

# Acceptance of Health Services on Mobile Phones

## A Study of Consumer Perceptions

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## **Abstract**

JEFFERY LAWRENCE LOO: Acceptance of health services on mobile phones:  
A study of consumer perceptions  
(Under the direction of Dr. Paul Solomon)

**CONTEXT:** Mobile phones are a popular technology capable of portable computing and data access. These features could be helpful for delivering health care services.

**OBJECTIVE:** This study examined health consumers' perceptions of mobile phone health services and their intentions to adopt the technology.

**DESIGN:** Participants viewed a presentation introducing mobile phone services for interacting with health professionals, taking health actions, delivering health information, and managing health care services. Afterwards, semi-structured interviews inquired about their perceptions and acceptance of the technology.

**ANALYSIS:** Qualitative analysis identified emerging themes from interview transcripts.

**PARTICIPANTS:** Forty adult health consumers who were healthy individuals or patients with chronic health conditions – additionally, they had experience with health services delivered through information technology, or they did not.

RESULTS: All participants intended to use the technology: thirty were ready to adopt immediately, while ten intended to adopt later upon the need or when particular conditions were met. Among all respondents, sixteen were interested in adopting a selection of the services only. Diverse motivations and pathways may shape health consumers' adoption decision. However, the general process has potential adopters considering their health status and health environment, their personality, and the perceived helpfulness of the technology. Helpfulness was determined by reflection upon positive and negative perceptions of the technology and consideration of usability and safety. Participants had positive impressions that the technology supports healthy behaviors and fosters quality and efficiency of care. There were also preferences for mobile and digital health services. Furthermore, participants believed the technology could support health information behaviors. The negative perceptions were concerns that the technology requires immense resources and skills, is stressful to use, neglects the social dimension of health care, and threatens the quality of care. Consequently, there was interest in the development of safe, responsive, and inclusive mobile health systems. Implementation of mobile phone health services should respond to health consumers' interests and concerns.

CONCLUSION: Health consumers are interested in using mobile phone health services.

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## **Chapter 1: Introduction**

Delivering health care services on mobile phones is a promising technology. Health organizations could reach many consumers with this nearly ubiquitous computing device. As of December 2008, 270.3 million people in the United States are mobile phone subscribers – representing 87% of the population – and they used their phones for 2.2 trillion minutes that year with one trillion text messages sent (CTIA, 2008). Additionally, one of every five US households (20.2%, 2008 estimate) relies solely on mobile phones for telephone communication (Blumberg and Luke, 2009). Furthermore, there is evidence that computer technologies may increase the skills, motivation, and self-efficacy for health activities (Suggs, 2006), so medical applications on mobile phones might drive healthy behaviors among consumers. Consequently, this technology has the potential to save resources, increase outreach, and improve health outcomes (Boland, 2007; McCann et al., 2009).

Recent research is laying the groundwork for mobile phone health services. Feasibility and pilot studies have explored their development and implementation from the health professional's perspective – focusing on technical, administrative, and organizational issues (Bielli et al., 2004; Dhar et al., 2006; Vilella et al., 2004). Increasingly, health outcomes studies are evaluating the benefits of this

technology through randomized controlled trials, exploring factors such as medical adherence and health improvement (Hurling et al., 2007; Ostojic et al., 2005). Additionally, examining the attitudes and experiences of health consumers is important to developing this technology (Pinnock et al., 2006; Pinnock et al., 2007). Understanding the perceptions and acceptance of these services may help design systems that are responsive to consumer expectations. For this reason, the study aims to understand the perceptions surrounding mobile phones in health care.

This research examines health consumers' perceptions of mobile phone health services and their intentions to use the technology. While there are many opportunities for health applications on mobile phones, the study focuses on services for interacting with health professionals, taking health actions, delivering health information, and managing health care services. Semi-structured interviews gathered health consumers' impressions of the technology. Study participants were either healthy individuals or patients with chronic health conditions – additionally, they had experience with health services delivered through information technology, or they did not. Qualitative data analysis identified themes from the interview transcripts.

This dissertation reports qualitative findings about health consumers' perceptions and acceptance of mobile phone health services. First, a background review describes the uses of this technology and examines how to

study the acceptance of an innovation. Afterwards, the methodology for data collection is outlined – explaining how the semi-structured interviews were conducted. Participants' acceptance of mobile phone health services are then detailed along with a description of the factors that shape this decision. Since technology perceptions are an important factor in the acceptance process, subsequent chapters outline participants' positive and negative impressions as well as the perceived impact on health and information behaviors. Next, the description of five participants' adoption experiences illustrates the unique pathways that lead to technology acceptance. To propose a direction for the technology's advancement, participants' suggestions for the sound development of mobile phone health services are reported. Finally, the conclusion reviews the findings and explores opportunities for future study. Overall, this dissertation contributes to the understanding of mobile phone health services by exploring health consumers' perceptions and acceptance of the technology.

## **Chapter 2: Background**

### ***Health services on mobile phones***

Mobile phones have the potential to support health care (Boland, 2007). As portable computers, they can process complex health information through voice, text, photo, audio, and video modes. The technology is also a familiar one. Many consumers already use mobile phones – and for services beyond the telephone call, such as scheduling with calendar applications or searching for entertainment like music, video, and games. Its mobility offers convenience for contacting health services wherever mobile networks exist. Because of their popularity and computing capacity, mobile phones could be valuable for delivering health care services to the general public.

There are mobile phone services for health communication and promoting healthy behaviors. They facilitate interactions with health care professionals, assist with health actions, deliver health information, and manage health care services (Table 1). In the future, as more tools converge with mobile phones, richer services may be possible.

Table 1. Mobile phone health services

Service	Example
<b>Facilitating interactions with health professionals</b>	
Collecting and sharing health measurements	(Cleland et al., 2007) (Scherr et al., 2006) (Trudel et al., 2007)
Sending information to contribute to diagnosis	(E-Health Insider, 2007)
<b>Assisting health actions</b>	
Facilitating healthy behavior	(Fjeldsoe et al., 2009) (Hurling et al., 2007) (Tsai et al., 2007)
Providing reminders for medication schedules and medical procedures	(Nugent et al., 2007) (Vilella et al., 2004)
Monitoring health status and providing guidance	(Boland, 2007) (Pinnock et al., 2007)
<b>Delivering health information</b>	
Delivering health education resources	(Wangberg et al., 2006) (Lim et al., 2008)
Delivering patient status updates	(Gammon et al., 2005)
Delivering local information relevant to health conditions	(Cleland et al., 2007)
<b>Managing health care services</b>	
Scheduling appointments	(Nokia, 2005)
Delivering appointment reminders	(Nokia, 2005) (Dyer, 2003)
Delivering medical test results	(Menon-Johansson et al., 2006) (Dhar et al., 2006)

Mobile phones can help health consumers interact with medical professionals remotely. Patients might collect health measurements on their mobile and then send this data for review by a medical team. For instance, asthma patients can measure airflow from their lungs using a peak flow meter that is attached to the phone (Cleland et al., 2007). A software application then generates graphs from these measurements to monitor the condition, and this data can also be sent to the medical office through mobile networks. Additionally, patients are able to send complex health information to help physicians with diagnosis. There was a case in Scotland where a woman used her camera phone to send a picture of her swollen legs. From the photograph, the doctor determined she had a serious condition and quickly set an ambulance to bring her to hospital (E-Health Insider, 2007). As these examples demonstrate, mobile phones can capture the patient's health condition and then send this information for medical review.

As a portable computer, the mobile phone can guide consumers to take health actions. For promoting healthy lifestyles, there is an Internet service to schedule exercise activities – and when the time comes, a reminder of this commitment is sent to the phone (Hurling et al., 2007). Another application helps with weight control. Diary software on mobile phones lets health consumers record food intake and exercise activity – and then it calculates whether targets for calorie consumption are being met (Tsai et al., 2007). Then there are automated phone reminders that help patients adhere to a medication schedule and follow through with medical procedures (Nugent et al., 2007; Vilella et al.,

2004). Finally, mobile phone applications can monitor health conditions for changes and then respond with suggestions. For instance, young asthma patients can enter their symptoms into a phone diary. Based on the data entered, the software can provide feedback like alterations to medical regimens or medication schedules (Boland, 2007). In brief, mobile phone computing enables digital services that assist with health actions.

With their access to telecommunication networks, mobile phones can deliver health information. First, there are educational health messages. Norwegian parents of type 1 diabetic children can learn about diabetes through text messages that provide definitions, facts, and management tips (Wangberg et al., 2006). There has also been a question-and-answer service for sexual health concerns deployed through text messaging (Levine et al., 2008). Secondly, caretakers may monitor patients through health status updates delivered to their mobile phones. For instance, children's blood glucose monitors can send the test results to the parents' phones for oversight (Gammon et al., 2005). Finally, there are services delivering local information to help patients prepare for their day. For example, asthma patients can review environmental conditions that might disrupt physical activity – such as pollen and pollution levels – on their phone (Cleland et al., 2007). All of these services keep consumers informed about their health.

Mobile phones may also manage health care services. Appointment scheduling is one example. Patients can text a clinic to request an appointment and then receive an automated response of available times (Nokia, 2005). Afterwards, the patient responds with a preferred appointment. A text message reminder is delivered as the date approaches. In another time-saving service, medical test results may be delivered to mobile phones, which could avoid delays in letter mail delivery. A sexual health testing clinic has successfully deployed such a program, and it resulted in patients being diagnosed and receiving medical attention sooner (Menon-Johansson et al., 2006). Overall, the mobile phone is capable of administering health care services.

### ***Technology acceptance***

There are several definitions for technology acceptance, so it is important to describe what will be studied. Some researchers examine the self-reported intention to use technology (Venkatesh et al., 2003), while others measure actual usage (An et al., 2007). The subject doing the accepting may be the individual (Compeau and Higgins, 1995; Davis et al., 1989) or an organizational entity (Leonard-Barton and Deschamps, 1988). In health technologies research, acceptance has often focused on hospital environments and the adoption patterns of health care professionals (Fonkych and Taylor, 2005).

There are different approaches for studying technology acceptance (Bouwman, 2005). The objectivist view examines the fit of an innovation within its organizational environment. The structurationalist perspective focuses on the interactions among technologies, users, and organizations. The individual is another focus for examination. This represents the subjectivist approach, which emphasizes relevance, perceptions, tasks, behavior, and other personal factors.

This study focuses on individual adopters and defines technology acceptance as the intention to use mobile phone health services. There are several reasons for this position. Behavioral intention is a good predictor of actual behavior (Ajzen, 1991). Additionally, technology acceptance theories have focused on individuals to explain adoption (Venkatesh et al., 2003), and many health studies have focused on the individual to understand health behavior (Ajzen, 1991). For these reasons, this research takes the position that individual beliefs, attitudes, intentions, cognitions, emotions, and readiness for innovations are important human dimensions to understanding health technologies (Backer, 1995).

### ***Studying individual perceptions***

Among technology acceptance theories, there are common theoretical themes focusing on behavioral intention and individual reactions (Venkatesh et al., 2003). According to one model, actual use of information technology is shaped by individuals' intention to use it and their reactions to the technology

(Figure 1) (Venkatesh et al., 2003). These three variables interact with one another, but not in a linear, sequential pathway. This model focuses on the subjective individual and holds personal relevance, perceptions, and intentions as important determinants of technology acceptance and adoption.

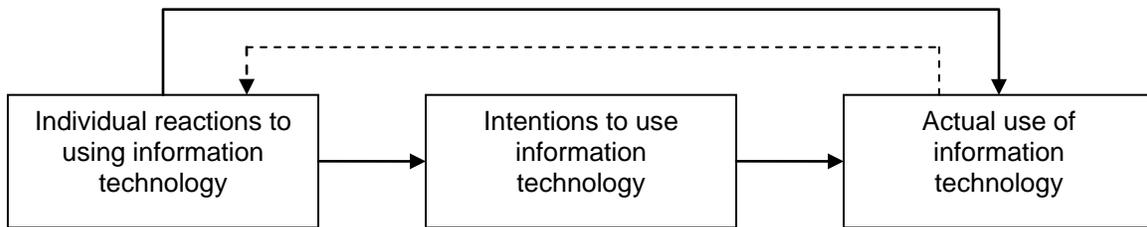


Figure 1. Underlying concept in user acceptance models (Venkatesh et al., 2003)

Three theories support this unified model of technology acceptance: the Theory of Planned Behavior, the Technology Acceptance Model, and the diffusion of innovations theory (Spil, 2006).

An important psychological theory in the health sciences, the Theory of Planned Behavior justifies the focus upon individual perceptions for understanding and predicting health technology acceptance (Ajzen, 1991). According to this theory, people are more likely to carry out a behavior when they are motivated to perform the behavior and when they perceive the behavior is easy to perform or not too difficult. These factors of intention and perceived behavioral control can explain variations in people's actual behavior (Ajzen, 1991). Personal beliefs are important in this theory because they shape the

behavioral determinants in the first place. Important beliefs are the favorable appraisal of the behavior (attitudes), what people important to us think about this behavior (subjective norms), and whether we think we can do it (perceived behavioral control).

The Technology Acceptance Model has two determinants of acceptance: perceived usefulness and perceived ease of use. People are more likely to adopt a technology if they believe it is useful and if they believe it is easy to use (Davis, 1989; Spil, 2006). Perceived usefulness is a belief that using the technology will enhance job performance in such ways as speed, productivity, effectiveness, and job ease (Davis, 1989). On the other hand, perceived ease of use is a belief that technology use will be free of difficulty and immense effort – specifically, the technology is easy to learn, controllable, flexible, clear, and understandable (Davis, 1989). This model uses subjective terms to measure acceptance and its determinants. It is based on prior research that showed self-prediction of future behavior is one of the most accurate predictors of individual behavior (Sheppard et al., 1988; Warshaw and Davis, 1985). By focusing on individual intentions and perceptions, this theory supports the study of health technology acceptance along individual and self-perceived terms.

Diffusion of innovations theory also supports a subjective focus in technology acceptance research. This sociological theory explains diffusion, which is the “process by which an innovation is communicated through certain channels over

time among the members of a social system” (Rogers, 2003). This theory has four dimensions: perceptions of innovations, communication channels, time elements – such as the speed at which technology is adopted – and social systems. Of relevance to this study, the theory explains how the rate that innovations are adopted depends on people’s subjective perceptions – and not objective measures of the technology. Five key perceptions include relative advantage, compatibility, complexity, trialability, and observability of the innovation – but the theory recognizes that many other perceptions may also control the adoption rate. Disciplines other than sociology have empirically upheld the role of these subjective perceptions in shaping adoption (Rogers, 2003), including health care innovations research (Greenhalgh et al., 2005; Rogers and Scott, 1997).

Many other theories explain technology acceptance. Taken together, they represent diverse perspectives for explaining our communication, our culture and our perceptions, and they propose an interconnection of many dimensions including the individual, the social, and the organizational. This variety raises the question: Which theory do we use in research?

The Unified Theory of Acceptance and Use of Technology responds to this question. The theory is an empirical synthesis of eight influential theories, including the three examined earlier (Venkatesh et al., 2003). It proposes that human behavior is influenced by people’s intentions and their facilitating

conditions. Intentions are shaped by social influence and our expectations of performance and effort. These behavioral determinants are moderated by gender, age, experience, and voluntariness of use. In developing this theory, Venkatesh et al. (2003) found that the eight theories underlying the model could explain between 17% and 53% of the variance in user intentions with information technology. Therefore, it may be difficult to select one particular theory from another when many of them are more or less statistically valid in their analytical power.

Overall, many technology acceptance theories highlight the role of individual perceptions in the adoption process. Our attitudes and thoughts shape our intentions to use a technology, and this intention is one of the best predictors of actual use (Ajzen, 1991). While there are different approaches for examining technology acceptance, focusing on individual perceptions is one pathway to understanding this complex process.

### ***Health information behavior***

This study also examines the perceived impact that mobile phone health services will have on information interactions. The focus is on consumer health information, which are resources directed for personal health use by patients and the lay person (Stavri, 2001). They include a variety of formats, types, uses, and communication – such as medical records, instructions, contact details, health

test results, social support, medical knowledge, appointment details, and much more. With this variety, a unifying definition for health information is difficult, so it might be better to define in general terms. For instance, “something that either reduces uncertainty or changes one’s image of reality” (Case, 2007) or “any difference that makes a difference to a conscious, human mind” (Bateson, 1972). Other researchers characterize information as a primitive concept (Fox, 1983) that needs no singular definition because it is so difficult to describe (Case, 2007).

Health information can contribute to our wellbeing. It may help patients to cope with their health problems. For instance, people may work through challenging health experiences while gathering information – and as patients learn about their condition, it prepares them to communicate with their health care providers and to make treatment decisions (Elf and Wikblad, 2001; Freimuth et al., 1989; Marshall, 1993). Furthermore, health information seeking may be an initial step for changing health behaviors by reducing uncertainty or increasing a sense of personal control over health (Freimuth et al., 1989). The resulting learning may cultivate health knowledge and change attitudes and skill sets for health compliance (Johnson, 1997; Rosenstock, 1990). Moreover, health information seeking is strongly correlated with health knowledge and healthy lifestyles (Ramanadhan and Viswanath, 2006). For instance, more informed cancer patients tend to actively participate in health care decision making and report greater treatment satisfaction – and these characteristics are significantly associated with higher emotional, social, and cognitive functions, and fewer

reported side effects (Luker et al., 1995; Schou et al., 2005). Overall, health information has a role in good health.

The term ‘information behavior’ encompasses all of our interactions with information. Many activities are possible because it is “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use” (Wilson, 2000:49). Even the avoidance of information is a component of this behavior (Case, 2007). Three important information behaviors are identifying information needs, searching for information, and using information.

Identifying an information need is the realization that our knowledge is “inadequate to satisfy a goal that [we] have” (Case, 2007). People respond by trying to find answers (Taylor, 1968), possibly in an attempt to reduce their uncertainty (Atkin, 1973; Belkin, 1978) or to make sense of the situation and the world around them (Dervin, 1983). Health information needs often develop at critical moments – when illness strikes or when those we know develop a condition (Cassileth et al., 1980; Johnson, 1997; Rutten et al., 2005). People need health information for a number of reasons – for gaining knowledge, making decisions about medical treatments, communicating effectively with health professionals, adjusting lifestyles, and coping (Johnson, 1997; Treiman and Squiers, 2005). The types of health information needed may vary because illnesses can raise different social, emotional, and psychological issues to be

addressed (Van der Molen, 2000). Adding to this complexity, health information needs may change across the continuum of a health condition (Rutten et al., 2005).

Information seeking is the acquisition of information in response to information needs (Case, 2007). This search includes intentional behaviors like discovering patterns (Garner, 1962), changing our state of knowledge to solve a problem or to learn (Marchionini, 1995), and acquiring information purposefully (Johnson, 1997). Information seeking is commonly modeled as procedural steps that begin with the identification of a goal or question followed by selecting an appropriate resource, searching through it, evaluating its content, and then deciding whether or not to continue with the search based on the adequacy of the retrieved information (Freimuth et al., 1989). Often times, health consumers begin their search on the Internet. In 2006, a typical day saw eight million adult Americans looking for health information online (Fox, 2006). Furthermore, 80% of American Internet users – representing 113 million people – have searched online for medical questions (Fox, 2006). Additionally, Internet users who want reliable health information are as likely to search online (46%) as they are to contact a health professional (47%) (Horrigan and Rainie, 2002).

Information use is when information is processed and applied to a need (Mallinger et al., 2005; Rosenzweig et al., 2000). It includes physical activities – like underlining important text – as well as mental acts, such as comparing new

information to existing knowledge (Wilson, 2000). For health decision making, information use is concerned with the patient's readiness to apply different types of information to health problems in order to attain outcomes like empowerment or satisfaction (Longo et al., 2001). Personal factors may influence health information use, including preferences, attitudes, demographics, and the patient's context – such as health status and the health services and information resources that are available (Longo et al., 2001).

For some health consumers, avoidance is a preferred health information behavior. There are several explanations proposed. Non-seekers might not want to question their clinician's care by seeking information, and there are apprehensions of being labeled a "bad patient" for questioning professional expertise (Leydon et al., 2000). Avoidance might also bolster hope because patients are then unaware of the severity of their condition (Leydon et al., 2000). Furthermore, apprehension of health information could rise from a sense of powerlessness in controlling health conditions (Johnson, 1997) or rise from anxieties about health in general (Lucock and Morley, 1996). Another explanation is fatalism, whereby patients believe that more information cannot help what is "meant" to be (Reynolds, 2004; Wolff et al., 2003). Complicating matters, the large volume of health information available may overwhelm the health consumer or induce anxiety, and thus contribute to avoidance (Pifalo et al., 1997; Wurman, 2001). Overall, there are many reasons for avoiding health

information, and they involve personal, situational, psychological, and structural factors (Ramanadhan and Viswanath, 2006).

Literacy skills are important to health information behavior. First, there is health literacy – the capacity to obtain, interpret, and understand basic health information and services for health enhancement (Joint Committee on National Health Education Standards, 1995). This skill helps patients to understand their medical condition, manage medications properly, find appropriate care, and attain many other health goals. Additionally, the proliferation of digital health tools and online information is driving eHealth literacy. This is the ability to seek, find, understand, and appraise digital health information in order to apply it to health problem solving (Norman and Skinner, 2006). Overall, health information behavior involves many activities and calls for diverse tasks, skills, and attitudes.

### ***Health behavior and interactive technologies***

An important component of well-being is health behavior – the personal traits, personality characteristics, actions, and habits that are connected with health maintenance, restoration, and improvement (Gochman, 1997). It is important for preventing and managing chronic health conditions like heart disease, stroke, cancer, asthma, and obesity. Some behaviors that have a significant impact on health are tobacco use, diet and activity patterns, alcohol consumption, illicit drug use, sexual activity, and avoidable injuries (McGinnis and Foege, 1993). These

activities may trigger an illness as well as predict its outcome. Changing health behaviors – such as acquiring new behaviors, modifying current ones, or stopping risky behaviors (Diclemente et al., 2001) – may reduce morbidity and mortality risks (Koop, 1996). Overall, health behavior has a great influence on health.

According to theory, three factors may shape our health behavior. First, there are social experiences and forces – where social cues and interactions inform and influence behavior; secondly, there are personality factors and affective dispositions, such as optimism, bias, and anxiety; and finally, there are beliefs and understanding, which are shaped by learning and experiences (National Cancer Institute, 2008). Health behavior theories recognize subjective perceptions as an important determinant of behavior – much as technology acceptance theories do. The Health Belief Model (Janz and Becker, 1984; Kirscht and Rosenstock, 1979), the Transtheoretical model (Prochaska and DiClemente, 1983), and the Theory of Planned Behavior (Ajzen, 1991) all highlight the role of individual perceptions in health behavior.

Health information may influence health behavior in a number of ways. It can cultivate health understanding (Severtson et al., 2006), elucidate options and choices for health decision making (Rudd and Glanz, 1990), shape emotional states (Miller, 1987), provide social support (Heaney and Israel, 2002), promote health awareness and self-care (Fox et al., 2000), motivate and activate good

health skills (Carpenter et al., 2007; Fisher et al., 1994), empower the patient (Kivits, 2004), and facilitate behavior change pathways (Rimer and Kreuter, 2006). The contribution of health information to self-care is important, especially with an aging population and a growing prevalence in chronic diseases (Science Panel on Interactive Communication and Health, 1999). However, the mere availability of information might not lead to a health impact (Janz and Becker, 1984). Rather, patients need to use the information in order to develop preventive and optimal health practices (Rudd and Glanz, 1990).

Interactive technologies can also influence health behavior. They allow users to access and control health information through responsive computer applications. For instance, there are Internet resources and electronic devices that can provide health feedback, engage consumers with health-related games, and respond to health questions (Street and Rimal, 1997). Using interactive health technologies might offer a number of benefits – including better relationships with health care providers, improved communication, more honest self-reports, reduction in unnecessary services, connectivity for social support, and patient satisfaction, which includes perceptions that the technology is fun, engaging, and novel (Mookadam and Arthur, 2004; Science Panel on Interactive Communication and Health, 1999; Street and Manning, 1997). However, scientific data to support these claims are lacking (Science Panel on Interactive Communication and Health, 1999), and there are few measurement instruments

to quantify the impact and health outcomes of these technologies (Jackson et al., 2006).

Interactive technologies can be useful for tailored health communication, which personalizes health information to address individual needs and characteristics (Kreuter and Skinner, 2000). A personalized approach could deliver information that is appropriate to the consumer's unique needs and context (Rimer and Kreuter, 2006). The tailoring may target audiences according to socio-demographic characteristics, psychological and emotional factors, skills and behaviors, and receptivity to health behavior change (Rimer and Kreuter, 2006). By personalizing health communication, messages may become more persuasive and may enhance motivation (Latimer et al., 2005; Rimer and Kreuter, 2006). In summary, interactive technologies might improve healthy behaviors by delivering tailored information.

## ***Summary***

This chapter reviewed the focus and approach of this study. The research concentrates on the health uses of mobile phones for interacting with health professionals, taking health actions, delivering health information, and managing health care services. Additionally, the study defines technology acceptance as the intention of individual adopters to use mobile phone health services. There is a focus on subjective perceptions, which is supported by the Theory of Planned

Behavior, the Technology Acceptance Model, the diffusion of innovations theory, and the Unified Theory of Acceptance and Use of Technology. Furthermore, information and health behaviors were reviewed as themes to be analyzed in the research findings. Overall, this study aims to understand the acceptance of the mobile phone health services by examining health consumers' perceptions and intentions of adopting this technology.

## **Chapter 3: Methods**

### ***Study design and setting***

This study examines health consumers' perceptions of mobile phone health services and their intentions to adopt this technology. First, participants completed a questionnaire about their demographic details and mobile phone experiences (Appendix 2). They then responded to a semi-structured interview about their health and technology experiences (Appendix 1). Next, participants viewed a narrated slide presentation introducing mobile phone services for interacting with health professionals, taking health actions, delivering health information, and managing health care services. The transcript for this presentation is available in Appendix 3. Afterwards, participants responded to a semi-structured interview about their perceptions of the technology and their intentions to adopt it (Appendix 1). Fieldwork took place in university meeting rooms, in participants' offices in academic and hospital environments, and remotely through telephone conversations.

### ***Recruitment***

Inclusion criteria for the study were based on potential participants' experiences with chronic health conditions and health services delivered through

information technology. Health consumers were suitable for study participation if they belonged to one of the following groups:

- healthy adults with experience of health services delivered through information technology;
- healthy adults with no experience of health services delivered through information technology;
- adult patients with chronic health conditions and experience of health services delivered through information technology; or
- adult patients with chronic health conditions and no experience of health services delivered through information technology.

These groups were selected for different levels of familiarity with health issues and technology. Two common activities were excluded from the definition of 'experience of health services delivered through information technology.' They were searching the Internet for general health information and telephoning health offices with general questions. Participants were recruited from the four categories and across age groups. They are profiled in the following chapter.

Potential participants were informed about the study through email, word of mouth, and poster and online advertisements. An informational mass email was sent to the University of North Carolina at Chapel Hill community to recruit faculty,

staff, and students. Through the Google AdWords program, advertisements were posted in Google results pages for searches with terms related to health conditions and information technology. Additionally, an online recruitment message was posted in Second Life – the online virtual world. However, only email, word of mouth, and poster advertisements displayed at the University of North Carolina at Chapel Hill campus were successful in recruiting participants. Individuals interested in study participation contacted the researcher to confirm their eligibility and to arrange an appointment.

Research participants were offered financial compensation. After the interview, a \$20 payment was sent via PayPal – the online company that allows money transfers and payments to be made through the Internet.

## ***Process***

At the beginning of each interview, the researcher explained the study procedures and obtained signed or oral consent from the willing participant. The questionnaire and semi-structured interviews collected participants' assessment of mobile phone health services. The discussion focused upon experiences with chronic health conditions, mobile phones, and technology use; perceptions of the value and applicability of mobile phone health services; intentions to use the technology; and suggestions for its development (Appendix 1). There were thirty-seven in-person interviews and three telephone interviews conducted. All

participants responded from the health consumer perspective. The study concluded when the researcher found no new data were being collected in the interviews.

The interviews were audio recorded digitally. The researcher actively listened to participants and refrained from interruptions and unwarranted prompts. Themes raised in the discussion were discretely recorded on paper. All recordings were transcribed and anonymized for confidentiality. There was judicious editing of the transcripts to shorten interview questions and remove trivial speech.

The research methods were tested in a pilot study. There were five participants, and they did not receive financial compensation. Their interviews were included in the final research analysis. Based upon this trial, the researcher believed that richer data may be collected through in-person and telephone interviews because clarifying questions could be asked immediately and there were opportunities for tangential discussions. This finding led to the elimination of online written surveys that were a component of the original research design – these surveys were intended for respondents who wished to participate in the study remotely. While this approach might have suited some participants' preferences, it would have been difficult to mimic the helpful conversational interaction of the in-person and telephone interviews.

## ***Analysis***

Analysis employed open qualitative coding. Interview transcripts were carefully read and then segments of the text were labeled with descriptive codes to classify them by topic. Afterwards, all responses associated with each code were reviewed together and analyzed for meaning, themes, and perspectives – these were labeled with sub-codes. Contradictory responses spurred reflection on how the codes may be redefined or reorganized. In order for codes to be consistently assigned, a dictionary was created to define their meaning and application. Coding of the transcripts was completed in MAXQDA 2007, the qualitative analysis software. Memos were written into the transcripts to record the researcher's observations and thoughts.

The research analysis focused upon the types of perceptions reported and the rationales behind the acceptance or rejection of mobile phone health services. A number of analytic techniques were used. First, responses were compared and contrasted together in order to identify thematic categories within the reported perceptions and explanations. Then there was comparison of responses from different participant groups and representing different perspectives. Finally, there was reflection upon the factors underlying the acceptance process.

## ***Researcher's position***

I strived to be objective and open in all the research interviews. My questions were neutral in tone, I refrained from interrupting participants, I actively listened to their discussion, and I asked clarifying questions to delve deeper. These techniques helped me to understand the experiences of participants as intensively and accurately as possible.

The research analysis and writing were shaped by my background. First, I am a librarian. My professional interests are information services and instruction, so I am motivated to explore how people interact with information. I am particularly interested in what consumers need in order to use health information efficiently and effectively. Secondly, I describe myself as a pragmatic technologist. In my analysis, I tried to identify health consumers' expectations of and concerns with mobile health services. I did this in order to understand the needs for the responsible development of the technology. Thirdly, I began using mobile phones only recently – I purchased the technology in the fall of 2006 after deciding on this doctoral research topic. I can understand why people might delay their mobile phone adoption or be reluctant to use the device. Therefore, I was not judgmental of participants' views of mobile phones, and hopefully, this encouraged more honest discussions about their mobile phone usage and behaviors. Finally, I have experience as a patient of health care systems of Canada, the United Kingdom, and the United States. But in this study, I focused

on American health consumers and reflected upon the context of the American health care system. Occasionally, I spoke to participants about health services in Canada and the United Kingdom and this prompted them to draw comparisons with their own experiences. As Creswell (2007) writes, "all researchers bring values to a study," so it is important to admit the "value-laden nature of the study." Hopefully, my perspective and my values will contribute to the understanding of mobile phone health services.

### ***Limitations***

This research has several limitations. Many of the participants were recruited from the University of North Carolina at Chapel Hill community. This may introduce educational and geographic bias that could reduce the generalizability of the findings. However, there were four subjects from Canada to add diversity, and the campus participants came from different faculty, staff, and student groups. Furthermore, participants in the study were likely to be interested in health technologies to start with and therefore have positive opinions. To address this bias, an open environment was fostered so participants could freely share negative opinions and neutral impressions. Additionally, many respondents' first introduction to mobile phone health services came from the presentation shown in this study. This provided brief descriptions of current services and did not explore future developments. Misunderstandings and misinterpretation of the technology might have occurred, and this could lead to

invalid or speculative responses. Therefore, participants' views may change significantly upon greater awareness of the technology. Nonetheless, it is important to understand health consumers' immediate impressions because they may lead to lasting positions (Rogers, 2003). Finally, intensive qualitative research is a reflexive process, where the researcher's opinions and experiences may introduce bias to data collection and analysis (Creswell, 2007). To diminish this effect, interview responses were analyzed for contradictory perspectives, and these are fully represented in this dissertation.

## ***Summary***

This research employed intensive qualitative methods. Adult participants were recruited for different levels of familiarity with chronic health conditions and health technology. Respondents were healthy individuals or patients with chronic health conditions – additionally, they had experience with health services delivered through information technology, or they did not. Participants first completed a background questionnaire, and then they viewed a narrated slide presentation introducing mobile phone health services. Afterwards, semi-structured interview questions inquired about their technology perceptions and adoption intentions. These interviews were conducted at in-person meetings and through telephone conversations. Qualitative analysis of the interview transcripts identified the types of technology perceptions reported and the rationale behind the acceptance or rejection of mobile phone health services. The validity of the

research methods was assessed in a pilot study. Objective and open analyses were promoted by reviewing all the evidence together, examining contradictory responses, acknowledging researcher bias, carefully defining the identified themes, and then reviewing them for accuracy. This qualitative approach has developed an intensive understanding of the technology acceptance of the research participants.

## **Chapter 4: Profile of research participants**

### ***Background and experiences***

The forty research participants ranged in age from young adult to senior citizen (Table 2). More women than men participated in the study (62.5% female). Many respondents were members of the University of North Carolina at Chapel Hill community (75.0%), and some were residents of Canada (10.0%) (Table 3). Only one participant did not own a mobile phone. The majority of respondents (75.0%) used their mobile phones multiple times daily (Table 4).

Experiences with chronic health conditions and health services delivered through information technology were varied (Table 5). Twenty-four participants (60%) were patients with a chronic health condition (Table 2), and 37.5% of the sample reported a health care background – such as health care professional, researcher, educator, or student (Table 3). Twenty-six respondents (65%) had prior experience with health services delivered through information technology (Table 6). They cited a number of reasons for adopting these services: to obtain speedy, convenient, and remote access to health professionals; to take initiative for self-care and self-diagnosis; to organize health information; to receive incentives and prizes offered by health care organizations; to follow doctor's recommendations; and to satisfy personal interests with new technology.

Few participants were familiar with mobile phone health services. Only six respondents had prior experience with the technology. Two other participants were aware of these services through academic coursework, research experiences, and association with health technology researchers. However, more respondents were aware of fixed line telephone health services. There were five individuals who discussed a family member's experiences with remote telephone monitoring and management of pacemakers.

Table 2. Participant demographics

Characteristic	n	%
Men	15	37.5
Women	25	62.5
Age (years)		
18 – 24	8	20.0
25 – 34	13	32.5
35 – 44	5	12.5
45 – 54	6	15.0
55 – 64	5	12.5
≥ 65	3	7.5
Health condition		
Healthy	16	40.0
With chronic health condition	24	60.0
Allergy (food)	1	
Arthritis	5	
Asthma	3	
Cardiovascular disease	5	
Diabetes	4	
Gastrointestinal disease	1	
Musculoskeletal disease	2	
Psychiatric disorder	4	
Thyroid disease	3	

Table 3. Participant background

Characteristic	n	%
National residency		
Canada	4	10
United States	36	90
UNC Chapel Hill affiliation	30	75
Faculty	2	
Staff	11	
Student	17	
Health care background	15	37.5
Health care educator	3	
Health care professional	7	
Health care researcher	1	
Health care student	4	

Table 4. Participants' experience with mobile phones

Characteristic	n	%
<b>Mobile phone ownership</b>		
0 – 4 years	6	15.0
5 – 9 years	19	47.5
10 – 14 years	9	22.5
15 – 19 years	3	7.5
≥ 20 years	2	5.0
Do not own mobile phone technology	1	2.5
Average (years)	9	
Median (years)	8	
<b>Frequency of mobile phone use</b>		
Very often (multiple times daily)	30	75.0
Often (1 or 2 times daily)	5	12.5
Regularly (several times weekly)	4	10.0
Do not use mobile phone	1	2.5
Adopted mobile phone health services	6	15.0

Table 5. Participants' experiences with chronic health conditions and health services delivered through information technology (IT)

Characteristic		n	%
Chronic health condition patient	with IT health experience	16	40
	without IT health experience	8	20
Healthy individual	with IT health experience	10	25
	without IT health experience	6	15

Table 6. Participants' experience with health services delivered through information technology

Characteristic	n	%
None	14	35.0
Prior experience	26	65.0
Appointment reminders	1	
Diet monitoring	11	
Electronic health records	4	
Emailing health professionals	4	
Exercise monitoring	4	
Health condition monitoring	4	
Online appointment scheduling	3	
Online support group	2	
Personalized information portal	3	
Prescription ordering	2	
Telephone health consultations	5	

## ***Attitudes and behaviors with mobile phones***

Participants' attitudes and behaviors with mobile phones were differentiated between the elementary user and the enthusiastic user. These profiles might influence the acceptance of mobile phone health services. Elementary users focused on basic mobile phone functionalities and avoided advanced features such as Internet access, text messaging, and video and camera functions. The lack of experience with advanced mobile computing might deter the acceptance of the technology – especially if data entry and computing seem complicated. By comparison, enthusiasts try to maximize their digital activities on mobile phones, and many already use the device for online banking and calendaring. Therefore, enthusiasts may be more receptive to adopting mobile phone health services.

When elementary users limited their mobile phone use, they did so in three ways. First, some of the technical features went unused. Some participants saw voice communication as the only purpose for mobile phones, so they did not adopt web, text, and multimedia functionalities. They purchased the phone with the most basic features and were satisfied with their decision. Advanced mobile phone tools were also rejected as a means of reducing expenses – some respondents described the cost of sophisticated devices as “*astronomical*.” Other participants found that alternatives for mobile phone use are easily accessible – for instance, fixed line phones or laptops with Internet access are prevalent. One respondent said she was frequently on the Internet at work and

at home, so she was “sick” of online access and did not want it available on her phone. Secondly, participants restricted their mobile phone use by selectively disclosing their phone number. One respondent said, “*I tend not to give out my cell phone number very often ... I got to know who you are and why you are going to be calling.*” Mobile phones can be a personal line of communication that users wish to protect. Thirdly, participants limited their use of mobile phones by relying on alternative technologies. They might prefer fixed line phones or voice mail to mobile calls and text messages. Others said they did not like talking on the phone, with one participant justifying how face-to-face conversations might yield more positive results due to the influence of eye contact. In many of these cases, mobile phone use was reserved for emergency and urgent situations. Consequently, this infrequent use meant participants would sometimes forget their phone and leave it at home or in their car. Overall, these restrictions may impose barriers to the acceptance of mobile phone health services.

Enthusiastic users value mobile phones immensely. The device is a prominent communication tool for them, with some participants preferring mobile phone calls to email. Many respondents were comfortable conducting the same digital activities on their phone as they would on a personal computer. Furthermore, there was a perspective that the phone is part of an integrated network of electronic resources and devices, which led one participant to describe his phone as an extension of his computer. For one respondent, if he

were to leave his phone at home, he would feel “*cut off from the world*” since this “*lifeline*” would be lost. Others were eager to follow advancements with the technology. One participant believed the pace of development was so rapid, she described her three-year-old phone as an “*old, ancient one*” and was excited for an upgrade. It may be expensive to keep up with the technology, but some enthusiasts believed the cost of the phone service was worthwhile in light of the connectivity and utility it provides. With this intensive use and appreciation of the mobile phone, the enthusiast’s positive attitudes to mobile computing might encourage the adoption of mobile phone health services.

*Participant: I always pick up my cell phone and respond to text messages. I don’t answer my email as frequently as I should ... [and] rarely do I get unimportant phone calls, and I’ll deal with [them] immediately.*

*Participant: This [mobile] phone is all about being able to connect to a central data repository to get information.*

*Participant: Now I’ve got [the mobile phone so that] I can do a lot online: banking ... Facebook, Twitter – all that kind of stuff.*

*Participant: I’m literally on my [mobile] phone multiple times an hour just checking if I have any email. I have Google Mail on my phone*

*and I have my school email. Continuously throughout the day when I'm on [the university] campus, I use it as a computer.*

Two negative perceptions of mobile phones – a potential cause of some brain cancers and a source of dangerous distractions (Kundi, 2009; Nasar et al., 2008) – were rarely raised by participants. When asked about the concern of brain tumors, some respondents believed that headsets might minimize any dangers from holding the phone next to the ear. Others were uncertain about the link between mobile phone use and health risks, and they believed that conclusive scientific evidence is lacking. As for distractions, participants felt that personal responsibility and legislation could reduce the danger of drivers who make phone calls on the road or pedestrians who lose their concentration during a phone conversation. Overlooking these negative ramifications, most participants focused on the benefits of the mobile phone. When respondents did share their negative perceptions, they concentrated on the interruptions of mobile calls and the annoyances of poor phone etiquette.

## **Summary**

The forty research participants had diverse experiences with chronic health conditions and health technology. Their age ranged from young adult to senior citizen, and their mobile phone behaviors were divided between the elementary user and the enthusiast. However, there was bias for technology experience

since many participants were proficient and regular mobile phone users.

Geographic bias was also introduced as many respondents belonged to the University of North Carolina at Chapel Hill community. Despite these limitations, different perspectives on the acceptance of mobile phone health services were still collected.

## Chapter 5: Acceptance of health services on mobile phones

### *Adoption intentions*

All participants intended to use the technology. The majority were ready to adopt the services immediately (30 participants, 75%), while some intended to use the technology later upon the need or when particular conditions were met (10 participants, 25%) (Table 7). There were respondents who wanted to use all of the mobile phone health applications described in the presentation (24 participants, 60%), but others intended to adopt only a selection of the services (16 participants, 40%). No participant opposed the development of this technology or its adoption by other health consumers.

Table 7. Acceptance of mobile phone health services

Self-reported intention	n	%
Ready to adopt immediately	30	75
Intend to adopt later upon need or conditions	10	25

## ***Quick acceptance***

Some participants quickly and enthusiastically accepted mobile phone health services. Shortly after learning about the technology from the presentation, they expressed intentions to adopt the services. These respondents were driven by perceptions that the technology is novel or will become an inevitable tool. Additionally, they were motivated because they found the services to be similar to existing practices.

The sense of novelty is important in shaping the quick acceptance of mobile phone health services. By this perception, the technology appeared more appealing and less threatening to try. For instance, many participants were intrigued that a “*simple*” device like the mobile phone could do “*amazing*” calculations and provide sophisticated health support. As a result, respondents wanted to explore the technology. Another participant described mobile phone health services as a “*win-win situation*” because the technology was “*fun ... but at the same time [it was] very helpful.*”

The sense of familiarity with the technology also made it appealing to adopt. For instance, some participants saw mobile phone health services as analogs of existing health services on the Internet – a medium that many were already comfortable with and accustomed to – so they described the technology as “*familiar services run on a smaller device.*” Others reported using online tools

and handheld computers to conduct many of the same health tasks offered by mobile phone health services. Since no radical differences between this technology and existing health tools were perceived, some participants came to their positive acceptance decision quickly.

Some participants accepted the services immediately because they believed the technology is inevitable. They felt that more and more mobile services will become available in the future – citing the growth of mobile applications for banking and business as examples. Recognizing this trend, some participants believed that the health care industry will benefit from embracing mobile computing. This inspired respondents to adopt the services sooner in order to contribute to the technology's development.

### ***Waiting to adopt***

Some participants intended to adopt the technology at a later time. There was the belief that mobile phone health services are most relevant for patients who needed recurring medical care and support. So the technology would be most useful when a health condition develops and requires this type of assistance. By this perspective, if an individual is healthy, then there is little motivation for adoption. For instance, respondents who did not require frequent medical attention would sometimes question the relevance of these services for healthy individuals. Additionally, some participants were delaying adoption until

the technology improves. They were anticipating developments that would improve the usability of the mobile phone – specifically features like larger screens, improved connectivity, and convenient data entry. Finally, some participants were delaying adoption in order for developers to fix and improve the technical complications that early adopters might identify first.

Despite these apprehensions, many participants believed mobile phone health services will be important to the future of health care. They expected the technology to become more relevant as time goes on – as they become older or as their health declines.

*Participant who intended to adopt the technology later: I can't say I would never use any of these [services]. These are all things that I can see myself doing at some point in my life should the need arise. Given the increasing pervasiveness of mobile computing technology, I see that more and more of these [health] tasks [are] going to that technology. There isn't anything here I would not do.*

### **Service preferences**

When participants were asked which health care services they would prefer using on a mobile phone, the most popular response was the management of health services. This was followed by services for interacting with health professionals and then services for taking health actions – both of these were

comparable in terms of preference. The least popular service was health information delivery. Many participants preferred using other technologies for reading and learning from health resources.

### ***Rejection of services***

There were some mobile phone health services that participants did not wish to use. For instance, a few respondents were uneasy about reminder services and health information delivery because of concerns with independence and privacy. Others would refrain from remote diagnosis and monitoring in order to avoid medical errors. Additionally, participants who wanted a high level of personal care were worried that the technology would replace face-to-face interactions. Finally, some services were not seen as relevant – such as automated educational messages. Many participants wanted control of their information seeking experiences and did not like health resources delivered to them automatically.

Participants were wary of some services because of negative experiences in the past. For one respondent, she found diet and exercise monitoring to be distressing activities, so she was not comfortable with using these applications on a mobile phone. Even negative experiences unrelated to health care may deter acceptance. One respondent was disappointed with an online appointment system he used for a golf reservation – when he arrived for his tee time, his

booking was not on the schedule. Because of this error, he was averse to automated scheduling services altogether, especially for an event as significant as a health appointment.

Many participants who were enthusiastic about mobile phone health services were not concerned with this opposition to the technology. They believed that mobile phones will be one option for health care access and that alternatives will always be available to meet the diverse needs of health consumers.

### ***Factors shaping the acceptance decision***

Participants considered three principal factors in their acceptance decision. First is the health context – including health status, health environment, and health costs. Then there are personality issues such as the readiness and emotional tolerance for health affairs, personal values and health goals, and the need for proof of the technology's effectiveness. Finally, the perceived helpfulness of the technology is important to acceptance. Participants determined helpfulness by reflecting on the positive and negative perceptions of mobile phone health services and then considering usability and safety.

### **Health status and environment**

Health status and health care environment may influence the acceptance decision. Many participants determined their need for the technology according

to their health condition, the disease course, their preference for providers, and their health care system. Unless there was an illness to manage, some healthy respondents saw the mobile phone health services as more of a *“hassle than assistance.”* The value of the technology was perceived to be greater for the patient with chronic health conditions who may need intensive management or greater access to care.

Participants with chronic health conditions believed the technology is applicable to all chronic conditions – however, its significance depends upon the disease course. At the early stages of diagnosis and treatment, they believed that monitoring and regular interactions with health professionals are helpful, but as time goes on, health routines become habit so periodic monitoring is sufficient. Therefore, the technology may be more beneficial for patients shortly after their diagnosis.

Preferences for health providers are another factor shaping acceptance. Two participants used mobile phone-based medical consultations to receive health care from an out-of-town health professional. After moving, they preferred to consult their former doctors because they were more comfortable with the history they had together. The respondents held favorable views that mobile phone health services could support these long-distance health interactions.

Health care setting is another factor in the acceptance decision. Trust in the provider and the health care system is important. For instance, a respondent

said he would rely on mobile phone health services only if they were administered by certified doctors, but not if they were run by private companies or health support staff – surprisingly, he felt this way despite having been an allied health professional himself. Another participant overcome her concerns for online privacy and began using an online tool for managing her chronic health condition because the service was operated by the state health insurance program. As a government employee, she was confident the state health insurance program could not deny her coverage if she noted in the online tool her health status had changed. Her trust in health services delivered through information technology might have been different had she worked in the private sector or had private health insurance coverage.

## **Costs**

*Participant: I've been going to a family care doctor that I've been going to for ten years not because he's the best one or I think he is the best choice, but because he is convenient – it only costs me ten dollars to go visit him.*

For some participants, health care decisions are based on their cost or inconvenience as much as what the best health decision is. They felt that time, effort, and financial commitments are important considerations for their adoption decision with mobile phone health services.

Large health care costs might deter adoption. Participants assumed that service charges would vary for this technology – simple services like appointment scheduling would be cheaper, but health monitoring would be more costly. These expenses could influence which services participants wished to use. Some respondents anticipated great expense in order to switch to another health provider who offered this “*sophisticated*” technology. Others believed a mobile phone upgrade was necessary in order to use the services – but some acknowledged this might be a worthwhile investment in their health. Additionally, there were participants who wanted to minimize their phone bills as much as possible, so they would limit the type of mobile services they would use.

While there were apprehensions of rising expenses, cost savings were also attributed to the technology. In reducing the need for doctor’s office visits, participants hoped that mobile phone health services could save time as well as a co-pay. Text messaging services were another perceived timesaver, and as one participant noted: “*I would be able to do something else instead of ... being on hold [with the doctor’s office] for an eternity.*”

### **Readiness and emotional tolerance for health affairs**

Health can be an emotional issue. Some participants discussed how emotional barriers may keep them from adopting health services on their mobile phones. For example, there was the fear of the technology delivering bad news,

hesitance to receive health information, guilt about poor health behaviors, and the fear of health care in general – all of which may lead some to avoid health technologies all together.

*Participant: It is very common to hear someone say: “Yes, I know I should eat fewer bonbons, or, yes, I know I should do this or do that” – but the emotional experience is driving the decision. They want to have that bonbon, but they have that intellectual guilt [over it]. There is guilt derived from intellectual knowledge.*

Negative emotions about health could supersede reason. For instance, one participant could rationally come to a positive adoption decision because of the technology’s potential for health improvement, but due to his emotional apprehension, he decided to adopt it later when critical health conditions should arise. This was an unexpected response because the participant is a tech savvy individual who readily embraces technology in other domains of his life. In another case, a respondent was enthusiastic for this technology, but she felt her lifestyle was not ready for adopting these services.

*Participant: I could see myself using it if I had steady employment with a schedule that didn’t change a lot, earning money so that I can buy a good phone, and actually having [the] mental space to think about things like this. Right now, it’s survival mode [for me], and [adopting this technology] is so extra.*

## **Match to personality**

*Participant: How can I use this information and [these] services in a constructive way ... that [also] respects my morals and ideals when looking at health care or personal information? ... That's how I arrived at my conclusion.*

Another important consideration for adoption is whether this technology suits personal values, characteristics, and behavior. One participant described herself as scientifically-minded, so the ability to use the mobile phone for collecting and monitoring health data is appealing. Adept mobile phone users felt they could improve their health communication through the asynchronous and mobile applications of the device – such as text messaging and online calendars. There were participants who described themselves as introverts, and they hoped that the technology could reduce the frequency of uncomfortable phone calls to health organizations. Finally, one participant said a large portion of her life is lived digitally – with many of her professional, social, and personal activities being conducted online – so she welcomed mobile phone health services.

## **Need for proof**

Some participants wanted proof of the technology's benefits. A range of evidence sources was desired – including scientific research results, positive word of mouth, demonstrations, trials, and recommendations by doctors. On the

other hand, there were respondents who felt that proof is unnecessary. One participant believed that mobile phone health technologies are inherently low risk because she saw them as organizational tools for self-management, and therefore, they are not as dangerous as drugs or surgical treatments. As with other organizational systems, she argued that it is the user's commitment to the program that reaps the rewards.

In a discussion about evidence for the benefits of mobile phone health services, one participant recalled a news story. A British surgeon volunteering in Congo, Africa, amputated the arm of a teenage boy with instructions sent by text message from a specialist in the United Kingdom (BBC News, 2008). This was a difficult procedure that the surgeon had never performed before. In recounting this story, the participant felt it could quell the concerns about the utility of mobile phone communications for complex health care services.

## **Helpfulness**

*Participant: When you are living with a chronic health condition, you are always hopeful. You are always looking for ways to make it less impactful on your life ... I would use [mobile phone health services] with the hope that it would cut down on the time that monitoring and taking care of my health condition sometimes takes, and that it would make the management of the illness a lot easier.*

Participants looked to this technology to help them. They hoped that mobile phone health services could simplify health tasks because of their portability, immediacy, and automation – and thus reduce the effort in performing healthy behaviors. The mobile phone was also regarded as an organizational tool for managing medical procedures and files. Additionally, some participants valued the technological oversight of the monitoring services and hoped this would hold patients accountable to their health. Respondents determined the helpfulness of mobile phone health services by comparing their positive perceptions of the technology against negative ones and by considering usability and safety issues.

*Participant on the need for technology to hold consumers accountable for their health: The doctor is not accountable for everyday actions. Most people assume that the doctor should be [accountable ... but] most people see their doctor only once a year. And doctors see a lot of patients everyday ... [they] can't keep track of everybody.*

## **Usability**

In discussions about the usability of the technology, participants focused on difficulties with mobile phone use. If respondents believed that usability barriers required immense effort to overcome, they then began to question whether the mobile phone is worthwhile for delivering health care services. The chief complaint was about screen size. Young and old participants alike found that

many mobile phones had screens that were too small for comfortably reading text and viewing images. Some said they would not bother examining health information that is difficult to read. Participants also felt that visual impairment – particularly during illness – could exasperate this problem. Other usability criticisms were about the difficulties in data entry and screen navigation. Some respondents found it slow and frustrating to type on the small buttons of a mobile phone keypad – especially an alphanumeric one. Finally, some participants doubted the mobile phone’s capacity for extensive computing because of limited battery life and spotty network connections. Because of these concerns, some saw the mobile phone as a secondary tool for health information, while the personal computer was their first choice because of its greater speed and reliability. In light of these usability problems, some respondents intended to wait for improvements in mobile phone design before adopting health services on them.

*Participant on mobile phone screen size: I think [with] the type of information that is presented in those monitoring applications, I’m not sure how suited the cell phone tool would be in terms of its interface and its screen size. I think for younger people that would be easier, but for older people – when their eyesight is starting to go – I think that would be frustrating [for them to try] to read those graphs and charts.*

*Participant: [Even though my mobile phone screen] is slightly larger than my friends' phones, I do have trouble on web pages. It's not so much reading [the text], but confusion of what's on the page [i.e., navigating the content] ... If somebody is trying to communicate a lot of information with me [on a mobile phone screen], it's going to be a problem.*

*Participant on data entry with mobile phones: I think it is hard to enter information into it now, and people get turned off by that ... it turns me off. I like gadgets and stuff, but I still don't want to be pressing a button three times to get a letter in.*

*Participant: I don't have a [keyboard on my mobile phone]. It's just the telephone pad numbers with letters on one key. Press, press, press ... The back [and arrow] keys are kind of confusing. Having to interact with an application on top of the phone would be problematic just because my phone is small and difficult to use.*

*Participant: I have questions about how soon can you communicate back and forth, and what do you wait for, and the cost, and how doctors take this [information], and what happens if there are technological glitches, cause that makes it intimidating – cause here [at my workplace] I have [technology support] services at my fingertips. I just walk down the hall and get help.*

Participants believed usability improvements could encourage the adoption of mobile phone health services. To assist with readability, there was a desire for larger screens in high definition. For easier data entry, participants wanted full keyboards and touch screen functionalities on their mobile phones. Many were confident these features would soon be prevalent – particularly because of devices like the Apple iPhone, which offers these options. Furthermore, there was a desire for automated features to reduce the manual effort for using health applications. For instance, participants wanted health measurements collected from a monitoring device to be automatically transferred to the mobile phone for delivery to the health professional. With these improvements, respondents believed the technology would be easier to use, and this would encourage its adoption.

*Participant on automated functions of mobile phone health services:  
[As for health monitoring] equipment, [if] I could plug [the data] into  
the cell phone, that would be easy enough ... But anything where I  
have to [do] texting, typing, selecting, and looking on the tiny  
screen, I think those would be deal breakers for me.*

## **Safety**

Concerns about safety revolved around privacy risks. Many participants were anxious about personal health information being stored on the mobile phone because of concerns that malicious individuals could intercept this sensitive

information. Health risks were another safety threat. Some respondents discussed the possible link between electromagnetic radiation emitted by mobile phones and brain cancer (Kundi, 2009). Another health risk is that mobile phone use is a potentially dangerous distraction while driving or walking (Nasar et al., 2008). Finally, participants were concerned about technology-related medical errors. Of the three safety concerns – privacy risks, health risks, and medical errors – participants focused on privacy.

The potential of privacy infringements in digital systems evoked concerns of Big Brother-like surveillance. These concerns were heightened if participants had minimal awareness of digital security issues. For instance, some respondents were unfamiliar with the security features of mobile phones, so they were uncertain if they could even identify or address the privacy risks with the technology. There was also apprehension about friends and family who may catch a glimpse of their phone and then potentially see personal health details. Additionally, mobile phones are small devices that can be misplaced easily or stolen, so there were concerns about the security of the health information stored on the device. In order to avoid these problems, participants believed that careful mobile phone use was important, and this included measures like password protection. However, participants were apprehensive of precautions like this because it would complicate phone use.

Participants foresaw immense consequences from security breaches with health information. If an illness was revealed, respondents worried about the denial of employment or health insurance coverage. Additionally, there was concern about stigma from family, friends, and the community – particularly for psychiatric disorders and sexually transmitted diseases. A participant believed that current anti-discrimination legislation for health did not offer sufficient protection from these risks. Therefore, the potential for privacy infringements with mobile phone health services seemed more perilous. Overall, these perceived threats were certainly frightening. Participants worried that privacy infringements could leave patients unable to acquire the health resources to get better – resources like health insurance and social support. Consequently, privacy is an important safety factor to the adoption decision.

*Participant: The security [of my health information on the mobile phone] gives me the most amount of pause ... My information being broadcast is a little concerning because there are bad guys out there who can use [this] information against you.*

*Participant on others' privacy concerns: [My] dad is really into privacy ... He won't even use Google anymore ... He only uses [the] Ask.com [search engine] because they protect your privacy more than Google [does]. I don't care about that stuff, but I know my dad would probably never do anything like [mobile phone health*

*services] because he thinks AT&T, [the telecommunications company], could then see [his] cholesterol... I think my dad – just knowing him – he [will think] it's some kind of Big Brother kind of thing ... There are just some people who are just like that.*

*Participant concerned about legislation against health discrimination: The laws are state-based, not federally-based, I believe. I also believe they have no teeth. We have insurance companies proving that day-by-day by eliminating people for quote, unquote, pre-existing conditions because you had the flu when you were two – therefore, [they]'re not going to [provide you coverage] ... Anyways, I don't think the laws are enough.*

Perceived privacy threats depended upon the health condition – both the nature of the illness and its severity. For instance, one participant would not mind receiving medication reminders on her mobile phone for her arthritis treatment because it was not a problem if others knew about this condition. On the other hand, she was concerned about receiving medical test results out of fear that others might learn about the degree of her declining health.

The willingness of participants to disclose personal information online was varied. For instance, one participant did not feel comfortable sharing any personal details on social networking websites, but she was more willing to share her health information in online environments. She believed she could trust the

online tools endorsed by her health professionals and hoped that sharing her medical details would be beneficial to her health.

Some participants did not find a critical privacy threat in mobile phone health services. They credited this perspective to an open personality as well as trust in the health care system. Some respondents believed that concerns about health privacy depend on age – for instance, when you are young, there may be fewer health issues to keep private. Others believed that privacy may depend on social role – unless you are the head of state or an executive of a large organization, there is little concern about who knows your health status. Respondents also recognized that there are precautions to minimize privacy risks. Vigilant and responsible information sharing was one proposed tactic for countering privacy threats.

*Participant on her open personality: For me, I just don't care [about privacy infringements with digital health systems] because I'm not hiding anything. [For] some people it is a principle [to guard their privacy highly] ... I think they sometimes take it to a higher level where it is a conspiracy theory. Nobody cares! For me, I feel like the benefits just outweigh the costs for me.*

*Participant: The types of health information presented in the video [introducing mobile phone health services] are fairly benign, [such as] appointment times and medication reminders. I'm a fairly open*

*person, so I wouldn't really care if somebody knew I was taking my Plaquenil at a certain time [participant laughs]. For me, that's not even something I thought about – to tell you the truth.*

Additionally, many participants dismissed health risks like electromagnetic radiation and distractions from mobile phones because they believed that using wireless phone attachments, such as earpieces, could prevent these problems.

*Participant on the potential health threats of the technology: I don't see anything dangerous. Contrary to what people think, I don't think we are going to get radiation waves [from the mobile phones].*

*Participant on taking action to reduce health threats: As far as health concerns, it doesn't seem like it would be that big of a deal, particularly with ... [mobile phone health services]. You aren't holding [the mobile phone] right up to your face. You're holding it [in your hands] and looking at a screen. You're typing stuff in – as opposed to talking to someone – so it would seem like it would be less dangerous. I don't see how holding ... [the mobile phone in your hands] would be any different from using a computer in terms of danger.*

Another reason for dismissing safety concerns was trust in medical, technological, and organizational safeguards. Some participants trusted their

health professional's legal, ethical, and professional obligations to protect patients, so they believed that health centers would not deploy new technologies unless they were safe and secure. Additionally, there was the perspective that electronic systems may keep health information safer. For instance, one participant believed that digital health records are “*locked up*” and that computer systems may monitor who and when somebody accesses her patient files – a security feature that is not always possible with paper systems. Moreover, a respondent argued that mobile phone health services are not the first opportunities for employers and health insurance companies to review medical records – she believed that there are other means of privacy infringement, so this technology is not a new threat.

*Participant on trusting health organizations: I think there's something about our [medical] culture that lets us know that security is somewhat of an important issue here. It's my suspicion [that] here [at the medical center] we do have good safeguards against loss of privacy.*

In their adoption decision, participants considered safety risks alongside the potential benefits of mobile phone health services. No respondent refused the technology solely because of a perceived safety threat. When considering the potential benefits, concerns about danger diminished for many participants because of the perspective that the technology's benefits could supersede safety

threats. For example, one participant believed that if you were extremely ill, you should let go of health privacy concerns in order to reap the benefits of the technology.

Overall, in terms of safety, participants were primarily concerned about privacy with mobile phone health services. There were additional concerns about health risks and technology-related medical errors. Participants had a range of perspectives on safety that varied with health context and personality. However, many respondents believed that safety issues with the technology are a manageable problem with risks that can be addressed.

### ***Few differences and relationships among participant groups***

Comparing the four participant groups – healthy adults and patients with chronic health conditions, and those who had experience with health services delivered through information technology and those who did not – there were predictable differences identified in their acceptance decisions. Due to experiences with long-term illness, participants with chronic health conditions were motivated to accept the health technology. They were familiar with the difficulties in managing health care services – recounting experiences with health care bureaucracy, other delays, and a lack of autonomy in their care. These encounters helped participants recognize the benefits of mobile phone health services more quickly. Furthermore, many patients with chronic health

conditions believed it is important to use digital systems to manage and monitor their health. Therefore, they were excited to learn about this technology. On the other hand, healthy participants did not speak from experience. They focused on the potential of mobile phone health services to be helpful should they develop a health condition. Another comparison to be drawn is between participants who had experience with health services delivered through information technology and those who did not. Respondents with experience were more open to the technology, and many of them shared the view that new technology is important to health care. Overall, experience with health conditions and health technologies may lead to greater interest and enthusiasm for these matters.

Besides familiarity with health management and enthusiasm for health technology, no other pronounced differences were observed among participant groups. Within the four broad categories, participants had diverse opinions and attitudes. Additionally, many respondents held views that aligned more closely to the views of members in other participant groups. The lack of consistent perspectives was also observed among different age groups. For example, there were young adult participants in their late teens and twenties who were enthusiastic for the technology, but there were also respondents in the same age group who were uncomfortable with mobile phones or found them difficult to use. Overall, few pronounced differences among participant groups were identified, and there was not a typical profile.

Relationships between participants' perceptions and their acceptance decision could not be identified. All respondents fell into one category: they all intended to use the technology. Therefore, drawing comparisons to identify relationships is not possible. Furthermore, as a qualitative study, the acceptance of the technology and the enthusiasm for the services were not enumerated for quantitative analysis of relationships. For these reasons, no conclusions were made about which group is more inclined to the technology or which decision factors influence the acceptance decision the greatest. Instead, the analysis focused on the issues and needs to be addressed when designing mobile phone health services.

## ***Summary***

All participants intended to use mobile phone health services in the future. Thirty respondents (75%) wished to adopt the technology immediately, and the remaining ten participants were waiting for later – upon usability improvements or a health condition developing. Some respondents were selective of which services they would use. With concerns for dependency, privacy, and medical errors, sixteen participants intended to adopt a selection of the tools only. The most preferred service was the management of health care administration and the least popular was health information delivery. Additionally, there was no consistent profile among the four participant groups. Within each category, respondents had diverse opinions and attitudes, and this variation was observed

among the different age groups as well. Overall, participants were interested in the technology and its potential.

Three factors shaped the acceptance decision for mobile phone health services. Participants considered their health context – particularly their health care environment, health status, health costs, and health privacy protection. The personality of the potential adopter also had a role – with emotional tolerance and affinity for health affairs driving interest in the technology. Finally, participants determined the helpfulness of the technology by reflecting upon their positive and negative perceptions – and considering the technology’s safety and usability.

## **Chapter 6: Positive perceptions**

Participants believed that mobile phone health services could improve health care. First, the technology might improve the quality of care by facilitating access to health services and preventing medical errors through computer oversight. Secondly, participants believed the technology may contribute to medical efficiency. This is possible through faster communication with health agencies – saving time and money as a consequence. Furthermore, mobile phone health services were perceived as leading to speedier health interactions. Finally, there were preferences for mobile and digital systems in health care. Some respondents saw the mobile phone as one of the best interactive technologies for health professionals to engage with health consumers. Others were enthusiastic about the technology because of a sense of novelty with the tools and a familiarity with mobile phone applications. By these perceived improvements, participants held positive views, which contributed to their acceptance of health services on mobile phones.

### ***Improving the quality of health care***

#### **Easier to contact health services**

*Participant: I guess it would give more of the presence of the doctor ... [in] the times between doctor's visits.*

Participants believed mobile phone health services could provide easier access to health care. The technology was seen as a lifeline – capable of rich, real-time communication with medical professionals. For instance, many participants were impressed by the case of the Scottish woman in the video presentation. From her mobile phone, she sent a photo of her swollen legs to the doctor, who recognized a serious health condition and quickly sent an ambulance for her (E-Health Insider, 2007). In this case, participants felt the technology offered medical expertise outside of the doctor’s office, and this accessibility meant health conditions may be addressed when they arise – instead of waiting for the next doctor’s appointment. Additionally, one participant was optimistic that any health communication technology could improve health care access. She came to this conclusion because of her experience with online searching for health information. This access “*revolutionized*” her health care because she has been able to find and acquire beneficial health services that her clinician did not know about. Overall, participants hoped that mobile phones will offer greater opportunities for acquiring medical care.

### **Providing oversight**

*Participant: [With mobile phone health services], you don’t have to rely on a note or your memory to do things [i.e., health activities] ... There will be automatic reminders for you, so you don’t have to remember all the time.*

*Participant on advantages of the technology: Just being able to take the [health] measurements quickly and let somebody else analyze the data and put it all out of your hands ... Again, maybe taking less responsibility for yourself and your living – [and having] an automated program tell you when and how you need to do different aspects of [health management].*

Some participants wanted greater oversight in their health care. They appreciated mobile phone reminder services, which they described in positive terms like “guardian angel,” “mother,” “assistant,” and “the doctor present with you.” There was also interest for automated health monitoring that would check and review a patient’s health status. One participant wanted an application to watch over her because in her experience, she didn’t think about health matters until there was a “big problem.” Respondents believed that this regular health monitoring is important to preventing medical emergencies and crises. Furthermore, participants wary of aging perceived mobile phone monitoring services as a source of comfort. They hoped the monitoring could anticipate health problems before a crisis occurred and then call for medical assistance quickly.

*Participant: I’m only getting older. The older you get, the more problems you start to have, and so you have to monitor a lot of things better.*

Some participants believed patient monitoring would be easier with mobile phone health services. One respondent who suffers from severe asthma and allergies described her frustration with her health care follow-ups. After some medical treatments, her doctor's office will call her and follow up on her status. But the participant found this inconvenient, especially when she misses the call and needs to check her voicemail and then call back. She hoped that a text messaging option would provide this monitoring without the hassle of telephoning someone. Additionally, participants believed the technology could be liberating for caretakers who need regular status updates and frequent contact with the patient.

### **Preventing mistakes**

Along with computer oversight for health regimens and monitoring, participants believed the technology could prevent medical errors by facilitating team communication. They envisioned different health care stakeholders communicating through multiple modes of interaction – such as text, audio, visual, and video formats. Respondents believed this would improve the quality and frequency of interactions with health professionals. For example, a health information delivery service conducted through text messaging might reduce misunderstandings because it provides a written record. Additionally, the possibility of asynchronous, mobile communication – like email and voicemail – could help health professionals coordinate care across different locations and

schedules. One participant's experience underlines the importance of multiple modes of communication among stakeholders.

*Participant: After I had my wisdom teeth removed, I was given a medication that was the wrong [one] – absolutely contraindicated for me. Had I taken more than one dose, I probably would have had an interaction that would have [resulted in] a seizure. My friend who is a pharmacist caught [this mistake] and we tried to get the physician to change it ... but the names of the drugs were very similar [and] he was not hearing it – he was an elderly man, he wasn't hearing a difference in the names. It was this big problem. eHealth coming in [i.e., health services delivered through information technology] would [mean] texting with physicians – getting something written to the physician rather than hearing it auditorily, maybe even involving a pharmacist too.*

## ***Improving the efficiency of health care***

### **Faster contact**

Participants wanted the ability to contact health professionals quickly. They wanted a direct phone line that could reduce the time and effort in reaching their physician. Fast contact was especially important during emergencies when participants need to know the severity of their health condition and the action to

take. Respondents also believed they would take better care of their health if it were faster to arrange medical appointments. Therefore, the speed of health services contact was important to the perceived quality of health care.

*Participant: If you think of something you need to do [for your health] and [you] could do it right now – rather than wait to do it [later] and possibly forget ... that would be a big plus [for my health care].*

Mobile phone communications were perceived as faster than other types of telecommunications. For instance, participants believed the technology would allow them to contact their clinicians even if they stepped away from their office because they could be reached on their mobile phones. Additionally, participants hoped for telemedicine services to be delivered on mobile phones, so that health appointments could be conducted remotely and immediately.

*Participant: It would be incredibly relieving to be able to do this stuff [i.e., mobile phone health services]. It often feels like [I] can use [mobile phones] in every other part of my life. But when I'm trying to deal with my health needs, I'm suddenly back dealing with the bureaucracies of the current system – this inability to have any direct interaction.*

## **Saving time and money**

With mobile phone health services, participants believed health care access could be faster and cheaper. Speedier interactions could also lead to emotional reassurance. For example, participants felt that receiving test results and health feedback quickly could reduce anxiety and eliminate the frustration of following up with health professionals.

Reducing the time spent at a doctor's office was another perceived time saver. In sending health data on mobile phones, participants hoped that medical appointments could be conducted from afar so that unnecessary visits could be avoided. Additionally, they believed that sending health measurements and status updates – just moments before the doctor's visit – could shorten the length of the appointment.

*A participant with asthma: The [mobile phone health service] with the peak flow meter that you blow into your phone would make life easier ... When you go to the doctor, you do it anyways, and you don't do it in front of the doctor so it makes the wait take even longer for a nurse to find a sterile one [i.e., peak flow meter]. Then you have to do it, and then they sterilize it again, and then they leave the room and you have to wait for the doctor. Whereas if*

*they had that information right when you go in, that might actually help with the ease ... [of] getting in and out.*

Additionally, participants felt that mobile phones could help them multitask better. They hoped they could address health affairs from their phone while waiting in line or during free moments in their schedule. With more opportunities for addressing health care, participants believed they could accomplish their health goals more easily.

### **Being organized and on schedule**

Being organized was important to participants who were managing a chronic health condition or trying to meet a health goal. Many respondents reported the need for careful organization and administration in order to carry out health activities successfully. Since poor organizational behaviors – such as forgetfulness and disorder – were regarded as barriers to healthy behavior, participants valued the organizational tools of mobile phone health services.

Participants saw two ways that the technology could organize their health care. First, mobile phone health services could guide health actions – such as facilitate appointment scheduling or provide instructions for health regimens. Secondly, the technology could offer electronic and mobile access to health resources. Participants felt these options could support health behaviors in an interactive and portable manner.

## **Mobility**

Participants valued the ability of mobile phone health services to reduce geographic barriers in health care. Respondents described a sense of freedom if medical services are accessible and manageable on the go. For instance, health files and tools stored on mobile phones meant fewer items that needed to be physically carried. No more paper diaries to record health symptoms, no more paper copies of health instructions, and no longer bringing paper test results to appointments. This was a welcome relief. With paper systems, participants worried about loss and they found them difficult to use and easy to misplace.

### ***Preferring mobile and digital health services***

#### **Mobile phones as the best platform**

Mobile phones were regarded as one of the best technologies for delivering digital health care services. According to participants, few technologies could compare to their portability, convenience, and network accessibility. Furthermore, respondents recognized a trend towards cloud computing, which is the use of online resources and tools that are accessible on various devices, and mobile phone health services were perceived as in line with this development. Since work, personal, and social activities were already conducted digitally on mobile devices, some participants wished to include health care into the mix.

A few participants were interested in the large-scale implementation of mobile phone health services throughout the medical system. They believed that this or any other technology introduced into health care will improve current conditions.

*Participant: My whole health experience has been pretty much revolutionized in the times that I've been able to use technology [for health care]. As someone who deals with [health issues] all the time, it has made a huge difference in my life ... There's no question about it [i.e., introducing more technologies into health care]. I don't have to ponder over it – yes or no? I think the answer is revealed in itself. To me it's a non-question.*

### **Novelty and familiarity**

Some participants wanted to use mobile phone health services because they found them to be novel and promising. By contrast, other respondents have used similar services on the Internet, so there was a sense of familiarity. They considered the technology to be the mobile analogue of digital health services used in the past. Additionally, some participants with chronic health conditions did not find the technology to be a recent development. From research into their health condition, they had read about phone technologies in medical care for some time now.

## ***Summary***

Positive perceptions of mobile phone health services were directed at the technology's potential for advancing health care. There was a belief that quality of care could improve with less restrictive contact with health professionals and computer oversight of health services. Additionally, respondents anticipated medical care efficiency through faster health communication, cost reductions, and improved health care administration. These advantages were attributed to the mobile and digital communications of the technology. As a result, there was a preference for delivering health services through the mobile phone platform.

## **Chapter 7: Negative perceptions**

Participants were concerned that mobile phone health services might be difficult to use and possibly threaten the quality of health care. First, some respondents believed immense resources – such as advanced mobile phone technology or skill sets – were necessary for using the services. Secondly, a few participants believed the technology could be stressful to use because they were uncomfortable with how mobile phones may be applied to health services and they were apprehensive of the annoyances and distractions from the technology. Thirdly, there was concern of the technology neglecting the human dimension in health care by reducing face-to-face services and raising the potential for dependence on automated tools. Fourthly, some participants were worried that the technology may introduce more risks into health care. All of these concerns led some to question whether mobile phone health services are a worthwhile technology. Overall, negative perceptions were concerned with ease of use and possible risks to care.

### ***Requiring immense resources and skills***

#### **Difficult to use**

Participants perceived a number of barriers with using mobile phone health services. There were physical limitations – such as small screen sizes and

keypads on mobile phones, which participants found difficult to maneuver. There were also motivational barriers. Many participants believed their elderly relatives would be extremely upset if they were asked to use the technology. Attributing their apprehension to a lack of familiarity with mobile phones, respondents felt that immense motivation and training would be necessary for encouraging adoption. Moreover, this sentiment was not exclusive to older adults. One young participant described the mobile phone as a “messy” and complicated technology – he felt this way despite regularly using a mobile phone himself.

*A participant in his twenties: [It] seems even for making voice calls, cell phones just usually add a lot of complexity to things – and in general, I like to cut down on the complexity. It’s complex because it’s a new, emerging technology. It just seems kind of messy. We’re not sure about security and privacy. Not all devices are compatible with each other. They don’t work all the time: sometimes they break, or the batteries run out, or they can get stolen.*

*A participant in his twenties: I may not be the best person to ask because I still think cell phones aren’t even all that great for talking on. I would be just fine using a regular phone attached to the wall. The only reason that ... I even have a cell phone on me is because I see that everybody else does. I don’t think that it’s surprising that*

*I'm not really looking forward to these devices for my health information. I guess it's [an] old-fashioned or short-sighted [perspective] – maybe both.*

For some people, acquiring the skills for mobile phone use can be difficult. One participant described her parents' difficulty with using text messaging, and she attributed it to their lack of a conceptual model of how the technology works. In another case, an elderly respondent discussed her difficulty in remembering mobile phone procedures. She was embarrassed by this problem, especially when her family members were frustrated with her slow pace of learning.

*An elderly participant: I don't know what to do ... how to use the technology [i.e. mobile phone health services]. I don't know what to do if I make a mistake. There seems to be a lot of responsibility for me and a lot for me to do – and a lot more than what I'm doing now.*

## **Technological and financial expenses**

Some participants believed their mobile phones were not technologically capable of running health services. They assumed their phones needed sophisticated features – like online access, more memory, a large display screen, a keyboard, or a high-resolution camera – in order to use the health services. Upgrading their phones with these improvements would incur costs that some participants wished to forgo. Furthermore, without knowing who would pay for

these expenses – whether the patient, the health organization, or the insurance company – there was some hesitance to adopt the technology.

Concerns about the potential expenses of mobile phone health services raised issues regarding health care inequality. Some respondents believed that individuals who could afford the technology would then have special access to doctors, and consequently, the health disparity gap with the financially needy would continue to grow. In order to avoid this inequity, a participant strongly advocated for socially conscious and equitable development of the technology.

### ***Leading to stress***

#### **Emotional discomfort**

For some, mobile phone health services could be a source of “*confrontational*” health experiences. One participant believed it would be difficult to control bad news if health messages were delivered to his mobile phone. Indeed, many respondents preferred personal conversations when critical health situations need to be addressed. They liked the opportunity for a caring discussion with a knowledgeable professional, and they were uncertain whether mobile phones could facilitate this type of communication.

Since many people have their mobile phones on them throughout the day, using the technology as a medical tool may direct more attention to health issues.

This constant reminder may not be welcome. For instance, one participant worried that the mobile phone would become a reminder of frailty and mortality, while another respondent felt that negative health information delivered to the phone would be more “*in your face*” and difficult to avoid.

Additionally, there are some people who adopt mobile phones primarily for emergency uses – for instance, to call for assistance after a car accident. Because of this reason, the device may become associated with a sense of danger, and this may then lead to emotional discomfort towards mobile phone health services.

*Participant on people’s association of mobile phones with emergencies: [For my parents], if [the mobile phone] rings, they answer it. They don’t have voicemail, so if they see that they missed a call from me, they will call anytime of night because they assume it’s an emergency.*

If automated health services lack a social dimension, this might induce anxiety for some people. For example, a participant with mood disorders found that her experience with mobile phone health services exasperated her obsessions with diet and weight issues. She was participating in a research study where she had to report her daily exercise activity and food intake by sending text message reports. In her opinion, this routine distorted her perspective on food because she became preoccupied with the number of

calories in her meals. She said, “[It] made me very obsessive ... [and] knowing all that information was too much for me.” Had there been a face-to-face component to the program, a health professional might have been able to detect and address this negative effect. Therefore, engaging in an automated health program without social support may be emotionally distressing.

Suspicion and doubt over the technology had some participants making stressed, confused, and provocative remarks. For instance, one respondent compared mobile phone health services to the nuclear bomb in that the technology may be developed with good intentions, but the results can be devastating.

*A participant stressed by mobile phone health services: [If I use the technology], I’m going to do something wrong and I’m going to mess it up. So why do it anyways? I’m too scared I’ll fail, or I just don’t like this thing, or what if it goes wrong? ... [T]here is a case that somebody operated on the wrong knee. You start asking these things ...*

If mobile phone health services are emotionally distressing for patients, this could be detrimental in health promotion.

*Participant: Sometimes, and I find this with myself, when you become overwhelmed you become complacent about [health] and that could backfire.*

## **Annoyances**

Health messages delivered to mobile phones are a potential annoyance. During the early stages of behavior change, participants believed health reminders could be helpful – but once this change becomes a habit, they felt the service would be unnecessary. Another aggravation would be poorly timed messages. Participants worried that reminders sent frequently and at inappropriate times would become disruptive. Moreover, some respondents felt that all health reminders would be annoying, and they would not want them at all. One participant, who chose to ignore particular health directives from her clinician, felt that health reminders are pointless for her. She had this outlook that she has made her health decision so a reminder is not going to change her position.

*Participant: The only [mobile phone health service] I would actually use less [of] is facilitating healthy behavior. [Suppose a health reminder delivered to my mobile phone says:] Okay, go swim now! [My response is:] No! I can be just as ornery with this [technology] as I am with myself.*

Participants also worried that the technology could annoy their health care providers. There was concern that sending data and asking questions might inconvenience the physician, and therefore damage the personal connection respondents hoped to foster with their health care team.

*Participant: The only negative thing that I wondered about was if the doctor would be annoyed by too much information ... My doctor feeling like: Stop sending it to me, I don't care anymore!*

However, some respondents believed that any annoyance from mobile phone health services would be worthwhile because of the potential health benefits.

*Participant: If I was in the middle of class and my cell phone [sent a health reminder to] stretch – [and] I can't [because] I'm in the middle of class – I [would still] think that's a good reminder. Even if someone is getting mad about [these reminders] ... they're [at least] thinking about stretching ... I think it's worth it because it then puts that in the forefront of your mind. [Even] if you're angry about something, you're constantly thinking about it too. I wouldn't mind.*

## **Distractions**

*Participant: I have a relative who goes to college. [I] visited and she was at the gym on a machine and text messaging. You're not exercising! There's no way you're working out.*

Mobile phone use for non-health purposes might distract attention from healthy behaviors. For instance, one respondent saw a rise in the culture of detachment among his peers who appear to be on their mobile phones all day. Additionally, participants worried that the connectivity of mobile phones may lead to more interruptions. One respondent described how difficult it can be to separate work life from personal life when business calls come at all times of the day. Therefore, there was concern that including health services on mobile phones could aggravate this problem.

*Participant: I think if you use your cell phone for health, that's ... one more reason to always have your cell phone on – to be connected... I worry you'll never have that downtime, you'll never have that time that you are not connected.*

### **Too much information**

Participants believed that access to health information is beneficial. But if large volumes of health information were delivered to mobile phones, there were concerns that this would be difficult to manage and organize. If there was too much information to process, they worried that this could lead to misunderstandings and health care errors. By comparison, a conversation during a face-to-face medical appointment was perceived as more helpful since health professionals would be able to detect misinterpretations by patients.

*Participants: I can see people getting annoyed with the volume of [health-related] text messages depending on how many are sent out or the content of [the] text messages. For example, if it's something that is very common and sounds like 'eat vegetables today,' that can be very annoying.*

## ***Neglecting human qualities***

### **Losing personal connections**

Some participants were unsettled by the possibility of remote and automated mobile phone health services. Eliminating personal connections to health professionals was especially alarming for those who valued one-on-one interactions with health professionals as an important component of their health care. Many saw these relationships as critical to fostering trust and improving the quality of care. If there were fewer face-to-face interactions with health professionals, respondents anticipated a reduction in health care empathy and a rise in machine dependence.

*Participant: I think that it is important to have a good relationship with your doctor. That way you can be on the same page and relate things ... [Your doctor will] have a sense of who you are [and] what you need in terms of medication or exercise. [Doctors] that you wouldn't come into contact with ... [face-to-face], I think they*

*will treat you differently if they knew you and had a relationship with you, than if they were just communicating with you without seeing your face or talking to you.*

*Participant: [Mobile phone health services] lessen the need for relationships and interactions [with health professionals] – the personal aspect of it. You wouldn't develop as personal a relationship with your doctor, which would then instill a sense of trust ... [It] takes out the social-personal medium.*

*Participant: Hopefully, technology frees up time [for health professionals] in doing administrative and bureaucratic things and not [reduce] important doctor-patient time.*

Many participants believed health care requires rich interaction between the patient and the physician. In addition to what the patient describes, respondents believed it was important for health professionals to consider non-verbal cues – such as the tone of voice, body language, and other mannerisms – to fully understand patients and their condition. However, mobile phone health services were seen to potentially divide health care into smaller automated tasks, which may not address the complex emotional issues such as trust and the unspoken needs of the patient.

*Participant: [With mobile phone health services], I'm afraid [health care professionals] won't ... understand me and the way I respond as a human being, so that they [can't] put that [information] in the data set of making a [health care] decision ...*

Additionally, a participant warned how remote health technologies may foster a false sense of security. The mobile phone health services may indicate patient status is okay, when in fact the technology may be broken or insufficient to detect a problem.

*Participant: [I] worry about situations where it is more complicated than could be recorded. I think about times where I emailed for a doctor's appointment and I explained what was going on. [I] actually thought it was something not very difficult and [was] hoping for a quick prescription and not having to go in. When I went in, it was more severe than I would have expected. So it was actually good that they made me go in instead of [writing] a prescription over the phone. I worry that if there was the transmission of information that wasn't [accurate, the condition] could be more complicated than the patient knows or realizes.*

## Dependence

There were reservations about automated mobile phone health services that would guide health activities. Some participants were concerned that this convenience would coddle patients, and consequently, they become less vigilant about their health and avoid responsibility.

*Participant: I'm not convinced yet that having things laid out so conveniently is necessarily the best way to go because I think that ... if something is convenient, you might have a convenient attitude towards it. It's almost like a lull of caring.*

*Participant: I feel I need to keep my mind sharp and the more I give to technology to manage my daily decisions, the duller my mind will grow. Perhaps it's an irrational fear, but it is my phobia nevertheless.*

Participants worried that the technology would also minimize personal responsibility for health maintenance. This could lead to dependence upon the technology, and there were intense feelings against this problem.

*Participant: I think there is the possibility of becoming too dependent on the cell phone. And when [people] lose [the device, they will be] just collapsing!*

However, this problem of dependency was not purely speculation. One participant felt she had become reliant on mobile phone health services. She was calling a nutrition expert at regular intervals throughout the day for guidance with diet monitoring, but when the therapy was complete, she found it difficult to manage her meals without this support.

*Participant: [The mobile phone health service] made me kind of too dependent on someone to ask [about diet issues]. It just sort of became second nature to call and ask someone: What should I eat today? [Once I was no longer using the service], it definitely did get a little ... not really hard to manage, but ... a little complicated maybe.*

If mobile phone health services required patients' active participation – so it did not diminish their personal responsibility – some participants would be less concerned about dependency.

*Participant: From the video, [the service where] a doctor receives [data about] the force of one's breathing via cell phone ... if it were necessary to give a doctor information about how strongly I breathe, I don't see what a big difference would be [between] going in and seeing him and being there via cell phone. Sending that via cell phone would only save time.*

Some participants believed that regular health reminders could diminish the sense of autonomy and personal control in health care. However, there was one individual who saw these interruptions as a worthwhile intrusion.

*Participant: I don't think [health reminders are] an invasion [of your privacy and freedom], especially if it means bettering your health.*

### ***Threatening health care***

Some participants worried that mobile phone health services could introduce medical errors into their care. First of all, a user may not be able to recognize when the technology is providing incorrect information. To avoid this problem, some respondents would reject all educational health materials delivered to their phone. Secondly, some participants were apprehensive about using remote health monitoring services because they worried about reporting health symptoms incorrectly. For instance, a nurse participant knows of patients who regularly downplay their health condition – when in fact, they are in a critical state when they come for their doctor's visit. If patients relied on mobile phone health monitoring and avoided physical checkups, she was concerned the technology could exasperate this problem. Thirdly, there were apprehensions of the technology destabilizing the health care system. Participants worried about patients who might send too much health data and messages, thus overloading physicians. Consequently, doctors may shift their priorities and reduce patient

care time in order to conduct more administrative work and respond to digital health requests. Finally, rapid developments in mobile phone technology were another perceived threat. A medical student described mobile phones as a transient technology with new features coming out year after year. If health systems should “*jump on the bandwagon*” and implement mobile phone health services, he worried that health professionals would become sidetracked in their medical practice as they catch up with the latest hardware developments. By this cautious view, the participant believed that mobile phone devices need to be firmly stabilized before they are used in health care – perhaps he means greater standards among devices. Overall, participants worried how the technology might introduce medical errors and destabilize the health care system.

### ***Will the technology make a difference?***

For complicated health conditions, some participants questioned whether mobile phone health services could make a difference. Respondents believed that powerful forces can contribute to poor health behaviors and illness – citing addiction, low self-efficacy, poverty, and idiosyncratic motivations as examples. So they began doubting whether these health issues could be addressed by technology alone. Furthermore, participants believed a comprehensive and intensive treatment plan was necessary for complex health conditions, and they were uncertain whether mobile phone applications could provide such a level of support.

*Participant: These electronic services [are] not a replacement of your own discipline [and] interactions with the doctor. This wouldn't be a fix-all ... There is still a certain amount of human factor[s], patient responsibility, [and] physician responsibility that are required for [health improvements] to work ... Nothing's a hundred percent. I have a lot of positive things to say about [this technology], but it's not foolproof.*

## **Summary**

Participants had negative perceptions that using mobile phone health services could overwhelm patients and disrupt established health care practices. They worried that immense skills and resources might be necessary if the services are difficult or costly to use. Additionally, the technology may lead to stress by drawing attention to health issues, providing unwanted information, and introducing distractions and annoyances. Furthermore, the social dimension in health care was greatly valued, so participants worried that the services could minimize personal interactions with health professionals and lead to dependence and safety risks. In spite of these perceived threats, respondents remained interested in the technology.

## **Chapter 8: Supporting health behavior with mobile phone services**

Participants believed that mobile phone health services could support important activities in healthy behavior. These activities include health awareness, contact with health professionals, participation in health care decision making, health behavior change, adherence to medication regimens, and health monitoring. Participants felt these could be difficult tasks to accomplish, and the mobile phone was regarded as a helpful computing tool for support in these areas.

### ***Cultivating health status awareness***

Participants believed that awareness of health status is an important activity. Developing this attention may be helpful for taking preventive actions and seeking medical care. One respondent, who was type 1 diabetic, also found a legal motivation for monitoring her health status.

*Participant: [Type 1 diabetes is] a condition that affects every moment of your life. You have to be mentally aware of how healthy you are at every moment. Where is your blood sugar at any given time? How is that going to affect what activity you choose to do?*

*For example, every time that I drive, I have to check my blood sugar that it is good, so that if anything could happen on the road – for example, a fender bender – people won't draw my condition into the event because I can prove my blood sugar is okay. Every time you eat, you have to assess what you eat and do calculations on how much insulin you take to cover what you're eating. And of course [you need to assess your] physical activity – that could be anything from vacuuming to checking the mail up the street. You need to know where you're at. [Diabetes] affects every moment of your life ... Managing it is a twenty-four hour event.*

Participants had difficulty with health awareness. When schedules became busy, some participants forgot to monitor and care for their health. They overlooked their well-being as a priority, so health actions began to slip from their routines. Another problem is bias in health awareness. One respondent described her optimistic bias in weight maintenance. She tries to be conscious of her health and can feel that she is doing well, but then doesn't notice until much later that she has gained weight. Another participant described her pessimistic bias. She can believe she has engaged in poor health behavior, when in fact she had not. Participants hoped that mobile phone health services could moderate these biases by providing objective monitoring services.

*Participant on negative health biases: That's one of the reasons that I liked using the charts [for recording my daily diet] because sometimes I get to the end of the day and I'm like: Oh my gosh, I really ate terrible today; I don't really know why I did it. Now, I look back [at the charts] and I'm like: I didn't really do so bad [with my diet]. It's just because I was tired and I thought in my mind that ... [I ate poorly, so then I began to think:] Oh my gosh ... if I've already blown it then I'm going to really blow it [i.e., eat unhealthily]. But I look back [at this diary and I] think maybe I could go a little longer because I did so good.*

Additionally, participants believed that mobile phone health services may be helpful for reminding patients to examine their health.

*Participant who uses a phone-based health consultation and follow-up service: Sometimes they'll call me out of the blue [i.e., health professionals from the service] and I might not realize that I'm really almost like in a crisis situation and by them checking in on me ... I actually do deal with [health] things that I would not deal with otherwise ... [If you have a health condition], it's good to have someone else pushing you and reminding you when you're needing to keep going [with self-care] ...*

## **Contacting health professionals**

*Participant: I definitely have ... not told the truth [to my physician] before – whether I was embarrassed that I didn't follow instructions and I'm embarrassed to admit it or that I wasn't clear [about them].*

Participants appreciated that text messages and email could provide opportunities for less direct communication with health professionals. Speaking with doctors can be intensely embarrassing, so participants have lied to their physician or refrained from questions and discussion in order to avoid awkwardness. A common sentiment was *“I wouldn't bother my physician with some of those questions.”* Many respondents recognized that these behaviors are not constructive. If health questions and feedback could be sent by email or text messages, they believed that embarrassment might be avoided. It is the visual anonymity that is helpful. Additionally, indirect communication may encourage honesty and openness as patients exhibit higher levels of self-disclosure in health discussions mediated by computers (Joinson, 2001). Finally, one participant found that electronic written communication was sometimes the only opportunity she had for contacting her health professional. Overall, many respondents believed the technology could help with communicating difficult health issues by providing opportunities for written communication.

*Participant on emailing questions to her doctor: Honestly, it was the sort of question that I would [email] the doctor about or not ask at all ... I might have gone to ask the pharmacist, but I sort of felt stupid [to say]: I have canker sores, what is the deal with this?*

*Participant: I personally have found that the ability to email the doctor a godsend. [With] the phone, a lot of the times you have in-between people, and messages get convoluted – messages don't get delivered. There're all kinds of problems on the phone. I find if you can email the doctor directly, you can say exactly what you need to say without an in-between person. And on top of that, it can be really intimidating to be in the doctor's office. You can be rushed, the doctor could be intimidating, and for lots of reasons, you end up not asking questions you want to ask or saying things you want to say.*

### ***Participating in health care decisions***

*Participant: The doctor is not accountable for everyday actions ... If you're not getting better and you're not doing it [i.e., following doctor's orders] on your own either, you can't blame your doctor for getting worse.*

Participants saw mobile phone health services as an empowering technology – one that makes healthy behaviors seem doable through its support and guidance for health actions. This feeling was partially attributed to the novelty of the services, which could inspire hope and excitement. The technology’s convenience could also “[make health actions] more doable,” explained one participant, “it [puts] health [management] ... right in your pocket, as opposed to being an afterthought.”

For acquiring the best possible care, several participants believed patients should participate in medical decision making with their physicians. Mobile phone health services were perceived as tools that could facilitate this active role. For instance, one respondent felt that patients would be more involved in their health care if they could take health-related actions from home on their mobile phone, such as sending measurements for monitoring or reporting symptoms. Additionally, greater access to medical information systems had participants feeling that they could be more of a partner with their physician – that there was the capacity to take responsibility of their own health.

*Participant: [Mobile phone health services give] ... patients a lot of control of their health care ... When you have that possibility ... [you will] be more involved in maintaining your own health – instead of expecting someone else to do it.*

One participant hoped that mobile phone access to health information could prevent errors in medical decision making. In the past, doctors administered injections for her asthma and allergy conditions without informing her of their purpose. During an appointment, she wanted the ability to reference health resources in order to review the safety of her doctor's treatment decisions.

### ***Changing health behavior***

Participants saw health behavior change as a long and discouraging process. Weight loss, exercise, and healthy eating were challenging endeavors. However, respondents believed that small changes in these activities could have a large health impact, so they wanted assistance to help them make these changes and to stick with them over long periods of time.

Participants saw the potential of mobile phones for supporting health behavior change. For many, the device is conveniently available, throughout the day and during many different activities. As a computer, it could run programs to make health plans, provide guidance, and maintain a schedule. With these benefits in mind, participants perceived the technology as a source of support for troubleshooting in behavior change and dealing with challenges. According to one respondent, even basic information delivery – such as sending exercise tips or healthy menu ideas – could be useful to help “*get you out of this stasis, [when] you are stuck in a rut [with your health activities].*” For some participants, the act

of carrying a mobile phone installed with health applications was a source of motivation by itself. The device would then symbolize a commitment to healthy living. Furthermore, respondents believed the technology may offer health support for people who do not rely on family or friends for assistance. Because of these sources of guidance and motivation, participants felt compliance with healthy behaviors could be easier when using mobile phone health services.

*Participant: [Mobile phone health services] will really help people who don't have a strong support system. While your phone isn't a support or [a] friend, you know something is on the other end that is keeping you honest [in conducting healthy behaviors].*

For behavior change, the interactivity and the responsiveness of mobile phone health services were the most valued elements. Participants wanted services to provide evaluations of their performance, recognition for their accomplishments, and personalized advice. They hoped that this information could help them overcome frustrations and setbacks. If encouraging messages were sent to the mobile phone, one participant imagined she would achieve her exercise and diet targets better. She noted that “we don't do a lot of rewarding in our society” and identified a need for more encouragement during health behavior change.

*Participant: [In health behavior change programs, you] don't really get to see how things are changing over time. I'm really interested*

*in the big picture and knowing that I did a good job that's awesome.  
How did I do last week? How am I doing in comparison to a month  
ago?*

### ***Taking medications properly***

Adhering to a medication regimen can be difficult. Participants explained how easy it is to miss a dose – especially when you are busy, have a disruption in your schedule, forget to renew the prescription, or do not receive reminders. Additionally, one respondent explained how she does not feel a health difference when she misses a dose, so there were not even physical symptoms to remind her.

*Participant [on following a medication regimen]: Honestly, some days I'll forget. It'll slip my mind and I'll feel like I'm too busy to go through it. [It] takes two seconds to take your pill, but still.*

*Participant: It is surprisingly easy to forget to take your medicine. If your routine wiggles the slightest bit – [for example], sleep [in till] nine or ten o'clock instead of [waking at] six o'clock, [or on the weekend] you sit down and have a second cup of coffee instead of run out the door – it's very easy to find yourself [wondering]: Did I take my medicine? I can't remember.*

Some participants wanted a reliable system to oversee their medical regimens. A reminder service on the mobile phone was perceived as a promising application since paper notes can be overlooked and timers may be out of earshot or go unset.

*Participant: If I got a text message everyday that told me to take my thyroid medicine, I would probably do it. Just because I know I'm a horrible patient and I need to come up with a way to be better. I tried different strategies and it just doesn't [work]...*

Medication reminders help caretakers as well. Participants described the difficulty of monitoring a family member's medication. They found this responsibility nerve-wracking, so they wanted a tool that could guide the proper administration.

*Participant: I think reminding people to take your medication is important. My mother never remembers. You have to remind her all the time. My dad has to put her pills in the middle of the counter with signs all over that say: "Take your medicines now." I think a lot of people would really, really love that [service]. My dad would go crazy, he would like that.*

*Participant: I know when I was with my kids, I had a horrible time remembering when did I [administer the medication and] when do I need to do it again?*

Participants also needed calculator and troubleshooting tools for medications. They wanted mobile phone applications to instruct patients on what to do if they forgot to take a dose of their medication. Additionally, medical calculators may help with safe dosing by avoiding imprecise mental mathematics. For instance, a participant with type 1 diabetes explained how a portable calculator tool prevents her from making wild guesses when administering her insulin.

### ***Health monitoring***

Mobile phone health services might help patients monitor their health symptoms and experiences. For instance, one participant wanted to record daily observations of her chronic health symptoms in order to identify what triggers her illness. Because she could not find a tool that was both portable and capable of analyzing the collected data, she kept a mental diary instead. Remembering these notes was imprecise and sometimes she did not bother to monitor at all. With a mobile phone health diary, she believed its balance of mobility and computational power would make it easier to create real-time health records.

*Participant: ... Weather changes or food, a lot of random things can have effects on pain ... [If] you had an easy way to keep a log of*

*symptoms and other conditions that were happening and things that I were doing to myself, then I could see those patterns [in my health condition]. Then it would be easy to change them. Without knowing the patterns, you can't know what foods to avoid, or [for example], if I need to take an extra dose of medication if it's raining.*

*Participant: [Being] able to keep a log of how [my pain symptoms are] fluctuating in my phone or having a system set up with my doctor online would be incredibly helpful. Right now, I have no way to do that. [I tell my doctor]: I think it started getting worse last week and I think I started that medication ... [but] it's never really precise.*

*Participant: In a new [electronic] environment, access and recording [of health] information would be much easier – [you] may enjoy a higher quality of life over a longer period of time [by monitoring your health].*

Participants recognized the potential of the mobile phone for real-time and automated health data collection. Because of these features, health symptoms may be recorded more quickly. In this way, participants believed the technology could provide real-time portrayals of their health condition and reduce biases and memory lapses.

Mobile phone health services were also perceived to offer flexibility and encourage spontaneity in health monitoring. A type 2 diabetic participant explained how tedious it is to research the nutritional content of restaurant menus before going out to eat. If there were mobile phone access to this information, she believed the advance planning would be unnecessary because she could then look up these details at the restaurant.

*Type 2 diabetic participant on monitoring her diet: [You] have to think in advance: Where may I be going for lunch today? What do I have to think about before I go and eat there? You find yourself [spending] a lot of time looking at the menu of a particular place online and thinking: That's loaded with salt, carbohydrates, sugar ... [This advance research] takes away the spontaneity, it takes away the interest [of eating out] because you're kind of sitting there going: This is an awful lot of effort, I think I will just go get a cup of yoghurt. You kind of find yourself doing the same thing all the time because you're falling into your safe zone.*

## **Summary**

For encouraging healthy behaviors, participants saw potential in the mobile phone – particularly for its computer-assisted support in health care.

Respondents hoped that the reminders, prompts, and communication options

available through the technology could facilitate healthy behaviors such as health awareness, contact with health professionals, medical decision making, health behavior change, compliance to medical regimens, and health monitoring. These activities were regarded as important for good health, so the potential support of mobile phones was valued.

## Chapter 9: Supporting health information behavior with mobile phone services

### *Readiness for health information*

Mobile phones may be a convenient tool for health communication. However, this potential is lost if health consumers are unwilling to use the information provided by the technology. This is an issue of readiness for health information, and according to participants, it is shaped by several factors: how people cope with illness, their comfort with asking health providers questions about their care, the timing, the context, and people's roles as patient, caretaker, family member, or friend.

*Participant: [When] my husband went through a brain tumor, he wanted all the information in the world. And as a librarian, I gathered all this information, all these articles. I gave it to him and he read them. I couldn't get myself to read them till after the surgery...*

*It's the timing issue. I wanted access to it, and I wanted it at my own time. I find that this is often with consumers – when I help people with health care questions. Some [people] only want the*

*teeniest tidbit, [while] some want it all at once. So timing, how they cope with that news, how they cope with crises with their lives – [they] kind of drive when [health consumers] seek information and how much information they seek ...*

*[Also], I think it varies by situation. Usually, when I have a personal problem going on, I research it completely and I read everything. When it was my husband and it was impacting our lives and I was scared, I didn't want to deal with it. He was telling me what the prognosis was [and] he was telling me [what] the current rates were, [but] I couldn't bring myself to look at that information until after things were more settled. If it were myself, I would be out there researching it and reading everything I can.*

Participants believed mobile phone health services could promote readiness for health information by reducing time barriers. Many participants with chronic health conditions were impatient when acquiring health information. Accessing medical records or retrieving health care instructions were slow procedures for them – and it felt slower because of the perceived lack of feedback, centralization, and personalization in health communication. Because of positive perceptions that the technology may expedite health interactions, some participants welcomed health information delivery on mobile phones.

Additionally, mobile phones could foster health information readiness by reducing emotional barriers and serving preferences for information delivery. Participants had several explanations. First, mobile phones could provide a written record of the health interaction through its text message and email functionalities. This is important because voice conversations can be forgotten – especially if the health professional is speaking too quickly for note taking. Poor memory and the lack of a written record had participants worried that they could not follow the doctor’s oral instructions. Secondly, mobile phones offer the alternative for written communication with health professionals. Some participants welcomed this option because they found telephone calls to be anxiety-inducing. Thirdly, there was the perception that acquiring health information would be easier because of the asynchronous communication on mobile phones – whereby the recipient does not need to engage with the sender at the moment of delivery, such as receiving a text message and then responding at a later time. Furthermore, by emailing or text messaging their health provider, participants did not feel limited to business hours for asking health questions.

*Participant on the need for written records of health interactions: I don't have the world's greatest memory, so you can tell me something on the telephone and I'll get the gist, the important part, but later on I'll be: Did they really want me to ... ? And then I'll have to make another call, so I prefer doing everything electronically ...*

*Participant who prefers text messaging to a phone conversation:*  
*[With text messaging], you can avoid actually interacting with people and there's no worry about finding a reason to get off the phone [with the other party]. I have some anxiety about making phone calls. I've never liked making phone calls. I feel like I'm paying for it and people yap, yap, yap – [but] when you are on text message, there is no concern about that.*

*Participant: I just don't like to talk on the phone ... I am also bad about answering the phone if I've got messages waiting.*

### **Collecting health data**

Collecting health measurements and keeping records of health events are important information behaviors. Respondents hoped these activities could help them understand their health condition and measure their progress. For instance, one participant kept a diary of his meals because he found that accounting for his food intake could prevent him from overeating. Other respondents hoped that health measurements collected daily could provide a richer, more realistic account of their condition. By comparison, participants worried that the periodic health test at the doctor's office could give an anomalous reading that may misdirect treatment. Overall, collecting health data was perceived as an important activity for health promotion.

Participants found health data collection difficult to perform. One respondent could not find a convenient tool for this purpose. Keeping a mental diary of daily symptoms was never precise. Paper diaries were not helpful either because they are conspicuous and easy to lose. Some participants used an Internet application, but they did not have online access throughout the day. Due to these barriers, one respondent who was monitoring her diet resorted to scribbling notes on tiny scraps of paper and collecting food wrappers. Throughout the day, she carried these notes until she could find a computer to log the calories. While participants complained about these difficulties, they cited greater obstacles in acquiring copies of their medical test results.

*Participant: I've had a really hard time getting a copy of my [medical] test results ... When I go and have my blood drawn, [I ask]: Can I have a copy of my test results mailed to me? And they go: ... you have to go ask the doctor. It goes into this whole thing where I have to call and sometimes call several times to get someone to mail me a hard copy of results. Why can't you just email me? Why do I have to go through five people to get a copy of my test results? That process can just take weeks. [It] drives me nuts that it's so difficult to do that!*

Mobile phone health services may address the data collection needs and barriers reported. First, as mobile phones are portable, participants believed

they would make a useful tool for recording health events immediately at the moment they arise. Waiting to record later was deemed counterproductive since the intensity of the symptoms may be forgotten or discounted altogether.

Secondly, respondents liked mobile phone applications that could prompt the user to collect data and then automatically run analyses. Thirdly, cooperative data collection may be possible through online tools accessible on mobile phones. One participant needed to monitor his son's diet, but it was difficult because his spouse fed him separately. So he wanted a digital diary tool that could synchronize the data he and his wife would record on their mobile phones.

Fourthly, participants anticipated health measurement tools converging with mobile phones. They envisioned health data recorded onto their phone and then sent through mobile networks for online storage and sharing. Finally, many participants used their mobile phones frequently throughout the day, and they would feel encouraged to collect health data when medical applications are at easy reach on their phone. Overall, the potential for ease and speed of accessing electronic health applications had respondents feeling more inclined to data collection on mobile phones.

*Participant on health data collection with mobile phones: Data would definitely improve. When I take a blood pressure reading, I don't always go write it down. I'm not necessarily going to log into a computer and put it on a form, but if [you] had [your] cell phone with you, [you could] go to these [websites and] you could*

*immediately punch it in. If you could develop an interface between the phone and the testing module, then it will be great. [You] could stick your phone there and read right into it.*

### **Seeking health information**

In addition to the convenience of mobile access to data and online tools, participants valued the mobile phone as a tool for finding health information from social and personal sources. For instance, some participants preferred speaking with medical professionals when they needed health information. Interactivity was important for them – to ask questions, to learn from responses, and then to ask more questions. With one respondent, her doctor was her only source of health information, and in the past, she switched physicians for someone who was more open to discussions. The mobile phone could serve these preferences through voice calls. Additionally, the technology may be conducive for social sources of information like health peers. For instance, one respondent found it difficult to contact her pulmonologist, so sometimes she turned to online support groups with her questions. In turn, she responded to her peers' questions, sharing her experiences and tips for health management. This dialogue may occur through social networking websites, email, text message, and voice conversations on the mobile phone. As participants reflected on this technology as a source of social information, they looked forward to accessing alternative and social health resources.

*Participant on personal sources for health information: I am an interactive person and that's the way I was brought up and that's a natural way for me. I ask a lot of questions of physicians ... I feel like I can get the information that I need cause I can ask the specific questions.*

*Participant: [Because of social sources of health information], doctors will have less authority and ownership of the right answer ... I recently ran across a social site that enabled people with health issues to form their own information environments – that are really separate from the structured medical environment – where they [can] all [interact] with one another. [Patients] took [health] information and their interaction with their doctor and shared it together in a different ... environment. It is a power dynamic that is changing there.*

Additionally, mobile phone health services might increase the demand for personalized information delivery. Participants expected health information on this technology to be filtered and tailored to the user's needs in order to address the perceived limitations in screen size, memory, and usability of mobile phones. Respondents hoped this personalization could help deliver more relevant information.

*Participant: People don't really know what [health information] to search for ... There's so much information out there about different kinds of diseases and different ways of diagnosing it, but it depends on your age, your weight, [and] your habits. If you could tailor [health information] to that person's weight, age, habits; [then] it will provide a more effective way of [delivering information] ...*

### **Organizing health information**

Many participants believed that mobile phone health services should accommodate electronic health records. Digital health information was perceived to help with organization because it is searchable, easier to store and retrieve, can be duplicated, and can be made available online. By comparison, paper health information was problematic. Participants worried about misplacing sheets of paper and then losing important instructions or prescriptions. With handwritten notes, respondents complained about the difficulty of reading handwriting – even if it was their own. Therefore, participants hoped that mobile phone health services could provide digital organization of their health information.

*Participant: I've gotten stretches or activities to do from a doctor on a piece of a paper. I'll lose the paper or I'll forget [to bring it with me]. If I had that [information] on my cell phone, it's like a finite*

*source – it's not going anywhere ... [With mobile phone health services], you can always get a reminder [of health activities] ... [and then] you can look from your [mobile phone] and see what you need to do ...*

Despite a preference for digital health information, participants still valued paper copies. For instance, some respondents used hybrid systems to manage their health records – storing documents in digital formats and printing paper copies when needed. The electronic version served as a searchable backup. With the paper copies, participants perceived a sense of permanence and preferred the tactile ways for managing this information – such as scribbling notes, sorting sheets on a table top, and filing them into a folder. The impression of durability and tangibility may be absent with mobile phone health services, so health consumers may still want paper copies of their health information.

### ***Putting health information to use***

Participants believed that health information available on mobile phones would encourage patients to review their health directives and to follow them.

*Participant: My other doctors do phone reminders [i.e., voice calls] or postcard reminders, which is helpful but it's never to my cell phone. I think I would prefer a text [message] reminder because then I still would have it written down. If they called me ... I'll have*

*to have it written down. I have to have a to-do list. If I don't write it down, it won't happen.*

However, some participants were concerned about the amount of content that could be delivered to their mobile phones because of limitations with screen sizes and the expenses of data transmission. By comparison, other respondents were not concerned with the quantity of information. They believed that the experience of receiving a health message is sufficient to prompt healthy behaviors and the content is not the most important factor. Furthermore, one participant believed that information delivery is not the technology's principal significance because people can ignore the messages easily. Instead, mobile phone health services are beneficial for their interactivity – providing options for communicating with health professionals and leveraging personalized computer applications to inspire and guide healthy behaviors.

*Participant: [Having health information delivered to me] would reinforce my taking a larger role in my [health] behavior – be it preventative health or reactionary health [in order] to take care of a certain problem.*

*Participant: I think the availability of health information is not going to do much, but the capacity of these devices to make it more interactive – to allow people to connect with other people when*

*discussing their [health] information – I think that is more towards how people change their [health] behaviors.*

## **Summary**

Participants believed that mobile phone health services may remove barriers to health information. They presumed the technology could address the difficulties with information interactions – such as awareness, timing, convenience, accessibility, and organization. For instance, the mobile phone could support urgent and complex information needs with its mobile, asynchronous, and multimedia communication. Additionally, the technology is a portable computer that may facilitate data collection and connect with online networks and programs. By these perceived benefits, participants hoped that mobile phone health services will improve the retrieval, organization, and use of health information.

## **Chapter 10: Experiences with health services on mobile phones**

Health consumers may have personal and complex reasons for adopting mobile phone health services. Five participants had intensive experiences with the technology, and their adoption decisions were shaped by different perceptions and behaviors. For instance, one respondent purchased a new mobile phone with powerful computing capabilities and this led him to adopt a sophisticated mobile health application. By comparison, another participant was drawn to a health program because of its simplicity. In other cases, respondents adopted the technology in order to acquire health services that could suit their needs. One participant wanted remote consultations with a preferred health professional, while another used the technology as an alternative line of communication for medical care. Finally, there was a respondent who, despite a negative experience using the technology, remained enthusiastic about its development because of her professional and personal interests. Examining these different experiences will highlight the influence of perceptions and other behaviors on technology acceptance and the unique pathways to use.

***Participant T, who found that a useable mobile computing platform made the difference***

After purchasing an Apple iPhone, the tech savvy Participant T became motivated to adopt mobile phone health services. At the time of his first interview for this study, T was using a less sophisticated mobile phone and he did not use it for health services. He was apprehensive of mobile phone health monitoring services in particular because he worried they may deliver bad news or induce guilt about his poor health behaviors. Due to these concerns, he believed a compelling health reason was necessary for him to become a sophisticated user of these services. However, acquiring his new mobile phone changed his mind about technology adoption. T praised the iPhone for its usability, computing capability, and its potential to network with servers and personal computers. He also liked its server-based applications because they allowed him to access his data from multiple devices. Excitement with his new mobile computing platform encouraged T to try different mobile phone applications, including one for health monitoring.

Participant T adopted a diet and exercise monitoring service in order to support his favorite hobby. T is a healthy triathlete and he began this pastime because of a need to lose weight. Therefore, exercise and weight management are important activities for him. He used an iPhone application that tracked his diet and exercise activities, and the program would calculate his caloric balance

for the day. It included a web component that synced with his iPhone so he could also check his data online through his personal computer. In the past, T did not use an electronic system for monitoring his exercise, but the novelty of his iPhone intrigued him to experiment with this application and determine whether it could enhance his leisure activities.

After using the monitoring service for a short period of time, it left T wanting more advanced functionalities in the program. This desire could jeopardize his continued use of the technology. For instance, T did not find the health monitoring application sufficiently engaging. He could not find a reporting function in the software for reviewing his long-term progress. It was also easy to skip a meal entry because there were not any reminders for him. Additionally, his trust in the system diminished when he believed there were inaccuracies with the estimated calories of food – in his opinion, some values were too high. Most importantly, T wanted a more comprehensive suite of functionalities for exercise and diet management – services that went beyond diary entries and calorie calculations. He wanted an exercise planning and scheduling tool as part of the system. T also wanted a social support element for motivation – such as online discussion with other users. While the program offered an option of joining an online group, he found only one other member interested in triathlon training like he was. As a result of these disappointments, T began questioning the benefits of his mobile phone health monitoring application, and his usage began to waver. He did not find the service as powerful as other iPhone applications – such as

online newspaper readers or mapping services, which he found easy to use and capable of complex tasks. By comparison, T felt his health monitoring application required immense effort to record diet and activity entries and the service didn't provide him with the feedback and analysis he wanted. In summary, T's continued use of mobile phone health monitoring applications depends on the value and engagement he finds in the service over time – well after the novelty has worn off.

***Participant S, who wished to consult a health care team remotely for intensive guidance and consultations***

Participant S began using a mobile phone health service upon the referral of her physician. S was a healthy college student living away from her hometown, approximately sixty miles away. About two years ago, her body entered a hypermetabolic state after running a marathon race. She became underweight and needed to regain her body mass, but S found this difficult to accomplish. So she chose to consult her hometown physician because of personal preference and for the sense of familiarity. As S describes it, *"I went to the doctor, and I was desperate for anything. When he recommended that I see this [sports medicine practice that wasn't located in the town where she was attending college] ... anything pretty much he said, I would have done."* Participant S needed a way to consult health services remotely and mobile phones facilitated this.

S used a mobile phone health service for remote and personalized consultations for diet management. At specific times of the day, she called a nutrition expert to report what she was eating and how much in order to monitor the calories she ate – at one point she needed to consume 4000 calories per day. During these consultations, the nutrition expert instructed S on procedures for weight gain. On evenings and weekends, she used a text messaging service to search for nutritional content in food databases. S found she could call for expert assistance wherever she went and she appreciated the financial savings of appointments without needing to drive to the clinic. Because of these features, Participant S has become an enthusiastic supporter of mobile phone health services and would recommend them to others.

*Participant S on mobile phone-based health consultations: [It] was really helpful because anytime of the day I had a question or anything, [I could call someone]. If I didn't have that, it would probably have been harder [to meet my health target]. It would have been more expensive for me to have to go into an office [regularly and paying] a co-pay each time. [The service was] definitely more financially beneficial and beneficial overall.*

*Participant S on mobile phone-based health consultations: Having to go to the doctor a lot and keeping in contact with someone a lot*

*made me realize how helpful it was not having to go in all the time.*

*I was definitely able to lead a normal life.*

*Participant S: I'd definitely recommend [mobile phone health services to others] because it's a lot easier to get information ... and get support if you have any questions. I would definitely recommend it.*

The social support S received was an important reason for her enthusiasm for mobile phone health services. S credited her success with weight gain to conversations she had with a helpful and responsive health professional who provided her emotional support to overcome the challenges. By comparison, S found her peers to be unsympathetic to her need for weight gain and her struggles with this goal. S's friends told her it was "cool" that she was required to eat more and limit her exercise. When her health condition improved, she stopped using these consultations, and this was a difficult change for her because she missed the meal planning guidance. More importantly, she missed the social interactions with her nutrition expert because they used to chat about topics other than diet during the consultations. Overall, the social dimension of this service was important to S, and this might have had an impact on her enthusiasm for the technology.

*Participant S on social interactions during her mobile phone-based health consultations: I kind of became friends with this [nutrition*

*expert I was calling], and we still kind of keep in contact cause it wasn't that long ago [that I stopped using this service]. I only stopped seeing her in May or June ... I still sort of keep in occasional contact. It was sort of nice because we would talk about other things in the end. I guess that's the big thing. I miss that part the most.*

### ***Participant N, who found simple mobile health applications very appealing***

Participant N is a registered nurse and a patient with rheumatoid arthritis. She used a simple health application on her smartphone to encourage exercise activity. Her case demonstrates how mobile health tools can be simple or straightforward and still be perceived as highly useful and engaging. N used a spreadsheet on her smartphone to record her exercise goals and swimming activity. This document reported her progress towards goals and calculated the distances she swam, and this was inspiring and motivating for N. Furthermore, she felt the spreadsheet was fun and novel, and it amazed her that a “*simple*” spreadsheet could carry out so many calculations. Additionally, N incorporated a social element into the program. Along with a friend, the two tracked their swim distances and competed at meeting their exercise goals – her friend used the spreadsheet on a computer instead of a smartphone. This experience

underscores how health applications do not need complex features in order to encourage adoption.

*Participant N on using a spreadsheet for monitoring exercise goals:*

*[It] said to you: Okay, if ... today is Tuesday and I only had three more days to swim, could I get to 100% [of my target goal]? If you wanted to get a certain distance, you knew you had to be in the pool for at least forty-five minutes. It became like a game. I was doing it with somebody else.*

*Participant N on a spreadsheet that calculates exercise statistics:*

*It's sort of intriguing to me. Even though I can't do that sort of stuff [i.e., create such a spreadsheet], I like what other people can do ... I find it amazing how you make these little things do so much ... And it's kind of fun too, but at the same time ... very helpful.*

It is also important to highlight the simple terms and conditions that led to her technology adoption. According to N, the spreadsheet was developed by an enthusiast and not a private company or health organization. It was free of charge and easily downloaded onto her smartphone, and because there were no financial expenses, she was interested in experimenting with the spreadsheet. N said she would not spend money on a health monitoring service. Additionally, the service did not involve a health professional, instead it relied solely on the computing capability of her smartphone. Finally, it was N's sister, and not a

clinician, who introduced her to the spreadsheet. This shows that complex systems and professional support are not always necessary for health consumers to adopt mobile phone health services.

***Participant Y, who was enthusiastic for the technology despite negative experiences***

Participant Y was enthusiastic about mobile phone health services because of her professional and personal interests. As an undergraduate student, she studied health education and eventually completed a Master of Public Health degree in the field. Through her coursework, she learned about the health uses of mobile phones, and this technology resonated with her. Y was fascinated with mobile phone health services because she believed they are one of the best technologies for reaching young adults who – in her opinion – seem to use their mobile phones frequently. Y felt strongly about the technology and believed it was important for her to support its development.

*Participant Y on mobile phone health services: I don't know if it's as relevant for me because I'm very highly motivated with my health, but it's something that I get excited about and I'd recommend [it] to other people. I would do it because I'm fascinated.*

Y used a text message health service and she experienced psychological stress and disappointment with the service. However, these experiences

appeared to diminish her enthusiasm only slightly. Y participated in a university research study for weight control. Participants were provided pedometers to use, and each day, the subjects sent a text message to report the number of steps taken, the number of sugared beverages they drank, and a number of other factors. Immediately afterwards, the participants received an automated text message response with feedback on their health targets. The study examined this system for fostering accountability with healthy behaviors. Y was disappointed by several problems with this service – it did not offer a reporting function to monitor her progress over time, it did not collect qualitative data, and the automated responses were basic and generically formatted. Because of these issues, she became less enthusiastic for the service. Furthermore, Y experienced stress and anxiety from monitoring her diet and physical activity, and this aggravated her mood and eating disorders. While her friend found success and lost weight with this service, Y became – as she described it – “*out of control.*”

*Participant Y on mobile phone monitoring of diet and exercise: I think [short term progress reports for meeting health targets are] fine if you're looking for very specific behavior changes [and] getting immediate, specific, detailed feedback. But I think that [for] people who are more interested in overall growth, you need more [long term reports]. It's got to be tailored to what people want.*

Eventually, Y quit the research trial for this health monitoring service. Perhaps the program with its quantitative focus and brief, automated feedback was too impersonal for her preference. Furthermore, the service did not offer emotional and social interactions for addressing Y's anxiety with health monitoring. In the end, she remained enthusiastic for mobile phone health services. She objected to using this technology again for diet and exercise monitoring, but she had intentions of using the other services. Overall, Y supported this technology because of her belief in its potential to improve health care.

***Participant M, who appreciated alternative pathways to health care services***

Participant M had a rare chronic health condition. She believed it is important for her to take initiative in her health care and find medical treatments and services for herself. M adopted mobile phone health services to help her with this goal. She used a comprehensive online health service operated by the state health insurance organization. As part of the program's information services, a medical professional would call her periodically to check upon her health condition and advise her about health services. M had a positive experience with these mobile phone consultations, especially with its personalized care. She believed these sessions could provide an alternative line of communication to her health care organization. She assumed that the nurses in the program would

have special access and authority in initiating medical services – thus offering her an inside connection to her health care system. Furthermore, M hoped that mobile phones could provide access to electronic health records, so she could review and share this information with clinicians at other health organizations. Overall, M's acceptance of mobile phone health services was catalyzed by her interest to take charge of her health care and to find alternative sources of support.

*Participant M on a mobile phone health service where medical professionals call periodically to check on patients' health conditions: [It is] timely. And not just [a call from] anyone – that's one thing nice with the nurse that checks in and is aware of your particular condition. They might not be an expert but they can verify [for you] to your practitioners ... They have a line to the practitioner that you don't have. They can go, "Yeah, this person is doing bad. I was talking to them and you need to get them [into the doctor's office]." ... It's a support that you may not have on your own when talking to [health professionals] who [are] ... – to be frank – all carried away with themselves and you're not their priority.*

## ***Summary***

Five participants had intensive experiences with mobile phone health services. They used diet and exercise monitoring programs and they conducted mobile phone consultations with health professionals. Their adoption of the technology was motivated by a sense of novelty, a recommendation from a family member, trust in their doctor, a desire for alternative methods, or professional interest. They acquired the services in different ways – through their health care system or health insurance provider, through participation in a research study, and by downloading online applications. Because there are different motivations and sources for acquiring the technology, the adoption process may vary among health consumers. However, the acceptance decision is generally shaped by the health context, the personality of the potential adopter, and the perceived helpfulness of the technology. While a few participants had negative experiences using the technology, they remained enthusiastic to try other services in the future.

## **Chapter 11: Development of mobile phone health services**

### ***Proposed services***

During discussions of mobile phone health services that could be developed, participants offered clear, tangible proposals for services. They wanted applications to support self-care, resolve time barriers, and provide mobile access to health records. Participants believed that these are important services that health systems should develop. By implementing them, mobile health technologies may be more relevant and compelling for health consumers to adopt.

### **Supporting self-care**

Participants wanted a way to receive medical guidance when health professionals are not easily accessible. They proposed self-care support tools that would provide patients with expert knowledge and guidance for conducting health-enhancing activities themselves. One specific recommendation was for medical calculators. Such applications would help in medical situations that depend on complex calculations for a resolution, such as determining medication dosages and estimating blood alcohol content.

Additionally, participants with chronic health conditions wanted health monitoring activities to be streamlined – particularly for activities that involve health measurements, health data record keeping, and health data analysis. Often times, these are separate and manual tasks that participants found bothersome and difficult to accomplish. For instance, a type 1 diabetic respondent carried multiple devices on herself everyday in order to collect, analyze, and transmit blood glucose readings to her health care team. She wished her glucose meter could be combined with her mobile phone to serve as a two-in-one device that would streamline her health monitoring activities.

In another proposed service, some participants wanted multimedia health education materials to be accessible on their mobile phones. Video guides could demonstrate health procedures and activities for patients. For instance, one respondent found it easy to forget the therapeutic exercises prescribed by her physiotherapist. If she could view an instructional video on her mobile phone, then she could follow along with her phone as a personal trainer.

Some participants wanted positive health messages delivered to their mobile phone. Since modifying health behaviors can be difficult and lonely activities – for example, smoking cessation can be a socially isolating experience (Tu et al., 2000) – participants wanted motivating messages sent to them. During difficult moments, they imagined they could refer to their mobile phone for encouragement.

The proposed self-care services reveal participants' interests for overcoming intellectual, technical, and motivational barriers to healthy behavior. The mobile phone was seen as a tool capable of providing computer support for health care. By this perspective, participants recognized the potential of mobile phone health services and became invested in their development.

### **Resolving time barriers**

Participants were frustrated with delays in health services delivery. The longer a health action took to complete, the more uncertainty and anxiety participants experienced. To address this problem, a respondent suggested a telephone triage system that could speed up the acquisition of medical care. As soon as a health condition develops, patients would contact the triage service and enter their symptoms. The system would determine whether the condition warranted immediate medical attention and then inform the user of actions to take. If the system were automated, it could provide health assistance at any time of the day – therefore saving more time. In another proposed service, participants suggested a mobile phone pager system to manage the wait times at medical offices and hospitals. The mobile phone would inform the patient of appointment delays, provide an estimated wait time, and then signal when the physician is ready. With such a service, the patient may roam in the vicinity of the clinic rather than be localized to a waiting room. Overall, these proposals

may help consumers acquire health services more efficiently. Hopefully, this could address the frustration with delays in medical care.

### **Mobility for health data**

Participants wanted the ability to review their health records on mobile phones. Without portable access to personal health data, participants felt that doctor's questions during an appointment could go unanswered or decisions could be made without a sufficient history. Looking up health records could allow patients to respond accurately about when procedures were last performed, what medications are being taken, and diagnoses that have been made. Participants did not just want viewing access to their medical record system. They wanted to be able to record their personal notes in a diary as well. This would help them to review their health care experiences and to learn from them.

A sophisticated health directory tool was also proposed for mobile phones. Patients with chronic health conditions may visit multiple health professionals frequently, so keeping track of clinics' contact details, services, and schedules can be complicated. A participant with rheumatoid arthritis counted six health professionals that she visits regularly. They include the physiotherapist, the physician at the arthritis center, the ophthalmologist, the rheumatologist, the medical test provider, and her general practitioner – and the participant still wondered whether she had forgotten some other clinicians. At each of these

practices, she interacted with multiple team members. Consequently, she had difficulty remembering who to contact when health problems arise. If she visited the wrong practice, she would need to arrange for another appointment elsewhere, and this would delay her medical care and contribute to anxiety. The participant wanted a system for identifying the best physician to consult. It could be an application that surveys her symptoms and then recommends a doctor to contact. Furthermore, with her many office visits, the participant wanted mobile phone reminders for scheduling appointments. She did not feel she could rely on administrative assistants at the clinic who already manage the schedule of many other patients.

### ***Suggestions for technology development***

Participants were interested in the development of mobile phone health services. They made suggestions for technology promotion, skills development, privacy protection, personalization, usability, and the development of inclusive systems. These interests reflect a desire for empowering the health consumer through the technology. Therefore, addressing them could encourage the acceptance of mobile health services.

### **Cultivate technology awareness**

*Participant: I'm a bit surprised [that this technology] hasn't been more widely deployed at this point. I feel like I've heard a lot about*

*what's going on in the medical field, and I'm a bit surprised I haven't learned about it to this point.*

*Participant: I consider myself pretty mobile [technology] savvy, pretty health savvy, but I've never really used anything on my phone related to health ... I think that is probably a problem that we have.*

Many participants were surprised to learn that health systems have already implemented mobile phone health services. They wanted to know more about this technology and its benefits. Participants hoped that health professionals – preferably their doctor and not private companies or health insurers – would inform patients of this technology and integrate it into clinical care. Respondents would trust mobile phone health services more easily if clinicians were the party introducing the technology.

*Participant: [People] want to hear from their doctor what ... [they should] do with their health and don't want to hear from their [health] insurance company.*

*Participant on accepting mobile phone health services: Yeah, whatever the doctor suggested I should do ... if he would suggest using a cell phone, I would do that.*

*Participant: I'm open to new technologies [in health services] if it's what the doctor uses.*

## **Cultivate technology skills**

Developing technology skills among stakeholders was another suggestion. Several participants were enthusiastic to adopt mobile phone health services, but then saw their doctors' lack of experience and skills in running these services as a primary barrier. This led one respondent to recommend that digital health tools should be an important component of health care education. Additionally, some participants were intimidated by the advanced features of their mobile phones, but despite their apprehension, they wanted to learn them in order to use mobile phone health services. They wanted instructors who are patient – and ideally they could be empathetic with the student by sharing a similar health condition. Overall, many participants believed that patients and health professionals should develop their technology skills for mobile phone health services.

*Participant on her doctor's lack of experience with digital health services: For example, just last week, they got an administrative assistant. Before that they were sharing the admin duties [themselves]. The idea of them being able to [send text messages] would almost be comical ... [The doctors' technology skills are possibly] low tech – but they can operate their computers. [However], texting? I don't know. I could be wrong. [Furthermore], I don't think they would have the time [to implement mobile phone health services]. I guess I don't think they have it in their mind ... to learn and to do that.*

## **Promote the social dimension**

Protecting social interactions in health care was important for participants. They wanted to retain the option of face-to-face appointments. Additionally, they preferred negative health news to be delivered through personal conversations – but mobile phone messages were acceptable for delivering positive news. These preferences were motivated by participants' beliefs that face-to-face appointments could offer better quality of care. Therefore, mobile phone health services could be reserved for situations when physicians are unavailable or when the patient cannot visit the clinic easily. Many participants valued the social dimension of in-person medical care and they believed that mobile phone health services would be an inadequate substitute.

It was also important that personal interactions with health professionals underlie technology-based health services. Many respondents believed they would be more accountable to their health if they knew somebody was going to review any health data they submitted. For example, one participant who joined an online weight loss program found it easy to cheat on her daily diet log. By comparison, when she was attending an in-person weight loss support group, she felt more accountable to keeping an accurate diet log because of the personal check-ups at the meetings. This illustrates how social interactions may motivate healthier behaviors.

Participants recognized that health information delivery is possible – and potentially easier – on technologies besides the mobile phone. Consequently, some respondents suggested that mobile phone health services should focus on applications that make health actions interactive, easy to conduct on the go, and fun – thus making the most of its computing capabilities. For example, there could be applications that measure health progress or online games that allow patients to track and compete with others in their health goals. Another important focus for the technology could be responsiveness. Participants found it frustrating when clinicians do not respond to their messages, and this leads them to question their trust in their health professionals. They also believed that health professionals are obligated to inform patients of any developments in medical decisions, procedures, and test results. Therefore, it is important that mobile phone health services are responsive to user input and confirms receipt quickly.

Overall, participants believed that the interactivity of mobile phone health services can demonstrate sensitivity to the vulnerability and urgency of health affairs, and this could encourage the adoption of the technology.

*Participant who contacted a health professional online, but did not receive a response: I should at least get an email within twenty-four hours. You should get a confirmation or something, but then I never got anything. What if I was really ill or something? ... [When] you make a technology available you have to be able to fulfill that [service, otherwise] it becomes even more annoying.*

## **Protect privacy**

For participants, professional and regulatory oversight of mobile phone health services is important to privacy protection. They believed that health professionals should be responsible for administering the day-to-day operations of the technology. Another suggestion was for fostering a culture of responsibility with digital health information. Participants believed doctors have an ethical responsibility to protect their patients' privacy. Therefore, health care systems should store and use their records as securely as possible. In turn, when consumers share health information, they should vigilantly monitor its security. Privacy was perceived as a responsibility of all stakeholders. Consequently, participants wanted to know more about the regulations and legislation for digital

health tools – particularly with the level of privacy protection provided and the consequences of infractions.

Technical privacy features were important as well. To help users feel comfortable with entering private details into their phones, encryption and password protection were proposed for health applications. Additionally, some participants suggested computer logs that could detect unauthorized access by monitoring who has viewed a health record and when.

### **Provide choices**

Participants wanted choices in the mobile phone health services they use. They wanted to control the frequency that health messages and alerts are delivered, the type of information displayed, the duration of service use, and the level of complexity. Without control of these factors, participants worried they could become overwhelmed by the directives issued by an automated program.

User control was also important for privacy. Since definitions of privacy in digital environments varied from one participant to another, users should have control over how health information is displayed on the mobile phone. One option is anonymity and another is to display messages in a code that others could not comprehend. For example, a reminder could display a one-word message like 'health' instead of explicit instructions to take a particular medication.

Additionally, participants believed that the mobile phone health services should be an option only and that health care systems need to offer multiple approaches for supporting patient care. They believed this will accommodate diverse health consumers who may be excluded from the technology due to lower skill sets or finances. Overall, this matter of choice could help protect the health consumer.

### **Keep it simple**

Participants had three suggestions for mobile phone health services that are simple to use. First, design health tools that focus on mobility. Powerful and intricate applications would be difficult to use on a small mobile phone, so respondents preferred using their personal computers for sophisticated services. Their mobile phones are then reserved for quick procedures and for reviewing small amounts of information. A second suggestion was for automatic features that minimize physical maneuverings with the mobile phone. For example, eliminate manual data entry to avoid the difficulties of typing on a small keyboard or navigating small menus. Finally, personalization could help manage large amounts of health information. Participants wanted resources that are relevant to their condition and needs. If too much detail were provided, participants believed this could be anxiety-inducing. To enhance the relevance of health information, they suggested that health services should adapt to patients in order to synchronize with their performance and their changing conditions. Overall,

these features could help reduce the effort of using mobile phones for complicated health issues

### **Develop an inclusive system**

Inclusiveness was an important issue. Participants believed that mobile phone health services should include many stakeholders – including patients, family members, friends, health care professionals, health insurers, and health organizations. Linking these parties together may increase the available health support for the patient. Inclusiveness also meant linking multiple computer devices together into a multiplatform service. This would overcome some limitations with the mobile phone's small scale. For instance, data entered on the phone could be stored on a remote server and then be made accessible on different machines. Mobile phones would be used for on-the-go data entry, and the patient could then turn to their computer for careful viewing, studying, and analysis of the information. Participants also believed that a multiplatform service was important for backups, data reuse, as well as printing of copies. In this manner, the mobile phone is part of a comprehensive suite of digital health tools, whose primary role is to provide mobile access to digital services. The idea of such an inclusive system was valued by participants.

## ***Summary***

Participants were interested in the development of mobile phone health services. They suggested services for resolving perceived deficiencies in health care. To improve self-care, they recommended applications that guide patients with their health activities. To reduce time and mobility barriers, participants wanted automated services and mobile access to health information.

Furthermore, respondents had recommendations for the development of the technology. Their suggestions include cultivating technology awareness, developing technology skills among patients and health professionals, promoting social interactions in health care, protecting privacy, providing choices, keeping services simple to use, and deploying multiplatform services that include many stakeholders. Overall, participants were interested in the sound development of the technology.

## **Chapter 12: Conclusions**

### ***Acceptance decisions are influenced by health context, personality, and perceptions of helpfulness***

All participants intended to adopt mobile phone health services. Many were interested in using the technology immediately (30 participants, 75%), while some intended to adopt later (10 participants, 25%). Due to concerns about privacy and medical error, some participants were only willing to use a selection of the available services (16 participants, 40%).

Participants came to their acceptance decision by considering three principal factors. The first is health context. If participants' health care systems were to offer mobile phone health services, many would adopt them upon their doctor's recommendation. Another contextual issue is health status. Having a health condition that required intensive management or extensive access to health professionals could encourage technology adoption. Furthermore, the costs associated with technology use are an issue. Additionally, the perceived privacy risks of digital health services are a significant consideration, and this depended on the trust participants had in their health care system to keep medical records confidential.

Secondly, the acceptance decision is shaped by the personality of the potential adopter. Emotional tolerance of health affairs and affinity for health innovations may influence consumers' receptiveness to the services and shape their technology perceptions.

The third acceptance decision factor is the perceived helpfulness of the technology. Participants hoped that mobile phone health services could reduce the effort for practicing healthy behaviors. They wanted the technology to be easy to use, but they were concerned about the small size of the mobile phone, which could be a barrier. To determine the technology's helpfulness, participants balanced positive perceptions against negative ones and considered usability and safety as well. However, there was a point where respondents were willing to overlook the negatives. If health status was poor and the need for assistive technology was great, participants believed that their views of danger, annoyances, and risks would diminish as they focus on the benefits of the technology. When the stakes are high, health consumers may tolerate greater risks associated with their care.

The mobile phone health service most preferred by participants was the management of health care services. This was followed by applications for interacting with health professionals and taking health actions. The least popular service was health information delivery because other technologies were preferred for this purpose, such as laptop computers. These findings correspond

to a 2007 public opinion survey that found a high level of interest for emergency intervention services delivered through mobile devices – 71.2% of the 1404 American respondents wanted the mobile phone to serve as a hotline to their doctor (Katz and Rice, 2009). However, the study found lower levels of interest for health information delivery and monitoring services. In this way, preventive health services are an overlooked application for mobile phones.

***Positive perceptions of the technology fostering healthy behaviors, quality of care, and efficiency of care; also a preference for mobile and digital health services***

Participants believed that mobile phone health services could improve the quality of health care. As a nearly ubiquitous computer and a portable communication technology, respondents saw the mobile phone as a convenient tool for contacting health professionals, monitoring health conditions, and reducing medical error through improved communication. By this perspective, participants identified the potential of mobile phones for “anywhere, anytime” access to health care (Boland 2007). Additionally, respondents believed that the technology could improve the efficiency of care. The mobile phone was perceived to offer faster communication with health professionals, savings in financial costs and time through remote consultations, and organizational efficiency for health administration. Furthermore, participants believed the technology could support healthy behaviors. They saw the potential for patient

empowerment through applications that motivate medical compliance and support health monitoring. Overall, many participants believed that health care organizations should take advantage of the benefits that digital and mobile health services offer.

***Negative perceptions of immense resources and skills required, stress, neglect of the social dimension, and risks to quality of care***

Participants had several negative perceptions of mobile phone health services. There was concern that immense resources and skills are needed to use the technology – such as sophisticated mobile phone equipment or advanced mobile phone skills. Other respondents were concerned that using the technology could be a stressful experience. There were a number of reasons for this apprehension, including emotional discomfort with health affairs and concerns that too many health reminders could lead to annoyances and distractions. Furthermore, participants worried that the social dimension of health care could be jeopardized if automated systems should diminish human interactions. This might then lead to dependence on the technology. Finally, there were concerns that mobile phone health services might introduce errors and privacy risks that would destabilize the health care system.

While there are strong concerns about the technology, no participant rejected its use outright. There was a belief that potential challenges could be overcome if consumers selectively and discretely use the services and monitor them for safety and privacy risks. To be cautious, participants suggested that mobile phone health services should complement existing medical practices rather than replace them.

### ***Perceptions of support for health and health information activities***

Participants believed that mobile phone health services could support healthy behaviors. It was assumed that the reminders, prompts, and communication options of the technology could foster health awareness, encourage monitoring, improve health communication, facilitate decision making, guide behavioral change, and promote compliance to medical regimens. Consequently, patients would be empowered for self-care.

For supporting health information behavior, participants saw potential in the asynchronous, mobile, and textual communication of mobile phones. They also identified the technology as a portable tool for health computing and access to information networks. As a result, participants believed that mobile phone health services will help them with finding, organizing, and using health information on the go.

For many respondents, the mobile phone was an appealing tool for health and health information activities. Because of an existing commitment to the technology, it would be simple to incorporate health services as another functionality of the mobile phone. There was excitement about the “anytime, anywhere” access to health services. However, some respondents doubted whether a single technology could radically change health behaviors – that at best, mobile phone health services are just one component to supporting the complexities of health care. Despite this skepticism, participants remained hopeful that the technology would be beneficial.

Mobile phone health services reflect a trend towards mobile computing in daily life. In a 2007 survey, 62% of adult Americans had experience with mobile access to digital data and tools (Horrigan, 2008). Additionally, 58% have used a mobile phone or personal digital assistant for non-voice data activities that includes text messaging, email, digital photography, video recording, and maps and directions. The study also found that 41% of adult Americans have accessed the Internet while away from work or home through wireless laptop connections or handheld devices. These numbers reflect positive attitudes towards mobile communication and information services (Horrigan, 2009). Furthermore, participants expressed an optimistic vision of what Varshney (2007) describes as “Pervasive Healthcare” – where mobile and ubiquitous computing offer “healthcare to anyone, anytime, and anywhere by removing locational, time, and other restraints while increasing both the coverage and the quality.” For

instance, respondents wanted portable and digital access to personalized health services. They also wanted health support through written, asynchronous, and real-time communication, which could overcome the barriers of face-to-face interactions. Overall, mobile phone health services may provide the access to medical care that consumers might expect and appreciate.

### ***Diverse motivations and pathways guide technology adoption***

Five participants had intensive experiences with mobile phone health services. Their motivations for using the technology were all different, and their pathways to adoption varied as well. Respondents were motivated by a sense of novelty, a family member's recommendation, trust in their doctor, a desire for alternative methods, or professional interest in the technology. They acquired the services from different sources – through their health care system or health insurance provider, through participation in a research study, and by downloading online applications. All of these participants were enthusiastic about the technology at the beginning of their trial. For some, this enthusiasm diminished slightly when their experiences did not meet expectations, but they generally remained excited by the potential of the technology.

Personalizing mobile phone health services may accommodate the different needs and preferences of health consumers. It is a matter of consumer choice. Patients prefer health services that are relevant to their personal characteristics

and want them administered by a method of their choice (Boland, 2007). In providing tailored options, health consumers' needs may be accommodated better.

### ***Interests for safe, responsive, and inclusive mobile health systems***

Many participants saw potential in mobile phone health services and were interested in the development of this technology. They had a number of proposals. For guidance with health activities, they wanted tools for self-care support. To reduce time barriers, participants wanted automated services. For portable access to health information, they wanted electronic health records accessible on mobile phones. Additionally, participants wanted technology development that would lead to safe, responsive, and inclusive mobile health systems. They believed this is possible by cultivating technology awareness, developing technology skills among health consumers and health professionals, promoting social interactions in health care, protecting privacy, providing choices, keeping services simple to use, and deploying multiplatform services that include many stakeholders. Overall, participants saw potential with the technology to help patients and health care systems, and consequently, they became invested in its development.

## ***Implications for theory***

The theoretical foundation of this study proposed a pathway underlying all technology adoption behaviors. Individuals' perceptions shape their intentions to use a technology – and this intention leads to adoption (Venkatesh et al., 2003). This theoretical pathway was built upon the Theory of Planned Behavior, the Technology Acceptance Model, diffusion of innovations theory, and the Unified Theory of Acceptance and Use of Technology. Many technology acceptance studies have taken this perspective. They aimed to identify the perceptions and characteristics that correlate to the adoption decision (Greenhalgh et al., 2005; Rogers, 2003; Venkatesh et al., 2003). However, this approach gives a generalized understanding of technology acceptance.

To guide intensive investigations, theoretical developments could address the underlying activities in the 'perceptions to intentions to technology adoption' pathway. For instance, there could be explanation of how potential adopters arrive at their perceptions and how these perceptions are evaluated. Regarding these issues, this study showed that health consumers are willing to overlook many of their concerns with mobile phone health services if their health conditions are sufficiently critical. In this way, participants believed that the potential benefits of the technology could justify some of its risks.

Additionally, theory could account for the different contexts, problems, and activities that individuals may face in their health care. According to participants, health behaviors may involve intensely emotional, personal, and idiosyncratic activities that are shaped by their values and personality. This complexity calls for intensive understanding. Furthermore, it is important to differentiate people's health behaviors from their professional and social practices. In these domains, technology adoption may vary significantly. For instance, there was a participant who – despite positive perceptions of mobile phone health services and is typically enthusiastic about new technologies – was apprehensive about adoption because of anxiety with health affairs. Additionally, there was a participant who was uneasy with online social networking services due to privacy concerns – but at the same time, she was enthusiastic to share health data with her physicians in online environments. Overall, technology acceptance theory could be developed by addressing the underlying activities in the 'perceptions to intentions to technology adoption' pathway and by focusing on the unique context of health care.

### ***Implications for research***

Health technology research could explore the role of mobility in health care more generally – extending beyond the mobile phone device. Participants were interested in anytime, anywhere access to health care services. Mobile phones are just one technology to provide the portable, asynchronous, and multimedia

tools that could be helpful. Therefore, future study might examine health consumers' experiences and behaviors with all sorts of information technology. This could identify new opportunities for infusing health services into daily life. As mobile health tools are developed, they could be merged into a unified system. This would allow patients and health professionals to collaborate together from different computing platforms and environments, so that these tools are truly mobile. Overall, research could explore mobile health care more broadly and examine how health services could fit into consumers' daily technology experiences.

Additionally, this study raises several themes for further investigation.

Researchers could:

- explore the influence of perceptions, personality traits, health status, and health environment in shaping the acceptance decision for health technologies;
- determine how consumers evaluate mobile health technologies according to the perceived impact on health behaviors, the quality and efficiency of care, health services access, social interactions in health care, emotional well-being, and required resources and skills – and how these perceptions are shaped by systemic, technological, emotional, social, and psychological forces;

- identify consumer needs for digital and mobile health services that support health and health information behaviors; and
- identify consumer preferences for the development of digital health systems that are safe, responsive, mobile, and inclusive.

Two observations deserve further attention. This study found that participants would overlook perceived risks with mobile phone health services if their health condition were sufficiently critical. Instead, they would focus on the technology's potential benefits. This raises a question: How do health consumers make the judgment to overlook perceived risks? Additionally, many participants believed that social interactions in health care are important to the quality of care. There should be exploration of how digital health services could support these interpersonal needs.

Future research may also address the limitations of this study. While the issues raised by participants are broadly applicable, the generalizability of the findings is restricted. Given the mix of respondents in this study, the analysis could not specify how the identified issues are distributed with respect to people's health problems, their experiences, or their limitations. To specify and validate the findings, more intensive studies could be conducted to target specific health consumer groups or particular adoption issues. Additionally, it is possible that acceptance decisions are influenced by consumers' health awareness, tolerance

for health conditions and risks, receptiveness to new technologies, and demographics – such as income, ethnicity, health literacy, education, health insurance coverage, or technology experience. These factors should be considered in future studies. Furthermore, many participants have not used mobile phone health services, so their perceptions – while grounded in their initial impressions – may be speculative and could evolve as they learn more about the technology. To resolve this problem, researchers may interview more participants with mobile phone health experience or provide trials with the technology. Finally, all participants intended to adopt the technology, and this may introduce a positive bias in the findings. Identifying health consumers who reject this technology would provide a contrary perspective for comparison. Hopefully, these suggestions for larger, more focused participant groups and examination of additional acceptance factors may yield richer, more generalizable findings.

### ***Implications for practice***

Mobile phone health services might intensify health consumers' participation in health care decision making. This could increase the demands on health professionals in a number of ways. First, many participants were interested in the services and wanted to learn more, so there is a need for informing consumers about the technology. Health professionals may respond by cultivating eHealth literacy. This is “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). Health educators could teach these skills for optimal health technology experiences – which include literacy, numeracy, and proficiencies in media, information, computers, science, and health care (Norman and Skinner, 2006). Since many participants were uncertain about privacy issues with mobile phones, it is also important to inform consumers about responsible behavior with health technologies. Secondly, as mobile phone health services may facilitate self-care and personal health management, patient-driven services could rise. For instance, consumers may contact health professionals more frequently and demand greater attention. Finally, while participants liked the option of mobile phone health services, they also wanted to retain face-to-face health interactions. They were not interested with the technology replacing traditional health care services – rather they wanted it to complement existing practices and for there to be a choice between technological and personal approaches. As the technology writer David Pogue (2009) observed about different modes of technology: “Everything just splinters. They will all thrive, serving their respective audiences.” Therefore, to meet the different expectations of health consumers, it would be helpful to provide personalized services and options. Overall, mobile phone health services have the potential to increase health consumers’ participation in health care and this could add to the responsibilities of health professionals.

## **Summary**

Delivering health services on mobile phones – a nearly ubiquitous computing technology – has the potential to improve health care access for many people. Through qualitative interviews, this study examined health consumers' perceptions and acceptance of mobile phone services for interacting with health professionals, taking health actions, delivering health information, and managing health care services. The forty participants were healthy individuals or patients with chronic health conditions – additionally, they had experience with health services delivered through information technology, or they did not.

Findings show interest in mobile phone health services. All participants intended to use the technology: thirty were ready to adopt immediately, while ten intended to adopt later upon the need or when particular conditions were met. Among all respondents, sixteen were interested in adopting a selection of the services only.

Diverse motivations and pathways may shape health consumers' adoption decision. However, the general process has potential adopters considering their health status and health environment, their personality, and the perceived helpfulness of the technology. Helpfulness is determined by reflection upon positive and negative perceptions and consideration of usability and safety. Participants had positive perceptions of the technology supporting health

behaviors and fostering quality and efficiency of care. Additionally, there were preferences for mobile and digital health services. The negative perceptions were concerns that the technology requires immense resources and skills, is stressful to use, neglects the social dimension of health care, and threatens the quality of care. Participants also believed that mobile phone health services could support health and health information behaviors.

There was interest in the sound development of the technology for safe, responsive, and inclusive systems. Implementation of mobile phone health services should respond to these consumer interests and preferences. Furthermore, the technology may intensify patient involvement in health care and increase the demand for patient-driven services. Therefore, future research could explore the needs for mobile health services among diverse consumers.

In summary, mobile phone health services are a promising technology that health consumers are interested in adopting.

## **Appendix 1: Interview protocol**

### **Background and experiences**

*Administer background questionnaire (Appendix 2).*

Have you ever studied or worked in the fields of library and information science, computer science, health sciences, or health care? If yes, please describe.

Please describe any experiences using mobile phones for health care services.

Do you have your mobile phone here? May I see it? *Observe mobile phone.*

What mobile phone services do you use? For example, text messaging, email, Internet access, or other services.

*For participants with chronic health conditions:* The next question is about your health, which can be a sensitive and private matter. If you do not feel comfortable responding, we can skip the question. Please remember your privacy is protected in this study. Your name and contact details will not be made available in publications or shared with other parties. Are you a patient with a chronic disease or health condition? Please describe.

What health services delivered through information technology or mobile phones have you used? Please describe how they worked and how you used them.

Think of a technology that you recently adopted. Please describe your adoption decision process.

### **Introduction to mobile phone health services**

*Show slide presentation (Appendix 3).*

*Provide handout (Appendix 4).*

### **Technology perceptions**

Describe your first impression of mobile phone health services?

*For participants with mobile phone health services experience:* Did you have a positive, negative, or neutral experience using the technology? Please describe and explain why you feel this way.

If any at all, what do you think are the positive aspects of mobile phone health services?

If any at all, what do you think are the negative aspects of mobile phone health services?

Do you know anyone who has used this technology? If yes, what do you know about their experiences?

Are there features of mobile phone health services that you feel neutral or ambivalent about, but you think other people may respond strongly to?

In your opinion, will the technology affect how you manage and use health information?

In your opinion, will the technology affect how you manage your health?

### **Technology acceptance**

Do you want to use/continue using mobile phone health services, now or sometime in the future? Please explain.

*For participants intending to adopt the technology:* Which mobile phone health services would you use? Why?

*For participants intending to adopt the technology:* Which mobile phone health services do you not want to use? Why?

*For participants with mobile phone health services experience:* Do you think the technology needs improvement? If yes, please explain how it may be improved?

Please think about your health experiences and habits. Can you think of a health service – not listed on your handout – that would make an ideal health application for mobile phones?

How did you come to your decision to accept/reject mobile phone health services?

Did the thoughts and feelings you reported earlier contribute to your decision to accept/reject the technology? Please explain.

Of the thoughts and feelings you reported about the technology, which had the strongest influence on your acceptance decision? How did they influence your decision?

*For participants with mobile phone health services experience:* Did your initial perceptions about the technology change after using it? Please describe.

### **Follow-up**

Do you have any further comments about your perceptions, thoughts, and feelings about the technology?

If later I have questions about your responses, may I contact you for a follow-up?

After I have written the final report, may I contact you to review the document?

Do you have any questions?

## Appendix 2: Questionnaire

Participant ID #: \_\_\_\_\_

### Mobile phone eHealth study – Background details

Please mark or write your response as indicated.

- What is your current age?

18 to 24  
 25 to 34  
 35 to 44  
 45 to 54  
 55 to 64  
 65 or older

- Do you own a cell phone?

Yes  
 No

- How many years have you been using a cell phone?

Approximate number of years = \_\_\_\_\_

- How often do you use your cell phone?

For example, making phone calls, text messaging, looking up the time, checking data stored on your cell phone, checking email, etc.

Very often (multiple times a day)  
 Often (1 or 2 times a day)  
 Regularly (several times a week)  
 Occasionally (several times a month)  
 Rarely (several times a year)  
 Never  
 Other. Please specify: \_\_\_\_\_

## **Appendix 3: Presentation transcript**

### *Slide 1*

Mobile phone eHealth.

### *Slide 2*

Mobile phone eHealth is a health technology. You use your cell phone to access health services and to promote your health.

### *Slide 3*

Mobile phone eHealth services are used for the following:

- Interacting with a health professional
- Helping you take health actions
- Getting medical information
- Managing your health care services

Let's explore these uses.

### *Slide 4*

Part 1, using cell phones to interact with a health professional.

### *Slide 5*

You can collect health measurements and send them to a health professional for analysis. Here is an example for asthma patients (Cleland et al., 2007). This peak flow meter measures how air flows from your lungs. The cell phone can transmit this data to your health care professional.

*Slide 6*

Afterwards, you can review your health measurements on your phone (Cleland et al., 2007).

*Slide 7*

Cell phones may also help physicians diagnose medical conditions more quickly. For example, in Scotland, a woman sent a picture of her swollen legs to her doctor through her cell phone (E-Health Insider, 2007). From the photo, the doctor saw that it was a serious condition and quickly sent for an ambulance.

*Slide 8*

Part 2, mobile phone eHealth can help you take health actions.

*Slide 9*

Some services encourage a healthier lifestyle. Here is an Internet-based service that lets you schedule exercise time (Hurling et al., 2007). You can then receive reminders of this schedule on your cell phone.

*Slide 10*

For managing your weight, you can use your cell phone to monitor your eating. Here is a cell phone program that lets you record what you eat and your exercise activities (Tsai et al., 2007). It can then calculate whether you are on target with your calorie consumption.

*Slide 11*

Mobile phone eHealth can help you stay on a schedule for your medication. Here a cell phone alerts the patient to take medication (Nugent et al., 2007).

*Slide 12*

In another service, text messages are sent to patients to remind them of follow-ups, such as scheduled doses for vaccinations (Vilella et al., 2007).

*Slide 13*

There are mobile phone eHealth programs for monitoring the state of your health. Here a patient can enter symptoms into a diary (Boland et al., 2007). Based on the data entered, a computer can instantly provide feedback in the form of an action plan for your health. For example, suggestions for altering your medical regimen, daily action plan, or medication schedule.

*Slide 14*

Part 3, you can use your cell phone to get medical information.

*Slide 15*

For example, you can learn more about your health from educational text messages delivered to your phone. In Norway, parents of type 1 diabetic children received text messages that provided information about diabetes – such as definitions, facts, and management tips (Wangberg et al., 2006).

*Slide 16*

With mobile phone eHealth, your cell phone may be used to monitor the health of a family member. In one example, blood glucose readings can be sent from a child's blood glucose monitor directly to the parent's cell phone (Gammon et al., 2005).

*Slide 17*

There are services that provide relevant information for your health condition. For example, here is a service for asthma patients.

Environmental conditions that may impact the patient's physical activity – such as pollen and pollution – are delivered directly to the cell phone (Cleland et al., 2007).

*Slide 18*

Part 4, mobile phone eHealth also lets you manage your health care services.

*Slide 19*

You can use text messaging to make an appointment with your doctor. Here is an example (Nokia 2005). You begin by sending a text message to the doctor's office requesting an appointment. You automatically receive appointment time options. You make your selection and respond by text message. The appointment is then made for you and you receive a confirmation.

*Slide 20*

Appointment reminders can be sent to your phone as well (Nokia 2005).

To confirm the appointment time, you respond with a text message.

*Slide 21*

After you have a medical test performed, the results can be sent to your cell phone. Delivered as a text message, you may get your results more quickly (Menon-Johansson et al., 2006).

*Slide 22*

Mobile phone eHealth may help you stay current with the latest health services. For example, your health care center may send you text messages that alert you of new programs.

*Slide 23*

To summarize, you can use mobile phone eHealth for the following:

- Interacting with a health professional
- Helping you take health actions
- Getting medical information
- Managing your health care services

*Slides 24 to 27*

(References)

## **Appendix 4: Participant handout**

### **Mobile phone eHealth is used in the following ways:**

#### Interacting with a health professional

- Collecting health measurements and sending them for monitoring
- Reviewing health measurements
- Helping physicians diagnose more quickly

#### Helping you take health actions

- Facilitating healthy behavior
- Staying on your medication schedule
- Reminders of medical procedures
- Monitoring your health and receiving recommended actions

#### Getting medical information

- Getting educational health materials
- Monitoring the health status of a family member
- Getting local information relevant to your medical condition

#### Managing your health care services

- Making an appointment
- Appointment reminders
- Getting medical test results
- Learning about new health services

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