me to use? ________. Thank you for that, Mr. /s _________. Before I begin, I would like to tell you the purpose of this study. One of my physician friends at your hospital told me about the new Sehaty mobile application,-which has many features for patients and healthcare providers such as allowing patients to view their health records and allowing healthcare providers to view patients' medical reports, etc. Therefore, I'm conducting a research study into the effectiveness of King Faisal Specialist Hospital and Research Centre's Sehaty mobile application, and I would like to include your experiences and opinions in this interview. Moreover, this interview will also help me understand how hospital personnel communicate with patients in their daily practice to ensure successful healthcare delivery.

Just before we start, I would like to ask you if I can record our interview so that I do not miss any important information that you talk about. If at any time during the interview, you would like me to turn off the recording, please do not hesitate to ask me. Your name and responses will remain confidential. This interview will take 45–60 minutes. Please feel free to provide me with in-depth answers. (Kindly, I'll hand the consent form to the participant) This is a consent form. It includes our study purpose…. (I'll explain briefly what is on the consent form) ...etc. Please feel free to read it and let me know if you have any questions or concerns. If not, please sign it, and this will indicate your consent to this interview.

PERSONAL BACKGROUND QUESTIONS

1. **May I start by asking some background questions?**
    a. So, tell me to which age group do you belong?
        - 19–28 years
        - 29–39 years
        - 40–50 years
        - 51–60 years
        - 60+ years

    b. What is your position at the hospital?
    c. How long have you worked here? ______________________________________

    *(**Expected answer:** 3 years or more. It is a condition in this research. We knew this information in advance when we collected the participant's contact information from the human resources department at the hospital)*

Transition: That is interesting, so you have worked here long enough to tell me some of your experiences with technology.

TECHNICAL BACKGROUND

2. **I'm interested to know a bit more about your experience with technology:**
    a. How would you describe your technological skills/ability?
    b. What types of technology do you use most often?
    c. What do you think about the information system used in your hospital?
    d. What can you tell me about the types of problems with your hospital system?

    *(**Clarification**, if needed: the server being down or problems with data entry?)*

    e. Would you say your hospital provides a computer-friendly environment, with adequate training and assistance to support the clinical information systems?

Transition: We have been talking about your personal experiences with technology, and I'm assuming that could

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[176] I'll say "again" since I will be contacting the participants in advance to book an appointment.

affect your experience with the Sehaty application. I know Sehaty is a new application, but according to our information from the hospital's human resources department, you are one of the people who use it.

USE OF SEHATY APPLICATION

3. **Generally,**
    - **a.** How often do you use Sehaty?
    - **b.** For what reasons?
    - **c.** What did you especially like about your experience with Sehaty?
    - **d.** Now, what do you dislike about using Sehaty?
    - **e.** What kind of help is readily available when you experience problems with Sehaty?
4. **Now, let's move on to more specific questions about Sehaty and patients' care:**[177]
    - **a.** In what ways, does Sehaty help or hinder your patient care?
    - **b.** In what ways has Sehaty helped you to improve clinical records?
    - **c.** Do you think Sehaty poses less of a threat to patients' privacy than paper records?
    - **d.** In time, do you think Sehaty will ultimately lead to improved patient care?

Transition: Okay, we have covered some of your experiences with Sehaty. Now, the next questions will ask you about your level of satisfaction with the data provided by Sehaty.

INFORMATION SATISFACTON OF SEHATY

5. What is your opinion regarding the quality of health information provided by Sehaty?
6. How does the data in Sehaty help you with health diagnoses and potential adjustments for patients?
7. What are your views about allowing patients to access the data on Sehaty?
8. What are your views about the type of health information that you are willing to provide to your patients via Sehaty?
    - a. In regards to critical health results (bad news about a health condition), would you provide this information to your patients using Sehaty?
9. What kinds of health information would you not share with patients via Sehaty?

Transition: Okay, all of your information about Sehaty is interesting and useful. Now, I would like to know a little more about the communication systems at your hospital that allow you to communicate with your patients between visits.

COMMUNICATION

10. What kind of communication tools does the hospital provide for you to communicate with your patients?
11. So, have you communicated with your patients between visits for any reason? Please explain.
12. When you communicate with patients, does this influence them to communicate back to you?
13. What about the Sehaty application, does it allow you to communicate effectively with your patients?
    - a. If no, do you feel that Sehaty should provide communication tools to facilitate correspondence with your patients?
14. What do you think of Sehaty in terms of increasing patients' understanding of their health conditions?

Transition: Okay, now we know more about the communication between you and your patients at your hospital. However, there are some factors that could affect patients' decisions to use Sehaty, which could also affect you as a result. Therefore, the next questions will address some of these factors.

PATIENTS FACTORS

15. What do you think of patients developing different opinions about their health treatment based on what they have read online?
16. When patients perceive Sehaty as a useful tool and use it to communicate with you, how do you feel that could affect your workflow?

*(**Clarification:** Have you ever had a patient communicate with you (i.e. via Sehaty) multiple times regarding the same issue?).*

17. What are your views about communicating with patients who have low health literacy?
18. What role do you expect to play in a situation where patients have misinterpreted health information because

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[177] **Source**: Moody, L. E., Slocumb, E., Berg, B., & Jackson, D. (2004). Electronic health records documentation in nursing: Nurses' perceptions, attitudes, and preferences. *Computers, Informatics, Nursing* 22(6), 337–344.

of information they accessed via Sehaty?

Transition: All of your comments were very helpful. Now, I would like to know more about the Sehaty application influences your workload.

WORKFLOW[178]

19. Generally, what are your expectations regarding how Sehaty affects you personally?

*(**Clarification**: What change in yourself do you hope will result from your Sehaty experiences?)*

20. As a result of patients' use of Sehaty, what do you think is the impact on your overall workload?
    a. How do you feel about the efficiency of communication with your patients?
    b. How do you feel about the quality of communication with your patients?
21. Based on your past experiences with Sehaty, would a patient's misinterpretation of health information received via Sehaty affect your workload?
22. How would you rate your overall satisfaction with your patients' use of Sehaty?
23. What do you think of implementing training programs at your hospital on how to use the Sehaty application?

*(**Clarification**: Would it increase your workload?)*

Transition: Okay, you have given us a lot of information about your experiences with the Sehaty application, what it is used for, and what you like and dislike about it. Now, we are almost at the end of our interview, and I would like to ask you about your recommendations regarding Sehaty.

CONCLUSION

24. If you had the ability to change anything about the Sehaty program, what would you make different?
25. Okay, you have been very helpful. Are there any other thoughts you would like to share with us to help us understand your opinions of the usefulness of the Sehaty application? Anything at all you would like to add?

We have reached the end of the interview. Thank you for your time, and we really appreciate your participation. If you feel that you would like to add more information, please do not hesitate to contact me via email or phone (I'll provide a copy of my business card). I wish you good luck, and have a nice day or night.

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[178] **Source**: Kittler, A., Pizziferri, L., Volk, L., Jagannath, Y., Wald, J., & Bates, D. (2004). Primary care physician attitudes towards using a secure web-based portal designed to facilitate electronic communication with patients. *Journal of Innovation in Health Informatics* 12(3), 129–138.

Appendix E: Other Scenarios (Results)

Table 21: *PPs' eHealth Literacy Results*

PPs' Opinions on Accessing Health Resources via the Internet							
11.2	**How important is it for you to be able to access health resources on the Internet?**	**INT_HEALTH _RESOURCES**	**Valid**	[-2] Not Useful At All	1	0.9	0.9
				[-1] Not Useful	2	1.9	2.8
				[0] Unsure	6	5.6	8.4
				[1] Useful	52	48.6	57.0
				[2] Very Useful	46	43.0	100.0
					107	**100**	
11.3	**I know what health resources are available on the Internet.**	**INT_KNOW_ HEALTH_RES OURCES**	**Valid**	[-2] Not Useful At All	7	6.5	6.5
				[-1] Not Useful	3	2.8	9.3
				[0] Unsure	16	15.0	24.3
				[1] Useful	41	38.3	62.6
				[2] Very Useful	40	37.4	100.0
					107	**100**	
PPs' Opinion on the Internet as a Useful Tool for Health Information Needed to make Health-Related Decisions							
11.1	**How useful do you feel the Internet is in helping you make decisions about your health?**	**INT_HEALTH DECISIONS**	**Valid**	[-2] Not Useful At All	2	1.9	1.9
				[-1] Not Useful	2	1.9	3.7
				[0] Unsure	10	9.3	13.1
				[1] Useful	47	43.9	57.0
				[2] Very Useful	46	43.0	100.0
					107	**100**	
11.10	**I feel confident in using information from the Internet to make health decisions.**	**INT_CONFID ENT_HEALT H_DECISIONS**	**Valid**	[-2] Not Useful At All	20	18.7	18.7
				[-1] Not Useful	5	4.7	23.4
				[0] Unsure	37	34.6	57.9
				[1] Useful	26	24.3	82.2
				[2] Very Useful	19	17.8	100.0
					107	**100**	
PPs' Perspectives on Where and How to find Helpful Health Resources on the Internet							
11.4	**I know where to find helpful health resources on the Internet.**	**INT_WHERE_ HELPFUL_RE SOURCES**	**Valid**	[-2] Not Useful At All	1	0.9	0.9
				[-1] Not Useful	4	3.7	4.7
				[0] Unsure	1	0.9	5.6
				[1] Useful	61	57.0	62.6
				[2] Very Useful	40	37.4	100.0
					107	**100**	
11.5	**I know how to find helpful health resources on the Internet.**	**INT_HOW_HE LPFUL_RESO URCES**	**Valid**	[-2] Not Useful At All	2	1.9	1.9
				[0] Unsure	7	6.5	8.4
				[1] Useful	41	38.3	46.7
				[2] Very Useful	57	53.3	100.0
					107	**100**	
PPs' Perspectives on Using Health Information Gathered from the Internet							
11.6	**I know how to use the Internet to answer my questions about health.**	**INT_ANSWER _HEALTH_QU ESTIONS**	**Valid**	[-2] Not Useful At All	2	1.9	1.9
				[0] Unsure	7	6.5	8.4
				[1] Useful	49	45.8	54.2
				[2] Very Useful	49	45.8	100.0
					107	**100**	
11.7	**I know how to use the health information I find on the Internet to help me.**	**INT_USE_OF_ HEALTH_INF ORMATION**	**Valid**	[-2] Not Useful At All	3	2.8	2.8
				[-1] Not Useful	4	3.7	6.5
				[0] Unsure	5	4.7	11.2
				[1] Useful	47	43.9	55.1
				[2] Very Useful	48	44.9	100.0
					107	**100**	
PPs' Opinions about their Skills to Evaluate the Quality of Health Resources on the Internet							
11.8	**I have the skills I need to evaluate the health resources I find on the Internet.**	**INT_SKILLS_ EVALUAT_IN FORMATION**	**Valid**	[-2] Not Useful At All	3	2.8	2.8
				[-1] Not Useful	3	2.8	5.6
				[0] Unsure	12	11.2	16.8
				[1] Useful	55	51.4	68.2
				[2] Very Useful	34	31.8	100.0
					107	**100**	
11.9	**I can tell high-quality health resources from low-quality health resources on the Internet.**	**INT_CONFID ENT_HEALT H_DECISIONS**	**Valid**	[-2] Not Useful At All	1	0.9	0.9
				[-1] Not Useful	2	1.9	2.8
				[0] Unsure	6	5.6	8.4
				[1] Useful	52	48.6	57.0
				[2] Very Useful	46	43.0	100.0
					107	**100**	

Appendix F: Patient–Participants (PPs) Other Demographic Variables

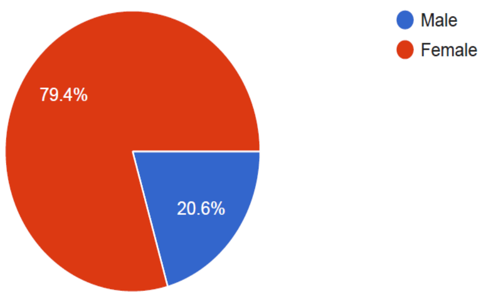

Figure 12: *PPs Gender*

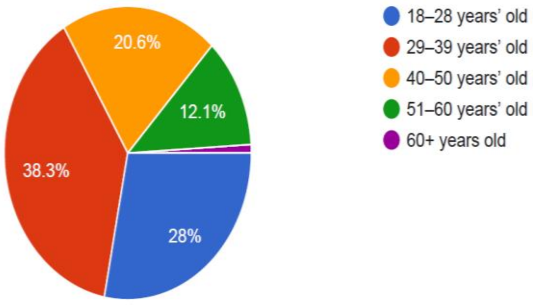

Figure 13: *PPs Age*

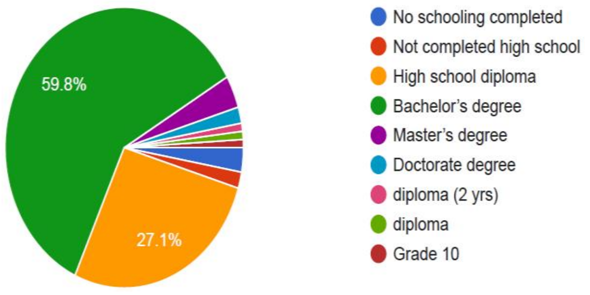

Figure 14: *PPs Educational Level*

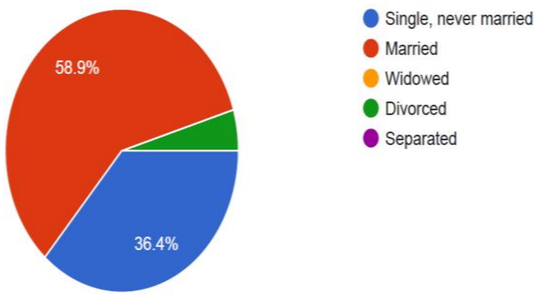

Figure 15: *PPs Marital Status*

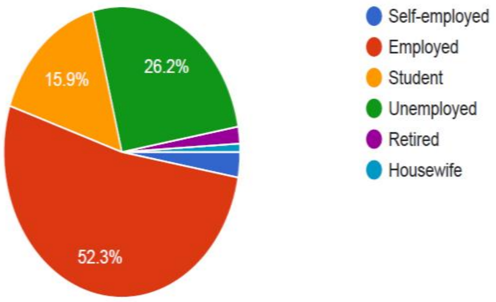

Figure 16: *PPs Employment Status*

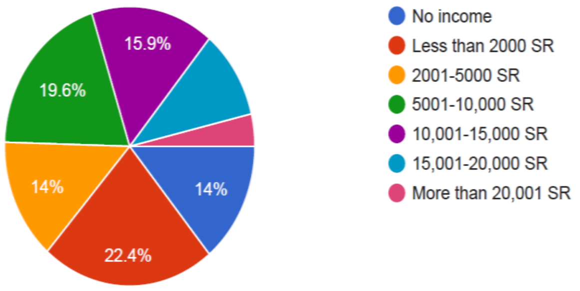

Figure 18: *PPs Economic Status*

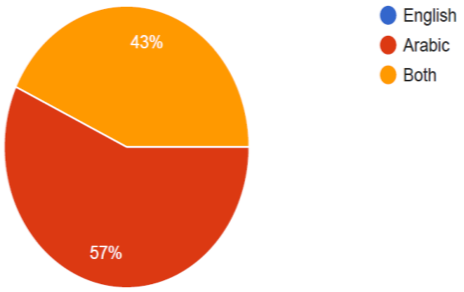

Figure 18: *PPs Language Ability*