ASSADI

ADOPTION OF INTEGRATED PERSONAL HEALTH RECORD SYSTEMS: A SELF-DETERMINATION THEORY PERSPECTIVE

Ph.D.

ADOPTION OF PERSONAL HEALTH RECORD SYSTEMS: A SELF-DETERMINATION THEORY PERSPECTIVE

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TITLE: Adoption of Integrated Personal Health Record Systems: A Self-Determination Theory Perspective

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ABSTRACT

In spite of numerous benefits that are suggested for consumers' utilizing integrated personal health record (PHR) systems, research has shown that these systems are not yet popular or well known to consumers. Therefore, research is needed to understand what would rise adoption rates for these systems. Hence, the main objective of this dissertation is to develop and empirically validate a theoretical model for explaining consumers' intention to use integrated PHR systems.

In developing the theoretical model of this dissertation, theories of information systems adoption were integrated with Self-Determination Theory (SDT), which is a well established theory from the Psychology literature that explains the mechanism through which individuals become more self-determined, i.e., motivated to take more active (rather than passive) roles in undertaking different behaviours. Taking such an active role by consumers, in the context of personal health management, is suggested to be necessary for realizing the full benefits of integrated PHR systems.

The proposed theoretical model was validated using the PLS approach to structural equation modeling, on data collected from a cross-sectional survey involving 159 participants with no prior experience in using PHR systems. A stratified random sampling was employed to draw a representative sample of the Canadian population. The results show that consumers with higher levels of self-determination in managing their health are more likely to adopt integrated PHR systems since they have more positive perceptions regarding the use of such systems. Further, such self-determination is fueled by autonomy support from consumers' physicians as well as consumers' personality trait of autonomy orientation.

This study advances the theoretical understanding of integrated PHR system adoption, and it contributes to practice by providing insightful implications for designing, promotion, and facilitating the use of integrated PHR systems among consumers.

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بسمه تعالی

تقدیم به پدر و مادر مهربانم

تقدیم به خواهران و برادرانم و همسران و فرزندانشان

This dissertation is dedicated to my beloved family.
The warmth of their love blessed me from across the Atlantic.

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LIST OF ABBREVIATIONS

A

ACO	…….	Autonomy Causality Orientation
ANOVA	…….	Analysis of Variance
AVE	…….	Average Variance Extracted

B

BI	…….	Behavioural Intention
BNS	…….	Basic Needs Satisfaction
BPNT	…….	Basic Psychological Needs Theory

C

CET	…….	Cognitive Evaluation Theory
CMB	…….	Common Method Bias
COT	…….	Causality Orientations Theory
CPLX	…….	Complexity
CR	…….	Composite Reliability
C-TAM-TPB	…….	Combined Theory of Planed Behaviour and

D

DV	…….	Dependent Variable

E

EHR	…….	Electronic Health Records
EMR	…….	Electronic Medical Records

G

GCT	…….	Goal Contents Theory
GoF	…….	Goodness of Fit

H

HTML	…….	Hypertext Markup Language

I

IDT	…….	Innovation Diffusion Theory
IS	…….	Information Systems
IT	…….	Information technology
IV	…….	Independent variable

M

MM	…….	Motivational Model
MPCU	…….	Model of Personal Computer Utilization

O

OIT	…….	Organismic Integration Theory

LIST OF ABBREVIATIONS

	P	
PAS	…….	Physician Autonomy Support
PCA	…….	Principal Components Analysis
PHR	…….	Personal Health Records
PLS	…….	Partial Least Squares
PU	…….	Perceived Usefulness
	R	
RQ	…….	Research Question
	S	
SARS	…….	Severe Acute Respiratory Syndrome
SCT	…….	Social Cognitive Theory
SDT	…….	Self-Determination Theory
SE	…….	Self-Efficacy
SEM	…….	Structural Equation Modeling
	T	
TAM	…….	Technology Acceptance Model
TPB	…….	Theory of Planed Behaviour
TRA	…….	Theory of Reasoned Action
	U	
UTAUT	…….	Unified Theory of Acceptance and Use of Technology

CHAPTER 1: Introduction

This dissertation addresses the issue of consumer adoption of integrated personal health record (PHR) systems. In this chapter, integrated PHR systems are defined, motivation for conducting this study is presented, overall objectives of the study are outlined, importance of the topic is discussed, and the outline of the dissertation is presented.

1.1 PHR Systems

For generations, individuals and families (consumers) have collected and stored their health information in order to present it to health care professionals at the point of care. Health information such as clinical notes, laboratory results, and immunization records have been collected and compiled by consumers and their care providers in a paper-based format. With advancements in computing technology, some consumers started storing health records in an electronic format such as word processor documents, and spreadsheets (Detmer et al. 2008). Electronic records can come from various sources including health care providers who have also begun storing records electronically (Tang et al. 2006). As a result, consumers have the opportunity to collect health data systematically in order to have a more comprehensive view of their health in the form of electronic *Personal Health Records (PHRs)*.

PHRs are created, owned, updated, and controlled by an individual consumer and/or others authorized by him/her. They contain a summary of the consumer's lifelong health information such as a history of previously undertaken health procedures, major illnesses, allergies, home monitoring data (e.g. blood pressure), family history, immunizations, medications, laboratory test results, etc. (Thomas 2006). Further advancements in information and communication technologies have made it possible to provide tools and functionalities to leverage such access to health records for the purpose of better managing one's health (Detmer et al. 2008; Tang et al. 2006). Examples of functionalities include allowing the consumer to request appointments, to request prescription renewals, to communicate electronically with clinicians (Tang et al. 2006), and to share records with clinicians (Teevan et al. 2006).

A *PHR system* refers to an information system that is composed of both data and supporting tools and functionalities. This dissertation utilizes the most cited definition of PHR systems (Kaelber et al. 2008; Tang et al. 2006) that is put forth by the Markle Foundation as (Markle 2003):

> *"An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment."*

In terms of connectivity to their surroundings, PHR systems encompass three main types (Detmer et al. 2008; Endsley et al. 2006; Raisinghani and Young 2008; Tang et al. 2006): stand-alone, tethered, and integrated.

In a *stand-alone* PHR system, data are stored on some form of portable media, possibly supported by some software to view or organize the data. Stand-alone PHR systems are considered to be primarily consumer driven and missing direct health care provider input, and as such there are concerns over timeliness, reliability and security of data stored in them (Wright and Sittig 2007a).

In a *tethered* system, PHR specific functionalities are provided to the consumer through the health care provider's information system. In this approach, the consumer can request to add supplementary information to her/his record, in addition to having read-only access to the entire record. Although a tethered PHR system is connected to a health care organization's system, and it has the advantage of direct provider input, it will be limited to those data sources associated with the hosting organization (Tang et al. 2006). In other words, the consumer would have less control over his/her information, compared to the first approach.

Finally, an *integrated* PHR system gathers and presents data from multiple sources (e.g., consumer, care provider, health care organizations, etc.) into a single view, generally through secure internet access (Ueckert et al. 2003). Integrated PHR systems have the potential to overcome the abovementioned limitations of stand-alone and tethered systems while providing the consumer with full control over their health information stored in the system. Integrated PHR systems are complex, but this complexity yields usability and flexibility (Tang et al. 2006), and it would facilitate transformative advancements in health care delivery and management (Detmer et al. 2008), as described in Chapter 2 of this dissertation. In view of that, the focus of this dissertation is on this third type of PHR systems (integrated PHR systems).

It should be noted that PHR systems are not the only type of IS that are used to maintain health records. Electronic Health Record (EHR) systems and Electronic Medical Record (EMR) systems are two other types of electronic health record systems that are different from PHR systems in their purposes and end users, but are sometimes confused with PHR systems (Raisinghani and Young 2008; Tang et al. 2006). For disambiguation purposes, the followings are brief descriptions of EHR and EMR systems. In addition, Figure 1.1 illustrates PHR, EHR, and EMR systems and the possible inter-connections among them.

EHR systems refer to software platforms *used by health care providers* to create, store, update, and maintain longitudinal electronic health records for patients (Angst and Agarwal 2009). The Healthcare Information and Management Society defines EHRs as "a secure, real-time, point-of-care, patient-centric information resource for clinicians" (Thomas 2006). With clinicians being the end users, EHRs can also support the collection of data for purposes other than clinical care. For example, they can be used for billing, quality management and outcomes reporting. PHR systems are different from EHR systems in that the locus of control of health information is the consumer, not the health care provider (Zuckerman and Kim 2009).

EMR systems refer to medical record systems controlled by health care providers. An EMR is an electronic version of a legal health record. It can be considered to be a subset of EHR data and functionality (Thomas 2006). As a part of its definition, the American Health Information Management Association describes an EMR as the *electronic documentation of the health care services* provided to an individual by a health care provider entity. EMRs typically contain medical records, legal records, patient admission information, assessment data, etc (Raisinghani and Young 2008).

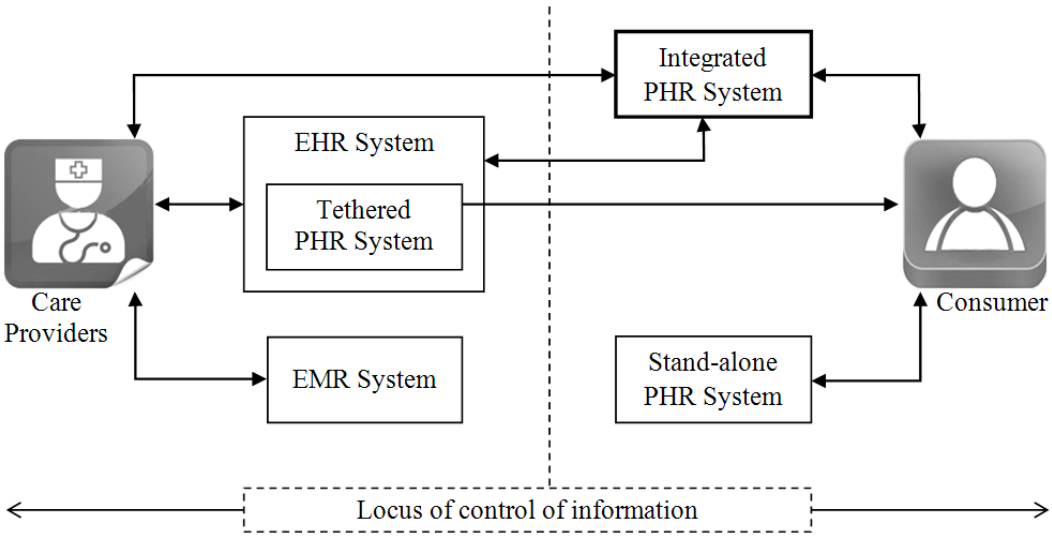

Figure 1.1: Types of health record systems, their possible interconnections, and their loci of control of health information

The arrows denote possible interconnections and direction of information

1.1.1 A Prefatory Note on Terminology

It is important to make the following two clarifications in the use of terms in this dissertation. Such clarification is expected to help delineate the domain of this study.

First, as mentioned in the previous subsection, the focus of this dissertation is on integrated PHR systems since this specific type of PHR systems is believed to have the potential to facilitate a transformative change in health care delivery and management. However, several characteristics are shared between various types of PHR systems (i.e., stand-alone, tethered, integrated) and are not specific to the integrated type. Consequently, throughout this dissertation, the term "PHR system" (i.e., the general term) is used where the subject of discussion applies to all the three types, and the term "integrated PHR system" is used where the subject is specific to the integrated type of PHR systems.

Second, throughout this dissertation the potential users of PHR systems (i.e., owners of its content) are referred to with the terms "consumer", "individual", and "patient", interchangeably, depending on the context of discussion. It should be noted that users of PHR systems are not necessarily dealing with immediate medical concerns and can be ill or healthy. In this dissertation, wherever the use of PHR systems is being discussed for managing a certain disease with which the user is diagnosed, the term "patient" is used. On the other hand, the terms "individual" and "consumer" are used in discussions that are general and not specific to managing a certain disease.

1.2 Research Motivation

Two important trends can be observed in the Canadian health care system (Urowitz et al. 2008): (i) the advent of e-Health giving rise to a more important role for information technologies in health care (Eysenbach 2001; Finn 2011; Parker and Thorson 2008; Tan 2005), and (ii) a shift towards consumer-based health care where patients are considered as partners in their own care process (Eysenbach and Diepgen 2001; Hesse 2008; Runy 2000). For example, today's educated and computer literate baby boomers, who make up almost one in every three Canadians (Folker 2007), are facing health-related conditions as they age and are increasingly seeking health-related information from various sources including the Internet (Bliemel and Hassanein 2007; Hesse 2008; Laugesen et al. 2011). Providing access to personal health information through innovative technologies could potentially reduce the cost and complexity of health care delivery through efficient use of resources in the health care system (Finn 2011; Helmer et al. 2011; Kaelber et al. 2008; Raghupathi and Tan 2002; Ralston et al.

2007; Tang et al. 2006; Wolf 2012). One such innovative technology is the use of PHR systems (Detmer et al. 2008; Zuckerman and Kim 2009).

Numerous benefits have been suggested for consumers utilizing PHR systems, in general, and integrated PHR systems, in particular. For example, consumers can access a wide range of reliable and credible health information leveraging this access to increase their understanding of their health condition and be more active participants in their own care (Archer et al. 2011; Ball et al. 2007; Cimino et al. 2002; Helmer et al. 2011; Raisinghani and Young 2008). PHR systems put consumers in control of their own health information by allowing them to update their records either manually or by automated polling of information from visited care facilities (e.g., hospitals) (Tang et al. 2006; Wolf 2012). By leveraging the control and access provided by PHR systems, consumers could become empowered to better manage their health (Grant et al. 2006; Helmer et al. 2011; Raisinghani and Young 2008; Tang et al. 2006). One example is that consumers could detect disease, in collaboration with their physicians, in its early stages by observing trends in their health status (e.g., changes in blood pressure). They could also consult with their physicians on any unusual condition noted by the system in their health records. (e.g., a conflict between newly prescribed medications and previously or currently used ones) (Baird et al. 2011; Detmer et al. 2008; Horan et al. 2009; Ngo-Metzger et al. 2010; Tang et al. 2006).

PHR systems are also suggested to be beneficial for patients with chronic diseases (Beckjord et al. 2012; Finn 2011; Heubusch 2007a; Tenforde et al. 2011; Wagner et al. 2012). Chronic diseases are often characterized by long latency requiring patients to be continuously aware of their condition in an ongoing collaboration with their caregivers (Heubusch 2007b). PHR systems can facilitate patient-physician communications in an efficient manner through changing such communications from episodic encounters to continuous interaction (Tang et al. 2006). Furthermore, self-management activities and active patient participation in the care process are shown to be major components of a successful chronic disease management program (Lankton and St. Louis 2005; Lauscher et al. 2012). A PHR system could potentially facilitate such a high level of patient engagement (Parker and Thorson 2008; Tang et al. 2006).

Various types of PHR systems (i.e., stand-alone, tethered, and integrated) have been directly available to consumers for more than a decade now ; available systems encompass various ranges of functionalities; they are well-suited to consumers' needs, and in many cases they are available to consumers at no cost (Cronin 2006; Jones et al. 2010; Sittig 2002). However, research has shown that such systems are not yet widely adopted or well known to consumers (Cronin 2006; Lafky and Horan 2011; Li et al. 2012a; Logue and Effken 2012; Pirtle and Chandra 2011; Raisinghani and Young 2008; Sittig 2002; Zulman et al. 2011). Bearing in mind all the aforementioned potential benefits and the consumers'

potential interest in PHR systems (Jones et al. 2010), research is needed to understand the reasons behind the lack of PHR systems popularity and adoption.

Existing studies have primarily concentrated on clarifying the characteristics and functionalities of PHR systems (e.g., Abrahamsen (2007)), PHR systems vision statements and research agenda (e.g., Kaelber et al. (2008)), and the value of PHR systems (e.g., Simpson and Fairbrother (2009)). Studies performed on the adoption of PHR systems are for the most part not deductive in nature (e.g., Winkelman et al. (2005)), and they are not grounded in theory (e.g., Ancker et al. (2011)). Hence there is a need for further research in this area. A detailed overview of existing PHR studies is presented in Chapter 3 of this dissertation. Existing studies have put forth numerous factors that bring about the lack of PHR system popularity and adoption including perceived usefulness of the PHR system (Wright and Reynolds 2006), the health status of users (Lafky and Horan 2008), among others. Of particular interest, Tang et al. (2006) suggest that behavioural and environmental factors may impact PHR system adoption. They suggest that a PHR system, particularly an integrated one, can be useful for the individual owner only if he/she understands and accepts a more active role as well as new responsibilities related to his/her own health care (Tang et al. 2006). However, the influence of such a role change on adoption of integrated PHR systems was not examined. This dissertation considers such a role change and its influence on the adoption of integrated PHR systems.

1.3 Research Objectives

This dissertation aims to contribute to the Information Systems (IS) literature by providing insights on the factors which would influence an individual's intention to use an integrated PHR system. The process of IS adoption by consumers consists of a series of stages that occur over time (from a pre-usage stage to a post-usage stage) (Karahanna et al. 1999; Montazemi and Qahri Saremi 2013). The focus of this study is on the pre-usage stage of the adoption process.

This study aims to develop a theoretical model of integrated PHR system adoption, and to subject this model to empirical testing. In order to develop the theoretical model, mainstream IS adoption models are integrated with Self-Determination Theory (SDT), which is a theory of motivation from the Psychology literature. The justification for augmenting IS adoption models with SDT, a theory of motivation, is twofold. First, motivational issues have been identified as major inhibitors to the adoption of integrated PHR systems by consumers (Tang et al. 2006). Second, for integrated PHR systems to be useful requires consumers' understanding and acceptance of a change in their roles in health management, from passive to active (Tang et al. 2006). SDT sheds light on

mechanisms through which individuals become motivated to take active (rather than passive) roles in doing different types of behaviours including individual health care (Ryan and Deci 2000). The theoretical development of this study is presented in detail later in this dissertation.

To sum up, this research pursues the following objectives:

(i) to develop and to empirically validate a model that integrates mainstream information systems adoption theories with self-determination theory, for explaining an individual's intention to use an integrated personal health record system;

(ii) to investigate the impact of individual characteristics (e.g., age, gender, Internet experience and education level) on an individual's intention to use an integrated personal health record system.

To reach these objectives, the study suggests a hypothetico-deductive research approach that gathers data from the general Canadian public via a web-based questionnaire on factors that are proposed to influence an individual's intention to use an integrated PHR system. The undertaken research methodology of this study is described later in this dissertation.

1.4 Importance of the Topic

As mentioned earlier in this chapter, PHR systems, particularly integrated ones, have the potential for helping consumers to become more involved in their own care, thus improving their health management as well as reducing the burden on the health care system. Nonetheless, as for any other type of information system, it is essential to improve the adoption rates of such systems if they are to have an impact on individual health care and management (Delone and McLean 2003).

From an academic perspective, results of this research will contribute to the IS literature by developing an adoption model specific to integrated PHR systems. While there is a plethora of research discussing adoption models for IS in general, there is need to further study adoption while recognizing the nuance of the specific IS in question and the associated context (Benbasat and Zmud 2003). In addition, mainstream IS adoption models mainly focus on IS use as a way of improving efficiency and effectiveness in existing organizational and individual processes. Integrated PHR system use, however, could result in more than improved efficiency and effectiveness. To gain more potential benefits from adopting a PHR, it requires a change in an individual's role in the care process from a passive to a more active participant. Making such change is in part determined by the individual's motivation. Therefore, there is a need to augment the IS adoption models with a proper theory of motivation. This research attempts

to address this gap by developing and validating a model that integrates mainstream IS adoption models with Self-Determination Theory to explain an individual's behavioural intention to use an integrated PHR system.

Although this research is being carried out in a Canadian context, it is, nevertheless, relevant for other developed countries that have similar demographic and health care system characteristics. It is hoped that this research will attract the attention of researchers to develop and test constructs and models applicable to consumer adoption and use of health information systems with a special focus on the shift toward consumer-based health care.

In terms of contributions to practice, results of this research will help health care providers gain a better understanding of consumer preferences in using PHR systems, in general, and integrated PHR systems, in particular. In addition, they will have a better understanding of how to support consumers to become more active in the care process. Furthermore, health care providers will also benefit from the results of this research by being able to deliver a higher quality level of care at a lower cost and complexity by involving patients in their own care through integrated PHR systems.

Findings of this research will help the governing bodies of the health care system in the development and promotion of integrated PHR systems. Results from this research can help direct attention to the most influencing adoption factors while proposing solutions that mitigate consumer concerns. Technology providers will benefit by informing the design of their proposed systems based on these results. This, in turn, will lead to higher rates of adoption and success of integrated PHR systems. Given the growing importance of consumer-centered health care, this study is both timely and relevant.

1.5 Outline of Dissertation

This dissertation is organized into six chapters. Chapter 1 defines PHR systems, introduces the problem under investigation, presents the research objectives, and highlights the significance of the study for both theory and practice.

Chapter 2 offers an examination of the literature pertaining to the potential of PHR systems to support a shift toward consumer-based health care. As such, it provides an overview of integrated PHR system data and functionalities, an overview of the benefits of using integrated PHR systems, and highlights the changing role of consumers in the new health care landscape.

Chapter 3 presents the theoretical development of the study. As such, it offers an overview of existing studies on PHR systems. Then, it presents the theoretical underpinnings of this study, based on both IS and Psychology

literatures. Finally, it presents the proposed theoretical model and uses the model to structure a set of research hypotheses.

Chapter 4 outlines the research methodology utilized in this study to test the hypotheses and to address the objectives of the study. The chapter presents the data collection method and instrument, followed by describing the data analysis techniques utilized to test the hypotheses of the study.

Chapter 5 contains results of data analyses of the study. First, the administration of the research instrument is discussed, followed by treatments made on the data prior to analysis. Then, demographics of participants are presented and discussed. Further analysis of the proposed research model is presented followed by the analysis of the role of individual variables and control variables. Finally, the chapter concludes with an examination of two open-ended questions which were utilized in this study.

Chapter 6 provides a discussion of the results and a conclusion to the dissertation. It provides answers to the research questions, presents the contributions of this dissertation to theory and practice, discusses the study strengths and limitations, and suggests future research directions. Finally, the chapter ends with concluding notes.

CHAPTER 2: Integrated PHR Systems and the Changing Role of Consumers in Health Management

The purpose of this chapter is to provide an examination of the literature pertaining to the potential of PHR systems to support a shift toward consumer-based health care. It is believed that a review of such work will help clarify the scope of this research. In addition, such a review will help in understanding the changing role of consumers in a new health care landscape. To fulfill this purpose, the chapter is organized as follows.

Section 2.1 uses existing publications to offer a description of integrated PHR systems with an emphasis on projected benefits of such systems in the shift toward consumer-based health care. As such, this section provides an overview of integrated PHR system data content and functionalities. Furthermore, this section highlights the projected benefits of successful implementation and use of integrated PHR systems.

Section 2.2 examines the literature in order to clarify the changing role of consumers in a new health care landscape. As such, this section highlights the importance of the changing role of consumers, and it introduces facilitators of these changing roles.

2.1 Transformative Potential of Integrated PHR Systems

Integrated PHR systems have the potential to transform health care delivery and management (Detmer et al. 2008; Tang et al. 2006). Such systems provide access to a consumer's lifelong health information, in addition to providing tools to leverage this access to support better management of health (Detmer et al. 2008; Tang et al. 2006). It is expected that the successful implementation and use of integrated PHR systems would result in transformative advancements in health care delivery and management. Projected transformative advancements include improved interactions between patients and care providers, increased opportunities to realize innovation in care management, a shift in locus of control of health information to a more "shared control" between patients and care provides, and improved efficiency in care (Detmer et al. 2008; Raisinghani and Young 2008; Tang et al. 2006).

As illustrated in Figure 2.1, the projected *advancements* would be enabled by the general *attributes* of integrated PHR systems. The attributes include providing access to health information, facile communication, access to health

knowledge, portability, and auto-population of records (Detmer et al. 2008). These attributes, in turn, are supported by integrated PHR system *functionalities* which allow leveraging of integrated PHR system *data content*.

This section of the dissertation provides a detailed explanation of the transformative potential of integrated PHR systems as illustrated in Figure 2.1. As such, sub-section 2.1.1 offers a summary of typical integrated PHR system data content and technical functionalities. Sub-section 2.1.2 explains the transformative potential of integrated PHR systems based on an examination of related literature. The transformative potential is explained in terms of projected advancements in health care supported by the general attributes of integrated PHR systems.

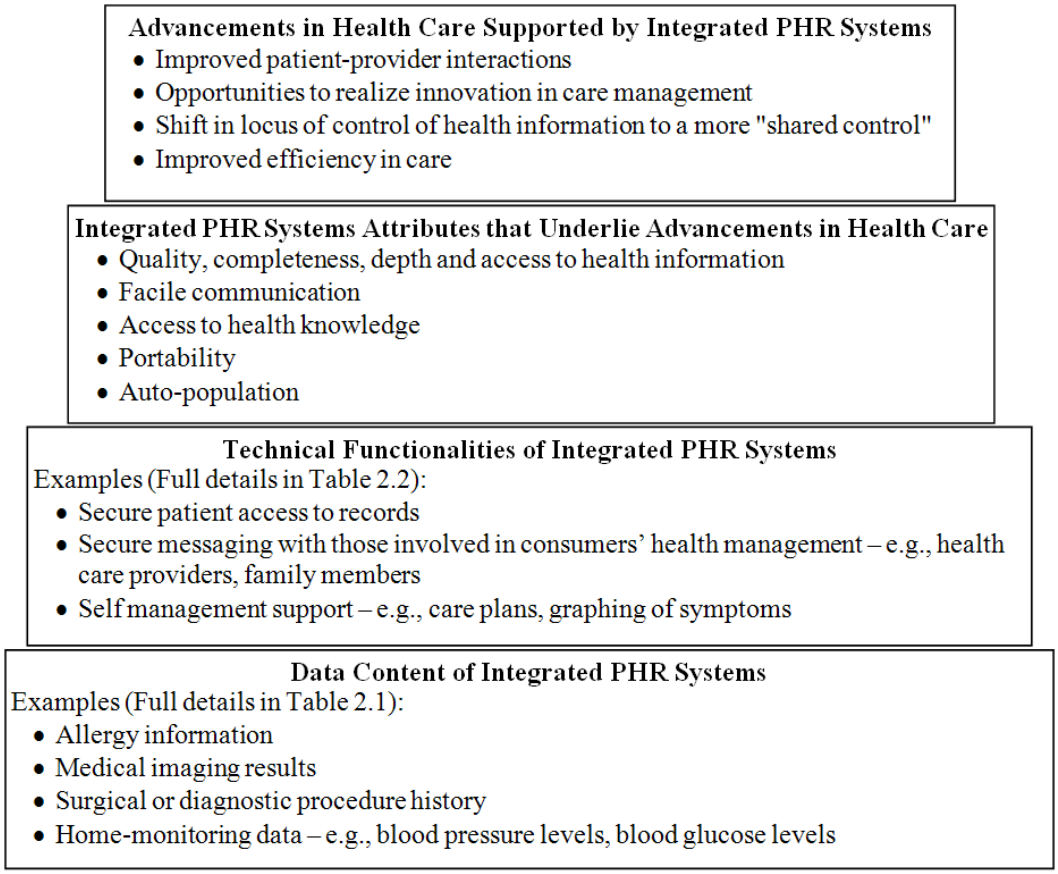

Figure 2.1: Transformative potential of integrated PHR systems

2.1.1 Integrated PHR Systems: Overview of data content and technical functionalities

2.1.1.1 Data Content of Integrated PHR Systems

Although there is no consensus over the exact data elements to be included in a PHR, it should contain as much data as possible from the consumers' lifelong health management history (Tang et al. 2006). The Markle foundation (Markle 2003) has suggested a minimum data set, and several other papers have provided their suggestions as well. Table 2.1 summarizes those suggestions categorized by data types.

Table 2.1: Typical PHR data elements

Category	Suggested Data Elements*
Personal Information of Consumer	• Name • Date of birth • Gender • Blood type
Contact Information	• Consumer contact information • Emergency contact information • Health care proxy information (e.g., family members, informal caregivers) • Care provider contact information, potentially linked to problems
Health Conditions	• Problem list • Major illnesses • Allergy information
Medications	• Medication dose, form, frequency, sig code (abbreviation used in medical prescriptions), route (path by which medication is taken into the body), status (e.g., "Do not substitute", active, on hold, etc.), clinical code • Date of prescription • Prescribing provider

Category	Suggested Data Elements*

Tests	• Laboratory procedure
	  ○ Procedure date
	  ○ Ordering provider
	  ○ Facility/location performed
	  ○ Normal range
	  ○ Results status
	  ○ Clinical code for lab test
	• Medical imaging results
	• Video as suggested for behaviour observation

Surgical or Diagnostic Procedure	• Procedure date • Procedure provider • Clinical code for procedure
Immunizations	• Immunization history
Provider Visit Information	• Treatment reports and observations • Prescriptions • Visit dates • Future appointments
General Information	• Home-monitoring data (e.g., blood pressure, blood glucose) • Family history • Social history and lifestyle
Miscellaneous	• Next of kin information • Organ donor information • Visited health care facilities information • Health insurance information

**References: Tang et al. (2006), Zuckerman and Kim (2009), Markle (2003), Oberleitner et al. (2007), and Oh et al. (2006).*

2.1.1.2 Technical Functionalities of Integrated PHR Systems

In addition to providing access to appropriate health data, integrated PHR systems must provide functionalities so that consumers can understand their health information and act on it (Tang et al. 2006). Similar to typical PHR data elements, there is no consensus over what exactly should constitute integrated PHR system functionalities. Nevertheless, several papers have suggested

functionalities to be considered in developing such systems. Table **2.2** summarizes the suggested typical integrated PHR system functionalities, categorized by attributes they enable in integrated PHR systems. The enabling attributes are presented in **Figure 2.1**.

Table 2.2: Typical integrated PHR system functionalities

Attribute	Functionality*
Quality, completeness, depth and access to health information	• Access, view, collect, organize, annotate, edit, and correct health records by consumers and/or those authorized ○ These include medical history, medical and emergency contacts, outpatient and hospital visits, immunization tracking, insurance records, and health-related alerts and reminders, etc. • Accurate entry of past and current medical conditions, including information regarding diagnosis and treatment • Accurate entry of past and current medications, including information about indication, dose, frequency, and duration • Secure access to records for the consumer • Verification of consumer entered information • Lab result viewing by consumer and care provider • Care provider visit summary note viewing • Radiology results viewing • Symptom diaries • Drug interaction checking (when a complete medication profile is available) • Medical documents management
Facile communication	• Secure messaging with those involved in consumers' health management – e.g., health care providers, family members • Sharing of PHR data content

Attribute	Functionality*
Access to Health Knowledge	• Care provider selection support • Self-management support—e.g., care plans, graphing of symptoms, passive biofeedback, tailored instructive or motivational feedback, decision aids, and/or reminders or notifications for consult/referral, immunization, laboratory tests, medications, radiology, preventive care, wellness • Wellness management • Capture of symptom or health behaviour data • Health education information • Diagnosis education support • Treatment education support • Medication support • Shared patient experiences support • Lifestyle choices support • Summary of health information for secondary use • Summary of important health events • Links to external health care information • Adding information of primary interest to consumers/patients rather than providers, such as patient-relevant decision support • Interactive health risk profiling and consumer/patient education resources
Portability	• Prescription refills • Appointment scheduling • Device integration and data collection • Home monitoring with recording • Tele-reporting of data to the record
Auto population	• Access to care provider's electronic medical records (summary or detailed)—e.g., history, drugs, test results
Miscellaneous	• Account access control • Possibility for emergency access • Authorized provider access • Document printing • Searching

**References: Johnston et al. (2007), Detmer et al. (2008), Kim and Johnson (2002), Sunyaev et al. (2010), Pagliari et al. (2007), and Zuckerman and Kim (2009).*

2.1.2 Transformative Potential of Integrated PHR Systems

Information technology (IT) can potentially transform health care delivery and management (Raisinghani and Young 2008). Integrated PHR systems are positioned to be tools to support the transformative effect of IT in health care (Detmer et al. 2008; Zuckerman and Kim 2009). As illustrated in Figure 2.1, data content and functionalities of integrated PHR systems enable certain attributes that underlie the transformative potential of such systems. Potential results of the transformation would be major advancements in delivery and management of care. The following sub-section provides an overview of the integrated PHR system attributes as well as advancements in health care delivery and management that are suggested to be the result of successful implementation and use of integrated PHR systems.

2.1.2.1 PHR Attributes That Underlie Advancements in Health Care

Enabled by data content and technical functionalities, integrated PHR systems encompass certain attributes that underlie the transformative advances in health care delivery and management (Detmer et al. 2008). Major attributes include quality, completeness, depth and access to health information, facile communication, access to health knowledge, portability, and auto-population (Detmer et al. 2008). Followings are brief descriptions of these attributes.

Integrated PHR systems contain data that are contributed by the consumer. Such data are closer to the consumer's experiences than what would be collected and stored by care providers only. This is because care providers are only able to collect data at the point of care, but through the use of integrated PHR systems, data collection would have virtually no limit in terms of time and location (e.g., home monitoring data). Such data contributed by the consumer provide a more comprehensive view of his/her situation for health care providers (Detmer et al. 2008). In addition, given the consumer-entered data evaluation functionalities of an integrated PHR system, such data would be more accurate and of better quality (Detmer et al. 2008).

Integrated PHR systems allow facile communication between various people involved in a consumer's health management (e.g., care providers). Synchronous and/or asynchronous communications enable interactive decision making (Detmer et al. 2008).

Integrated PHR systems can be potentially integrated with health knowledge bases, self-care content and best practices for both clinical and self-care purposes, thus enabling access to health knowledge (Detmer et al. 2008).

Integrated PHR systems have the potential to provide virtually anytime, anywhere access through a single interface made possible by the portability of electronic health records (Detmer et al. 2008).

Finally, the effort of entering health information by consumers in a non-integrated PHR system might be considered a barrier to adoption of such systems. However, integrated PHR systems have the potential of enabling consumers to auto-populate their accounts from visited health care facilities as well as health measurement devices, thus reducing the burden of data entry on the consumer as well as improving accuracy, completeness, non-redundancy and timeliness of the records (Bieliková and Moravcik 2008). Such auto-population attribute is considered key for long-term viability of integrated PHR systems (Bauer 2006).

2.1.2.2 Advancements in Health Care Supported by Integrated PHR Systems

Integrated PHR systems have the potential to provide a number of benefits in the form of transformative advances in health care delivery and management (Detmer et al. 2008). At the core of these advancements are improved interactions between patients and medical professionals, opportunities to realize innovation in care management, a shift in the locus of control of health information to a more "shared-control" among patients and health care professionals, and opportunities to enhance efficiency of care (Detmer et al. 2008). Below is a description of the four categories of advancements along with a few example PHR benefits under each category.

Integrated PHR systems would, potentially, **improve interactions between patients and care providers** through the availability of patient information at the point of care. For example, practitioners would be enabled to spend less time gathering information about the patient, and they would have more time to focus on questions and concerns regarding patient conditions (Hassol et al. 2004; Kim et al. 2004; Luo 2006; Wang et al. 2004). In addition, diagnosis would be easier by having access to a full history of the patient at the point of care (Iakovidis 1998b). As another example, asynchronous electronic communication between patients and providers would enable both sides to respond to each other at their convenience, thus enhancing accessibility to each other. As a result, limitations of telephone and face-to-face interactions would be overcome, and the cost and time of interactions would be reduced (Kaelber et al. 2008; Tang et al. 2006). It is worth mentioning that such electronic communication would be automatically recorded for future references (Detmer et al. 2008). Further, patients, especially those afflicted with chronic diseases, could benefit from ongoing connection with their care providers. Such "continuous" rather than "episodic" connection would result in reducing the time that is needed to tackle health problems as they arise (Tang et al. 2006). Finally, providers'

sharing of health records through the integrated model of PHR systems enhances delivery of care at the point of care through completeness of information and by reducing medial errors such as adverse drug interactions (Bates et al. 1998; Bates et al. 1999; Ozdemir et al. 2011).

Opportunities to realize innovations in care result from electronic connectivity among clinical care managers and patients and/or their caregivers. Such connectivity could potentially provide access to more data on patient self-management and to data captured by home monitoring devices. Otherwise, it would be difficult to have access to those kinds of data (Joslyn 2001). This data can potentially be used for improvements in public health, health research, and performance measurement of health care delivery (Mandl et al. 2007). Electronic connectivity would likely result in improved treatment monitoring, better time efficiency, fewer office visits, and improved continuity of care, through common access to test results especially for patients with chronic diseases (Joslyn 2001; Tang et al. 2006). Furthermore, automatic reminders and alerts could help care providers stay aware of their patients' status and improve their delivery through reducing the chances of medical errors and adverse drug interactions (Detmer et al. 2008; Iakovidis 1998a). Finally, in staying healthy as well as in managing various health conditions, getting help and support is very important. Integrated PHR systems would make it easier for consumers to get support from care providers and family members by sharing their health information and making other people aware of their condition (Mazzi and Kidd 2002; Tang et al. 2006; Winkelman et al. 2005). Consumers would also be empowered to prevent disease or minimize its effect through self-care and personal health information management (Hassol et al. 2004; Mazzi and Kidd 2002; Winkelman et al. 2005).

Supported by integrated PHR systems, a **shift in the locus of control of health information to a more "shared-control" among patients and health care professionals** will result in patients' owning and jointly managing different aspects of their health information through a care process that is virtually always accessible, available, patient-centred, continuous, comprehensive, family-centred, coordinated, compassionate, and culturally effective (Detmer et al. 2008; Parker and Thorson 2008). In addition, this shift in the locus of control will likely enable health knowledge promotion through providing consumer-friendly health education information (Detmer et al. 2008). Consumers could leverage health knowledge to understand and actively track their health issues, thus improving their health and wellness management (Tang et al. 2006). Further, consumers can achieve health related goals such as lowering cholesterol and losing weight by using Mashup tools [1] that feed information from/to integrated PHR systems.

[1] Mashup tools are software applications that use and combine data, presentation or functionality from multiple sources to create new services. Baltzan, P., Detlor, B., and Welsh, C. (2012). *Business-Driven Information Systems*, (Third Canadian Edition ed.) McGraw-Hill Ryerson: Whitby, Ontario.

Finally, consumer's use of a PHR system means more engagement from him/her in the care process, thus making the process easier for his/her health care team (Tang et al. 2006).

Improved efficiency in health care delivery and health management is likely to result from reducing redundant transactions and tests, efficient use of time, data gathered from home monitoring, saving provider time in terms of digging patient history, informing people involved in the care process about the situation of the patient, etc (Detmer et al. 2008). Time saving may also come in the form of scheduling appointments online at consumer's convenience, getting electronic prescription drugs, quickly refilling prescriptions online, transferring records electronically when switching doctors, etc (Tang et al. 2006). By keeping accurate and up-to-date health records supported by the use of integrated PHR systems, consumers may reduce the chances of costly duplicate medical procedures and medical errors. In addition, cost saving may occur by avoiding unnecessary trips to doctor's office as they can schedule appointments online, and they can communicate electronically with the doctor for minor questions and getting prescriptions. Furthermore, consumers can set up preventive care alerts to stay aware of their health status, thus reducing preventable health care expenses (Hassol et al. 2004; Mazzi and Kidd 2002; Tang et al. 2006; Winkelman et al. 2005). Cost saving benefits of integrated PHR system use may be realized by the payers (Kaelber et al. 2008). Lower disease management cost and lower medication cost are examples of cost savings facilitated by consumers' use of PHR systems (Tang et al. 2006). Use of PHR systems could result in lower wellness program costs (Tang et al. 2006). Efficiency of operations, increased patient empowerment, and improved disease management are goals that motivate health care organizations to support the use of PHR systems (Grant et al. 2006; Kaelber et al. 2008). Finally, health care leaders acknowledge the role of integrated PHR systems in integrating patient and provider access to health information across the care continuum (Kaelber et al. 2008).

In order to provide a clearer picture of the suggested benefits of integrated PHR systems, Table 2.3 provides some example benefits for various stakeholders in a more structured format.

Table 2.3: Example benefits of integrated PHR systems for various stakeholders*

Stakeholders →	**Consumer**		**Health care providers**		**Health care system**	
↓Advancements	What benefit	How	What benefit	How	What benefit	How
Improved patient-provider interactions	Tackle health issues faster and as they arise	"Ongoing" rather than "episodic" interaction with care providers	Spend less time gathering patient data and spend more time on patient issues	Availability of patient contributed data at the point of care	Improved accuracy of legal procedures	Availability of electronic records of patient-provider interactions
Opportunities to realize innovation in care management	Receive social support when needed	Electronic connectivity to peer support groups	More accurate diagnoses	Availability of home monitoring data	Lower chronic disease management costs	Improved monitoring of disease through e-connectivity
Shift in locus of control of health information to a more "shared control"	Actively track and manage health issues	Using alerts, reminders, and tracking features	More comprehensive view of the patient	Availability of patient supplied data	Improved public health	Promoting health knowledge
Improved efficiency of care	Lower health management cost	Fewer visits to care providers, self-care	Time saving	Replacing in-person interaction with online communication	Lower cost	Patients being able to take more of their care

**References:(Berner and Moss 2005; Detmer et al. 2008; Hassol et al. 2004; Iakovidis 1998b; Kaelber et al. 2008; Mazzi and Kidd 2002; Tang et al. 2006; Walton and Bedford 2007; Winkelman et al. 2005; Young et al. 2004).*

2.2 The Changing Role of Consumers in Health Management

Integrated PHR systems have attracted the attention of policy developers at the national and international levels (Detmer et al. 2008; Steinbrook 2008) for the potential benefits outlined in the previous section. However, for the majority of the projected benefits of integrated PHR systems to be realized, there is need for consumers to accept a more active role in managing their own care. It is widely believed that successful implementation and proper use of integrated PHR systems would give rise to a change of the role of consumers from passive recipients of treatment to active partners (with health care providers) in the care process. Such partnership includes, for example, consumers' seeking health information (Folker 2007), managing their own health and wellness (Detmer et al. 2008; Hassol et al. 2004; Raisinghani and Young 2008; Tang et al. 2006), and becoming more involved in health care decision making (Raisinghani and Young 2008). Such a role change is similar to what happened in the banking industry by introducing ATM[2]s and online banking, thus involving consumers in the banking business processes (Parker and Thorson 2008; Raisinghani and Young 2008). Integrated PHR systems are suggested to be the core for building new structures and relationships in the new health care landscape (Ball and Gold 2006).

Integrated PHR systems provide consumers with greater access to and control over their health information, and as a result, such systems facilitate a change in the role of consumers in their own health management (Parker and Thorson 2008). Such access and control, when integrated with providers' access to the same information, would potentially result in a consumer's being more actively involved in care, and they would enable shared decision making across the care continuum, including at home (Detmer et al. 2008).

Consumers' being more actively involved in care is key to improving quality of care, and cost reduction strategies (Pagliari et al. 2007). In addition, greater patient engagement would result in providing a more comprehensive and balanced view of the patient to care providers. Such a view would be built based on objective information that is supplied through the use of health technology (e.g., PHR system) rather than being based solely on subjective information provided by the patient at the medical appointment (Reiser 1978). Furthermore, the sharing of health information would result in reduced medical errors, reduced redundant procedures and tests, improved quality of care, and reduced costs (Raisinghani and Young 2008). In addition, an informed patient brings high expectation into the health care relationship, thus potentially improving the way care is delivered (Goldsmith and Safran 2004). It is suggested to be in these interactions that improved outcome lies (Abramson 2004). Finally, in the case of patients with multiple care providers, a single point of access to health

[2] Automated Teller Machine

information avoids a fragmented system of storing and retrieving critical data which impedes optimal care (Tang et al. 2006).

At the heart of the transformative influence of integrated PHR systems, lies the necessity for a change in the role of consumer from passive to a more active participant in his/her health and wellness management (Tang et al. 2006). Research shows that consumers themselves are interested and eager to have access to their health records (Parker and Thorson 2008), yet the adoption of PHR systems is still low (Raisinghani and Young 2008). Several studies have investigated the factors responsible for such lack of adoption. However, consumers' tendencies and motivation to accept the new role have not been investigated. As such, this research tries to understand what would motivate consumers to be willing to take up a more active role in their health and wellness management, and how such willingness would influence their adoption of integrated PHR systems.

CHAPTER 3: Theoretical Development

The purpose of this chapter is to offer a theoretical model of individual adoption of integrated PHR systems. For developing the proposed theoretical model, related publications from information systems (IS) and Psychology literatures are reviewed. Based on the IS literature, a parsimonious model of technology adoption is developed and presented in this chapter. This model is then integrated with Self-Determination Theory (SDT) (Ryan and Deci 2000), a motivation theory from the Psychology literature, in order to develop the proposed theoretical model of this dissertation. The integrated model is proposed to explain consumers' intention to use integrated PHR systems. This chapter is outlined as follows. Section 3.1 offers an overview of previous research on PHR systems in order to position the current study. Section 3.2 explains the theoretical backgrounds of the proposed research model of this study by providing an overview of theories from both IS and Psychology literatures. Section 3.3 presents the proposed theoretical model and uses the model to structure a set of research questions for this study. Finally, Section 3.4 presents the hypotheses with theoretical support from the literature.

3.1 Previous Research on PHR Systems

Since the beginning of the 21st century, there has been a surge in research on electronic personal health records (Tang et al. 2006). More specifically, there has been a sudden increase in the number of publications surrounding PHR systems since 2004 (Kim et al. 2011). Although there are overlaps, existing studies devoted to PHR systems can be categorized into eight categories as seen in Table 3.1.

Table 3.1: Existing PHR system related research publications

Category	Publications
Definitions and descriptions	Jeffs and Harris (1993), Kim and Johnson (2002), Sittig (2002), Rubel et al. (2005), Lafky et al. (2006), Thomas (2006), Cronin (2006), Abrahamsen (2007), Atkinson et al. (2007), Lee et al. (2007), Brown (2007), Halamka et al. (2008), Binnersley et al. (2009), Fuji et al. (2012)
Architecture and technical issues	Moen and Brennan (2005), Tang et al. (2006), Yee and Trockman (2006), Mandl et al. (2007), Constantinescu et

Category	Publications
	al. (2009), Wu et al. (2009), Caine et al. (2010), Fonda et al. (2010), Koufi et al. (2011), Wu et al. (2011), Lamb et al. (2012), Steele et al. (2012)
Vision statements and prediction, research agenda	Iakovidis (1998a), Sittig (2002), Iakovidis (1998b), Neame (2000), Klein-Fedyshin (2002), Burrington-Brown (2005), Burrington-Brown and Friedman (2005), Campbell and others (2005), Hagland (2005), Hicks (2005), Kaelber et al. (2008), Kimmel et al. (2005), Morrissey (2005), Nobel (2005), Tang and Lansky (2005), Waegemann (2005), Ball and Gold (2006), Clarke and Meiris (2006), Friedman (2006), Kun (2006), Lowes (2006), Pope (2006), Smith (2006), Tang et al. (2006), Abrahamsen (2007), Albright (2007), Anderson (2007), Foxhall (2007), Greeg et al. (2007), Heubusch (2007a), Heubusch (2007b), Kantanka (2007), Lovis (2007), Pagliari et al. (2007), Reinke (2007), Rhoads and Metzger (2007), Robeznieks (2007), Rodriguez et al. (2007), Schleyer et al. (2011)
Value and effect (e.g., on health outcomes, health care processes)	Bjerkeli Grøvdal et al. (2006), Fricton and Davies (2008), Horan et al. (2009), Simpson and Fairbrother (2009), Tulu and Horan (2009), Sharp and Gwadry-Sridhar (2010), Finn (2011), Tenforde et al. (2011), Yellowlees et al. (2011), Kim (2012), Kim et al. (2012), Wagner et al. (2012)
Adoption and attitudes	Jeffs and Harris (1993), Liaw (1993), Jeffs et al. (1994), Tobacman and Nolan (1996), Liaw et al. (1996), Ayana et al. (1998), Liaw et al. (1998), Jones et al. (1999), Dawson et al. (2000), Denton (2001), Kim et al. (2004), Kim et al. (2005), Morrissey (2005), Tang and Lansky (2005), Winkelman et al. (2005), Angst and Agarwal (2006), Cooke et al. (2006), Lober et al. (2006), Smith (2006), Sprague (2006), Tang et al. (2006), Davis (2007), Miller et al. (2007), Halamka et al. (2008),Lafky and Horan (2008), Assadi and Hassanein (2009), Chan et al. (2009), Daim et al. (2009), Dawson et al. (2009), Hart (2009), Randeree (2009), Whetstone and Goldsmith (2009), DesRoches et al. (2010), Forsyth et al. (2010), Nazi (2010), Ancker et al. (2011), Heise et al. (2011), Lafky and Horan (2011), Liu et al. (2011), Morton (2011), Nguyen (2011), Patel et al. (2011b), Pirtle and Chandra (2011), Sack et al. (2011), Zulman et al. (2011), Day and Gu (2012), Emani et al.

Category	Publications
	(2012), Hilton et al. (2012), Jian et al. (2012), Karamanlis et al. (2012), Li et al. (2012a), Lim and Kim (2012), Logue and Effken (2012), Noblin et al. (2012), Patel et al. (2012), Richards (2012), Smith et al. (2012), Muhammad et al. (2012b), Muhammad et al. (2012a), Tom et al. (2012), Tulu et al. (2012), Weitzman et al. (2012)
Evaluation (e.g., evaluation of functionality)	Liaw et al. (1996), Liaw et al. (1998), Ayana et al. (2001), Davis and Bridgford (2001), Cornbleet et al. (2002), Kim and Johnson (2004), Kim et al. (2004), Tobacman et al. (2004), Wang et al. (2004), Kimmel et al. (2005), Slaughter et al. (2005), Wuerdeman et al. (2005), Dorr et al. (2007), Gysels et al. (2007), Hess et al. (2007), Ngo-Metzger et al. (2010), Segall et al. (2011)
Privacy and security	(Baker and Masys 1999), (Blechner and Butera 2002), (Harman 2005), (Sax et al. 2005), (Conn 2006), (McSherry 2006), (Srinivasan 2006), (Fullbrook 2007), (Wright and Sittig 2007a), (Wright and Sittig 2007b), (Ibraimi et al. 2009), (Shoniregun et al. 2010), (Asim et al. 2011), (Lim and Kim 2012), (Señor et al. 2012)
Other topics (e.g., regulation, policy, frameworks)	(Taylor et al. 2005), (Hasan and Rotenstreich 2008), (Layman 2009), (Rank 2009), (Leyland 2010), (Wakefield et al. 2011), (Muhammad et al. 2012a), (Muhammad et al. 2012b), (Williams et al. 2012)

This dissertation builds, in part, on the existing studies on PHR systems in order to develop and validate an adoption model for integrated PHR systems. To the best of my knowledge, this is the first study to develop and validate a PHR system adoption model while observing the following unique set of characteristics: (i) it is targeted at the general public, (ii) it focuses on integrated PHR systems, (iii) it is not disease specific (i.e., relates to health and wellness management in general), (iv) it is grounded in theory as it integrates mainstream IS adoption models with self-determination theory, and (v) it employs a rigorous hypothetico-deductive method for validation of findings. The uniqueness of this research study is further clarified below by comparing it to several representative examples of PHR adoption studies from the literature.

While this dissertation builds on and acknowledges the significance and contributions of previous studies on PHR system adoption, the remainder of this

subsection presents several examples of existing studies in order to help distinguish the current study from existing ones.

A number of existing studies are atheoretical, i.e., they lack a theoretical base (e.g., Patel et al. (2011a), Pirtle and Chandra (2011), and Karamanlis et al. (2012)). Although insights gained from these studies are of considerable value, the theoretical model of the current study was developed based on existing well-established theories. The value of scientific theories is in that they are based on a body of knowledge that has been previously validated (National Academy of Sciences 1998).

None of the existing studies that are based on scientific theory have employed Self-Determination Theory (SDT) in order to understand the adoption of PHR systems. Table 3.2 presents a list of underlying theories found in the existing theoretical PHR system adoption studies. As explained in further detail at the end of Section 3.2.1 (IS Adoption) of this dissertation, SDT is a viable theory to be integrated with existing IS adoption models for the purpose of explaining the adoption of integrated PHR systems. In summary, an integrated PHR system supports a change in the role of consumers in health management, from passive to active. Thus, the system can be useful for the consumer only if he/she understands and accepts a more active role as well as new responsibilities associated with the active role (Tang et al. 2006). SDT explains the mechanism through which individuals become motivated to take more active (rather than passive) roles in engaging in different types of behaviours including individual health care (Ryan and Deci 2000).

A number of the existing adoption studies have taken an interpretivist view in their research design, and have mainly used qualitative and grounded theory (Martin and Turner 1986) approaches to identify factors that influence PHR system adoption (e.g., Sack et al. (2011), Day and Gu (2012)). Although there is considerable value in the findings of those studies, they are distinct from the current study in that the current study takes a positivist view and employs a quantitative approach in understanding the adoption of integrated PHR systems.

Several of the existing adoption studies are disease specific, i.e., they are targeted only at individuals afflicted with a certain disease (e.g., Morton (2011), Smith et al. (2012)). This dissertation proposes and validates an adoption model that is not specific to a disease and considers using an integrated PHR system valuable for general health/wellness management. Participants of this dissertation study were recruited from the general public.

Table 3.2: Underlying theories found in the existing theoretical PHR system adoption studies

Base Theory	Reference	Example PHR System Adoption Studies that Employ the Theory
Technology Acceptance Model (TAM)	(Davis 1989; Davis et al. 1989)	Davis (2007), Chan et al. (2009), Daim et al. (2009), Whetstone and Goldsmith (2009), Morton (2011), Richards (2012)
Unified Theory of Acceptance and Use of Technology (UTAUT)	(Venkatesh et al. 2003)	Randeree (2009), Logue and Effken (2012)
Health Belief Model	(Janz and Becker 1984)	Assadi and Hassanein (2009)
Protection Motivation Theory	(Maddux and Rogers 1983)	Laugesen and Hassanein (2011)
Task-Technology Fit	(Goodhue and Thompson 1995)	Laugesen and Hassanein (2011)
Theory of Planned Behaviour	(Ajzen 1985)	Jian et al. (2012),
Innovation Diffusion Theory	(Rogers 1995)	Zulman et al. (2011)

Some of the existing PHR system adoption studies are targeted at a specific population and/or demographic such as elderly, youth, and children (e.g., Heise et al. (2011), Tom et al. (2012)), rather than the general public which is the scope of this dissertation.

Most of the existing PHR system adoption studies are focused on non-integrated PHR system types such as stand-alone PHR systems (e.g., Jian et al. (2012), Li et al. (2012a)). Prior research has shown the influence the type of a PHR system on consumer adoption (DesRoches et al. 2010). Therefore, results of adoption studies on non-integrated PHR systems cannot be fully generalized to integrated PHR systems. This dissertation is focused on the adoption of integrated PHR systems which are suggested to support a transformation in health care delivery and management.

Finally, unlike the current dissertation that seeks to understand the adoption of integrated PHR systems by consumers, a number of the existing studies are concerned with the adoption of such systems by health care providers rather than consumers (e.g., (Widmer et al. 2013; Witry et al. 2010)).

The remainder of this chapter explains the development process of the proposed model of this dissertation, followed by the presentation of the study's research questions and hypotheses.

3.2 Theoretical Background

This section presents the theoretical underpinnings of this study. In order to develop the research model for this dissertation, theories from both IS and Psychology literatures are reviewed. As such, based on a review of the IS literature, a parsimonious model of technology adoption is developed. This model of technology adoption is, then, integrated with Self-Determination Theory (SDT) in order to form the proposed research model of this study. This section presents the review of IS adoption theories, presents the developed model of technology adoption to be used in this study, and introduces SDT.

3.2.1 IS Adoption

IS adoption literature was reviewed in order to form a parsimonious model of technology adoption for the purpose of this dissertation. The model, depicted in Figure 3.1, will be a part of a final research model for this dissertation. The process of forming this model is described in this section.

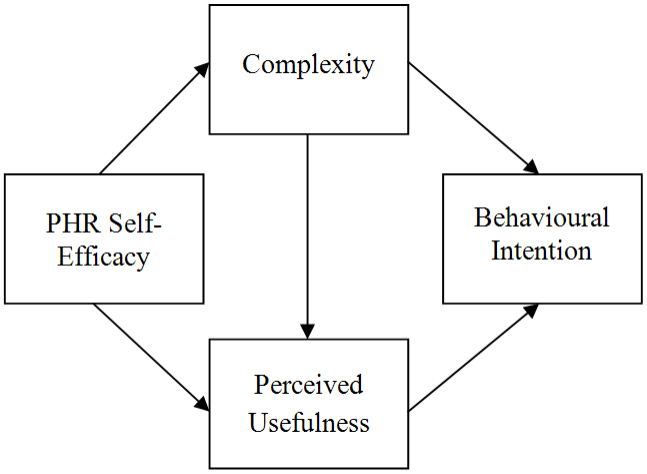

Figure 3.1: A parsimonious model of technology adoption formed for this dissertation

There has been extensive research on IS adoption (e.g., Davis (1989), Davis et al. (1989), Venkatesh (2000), Venkatesh and Davis (2000), Venkatesh et al. (2003), Venkatesh and Bala (2008), Venkatesh et al. (2008), Venkatesh and Goyal (2010), Brown et al. (2012)). In a comprehensive review of theoretical models of individual acceptance of information systems, Venkatesh et al. (2003) identified eight competing theories, including Technology Acceptance Model (TAM) (Davis 1989; Davis et al. 1989), Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), Theory of Planned Behaviour (TPB) (Ajzen 1985; Ajzen 1991), Motivational Model (MM) (Davis et al. 1992), combined TPB and TAM (C-TAM-TPB) (Taylor and Todd 1995), Model of Personal Computer Utilization (MPCU) (Thompson and Higgins 1991), Innovation Diffusion Theory (IDT) (Moore and Benbasat 1991; Rogers 1995) and Social Cognitive Theory (SCT) extended to personal computer usage (Bandura 1986; Bandura 1989; Compeau et al. 1999; Compeau and Higgins 1995b).

The eight theories technology adoption identified by Venkatesh et al. (2003) share a basic underlying framework which is depicted in Figure 3.2. In this framework, individual reactions to using information technology are considered major determinants of behavioural intention to use such technology. The main objective of this dissertation is to explain behavioural intention to use integrated PHR systems. Following Fishbein and Ajzen (1975), behavioural intention in this dissertation is defined as a measure of the strength of an individual's intention to use an integrated PHR system for managing his/her health. Prior research in IS and reference disciplines has shown the role of behavioural intention as a strong predictor of actual use (e.g., Venkatesh et al. (2003), Ajzen (1991), Sheppard et al. (1988), Taylor and Todd (1995), Venkatesh and Davis (2000)). Therefore, behavioural intention is incorporated as the endogenous variable in the model of Figure 3.1.

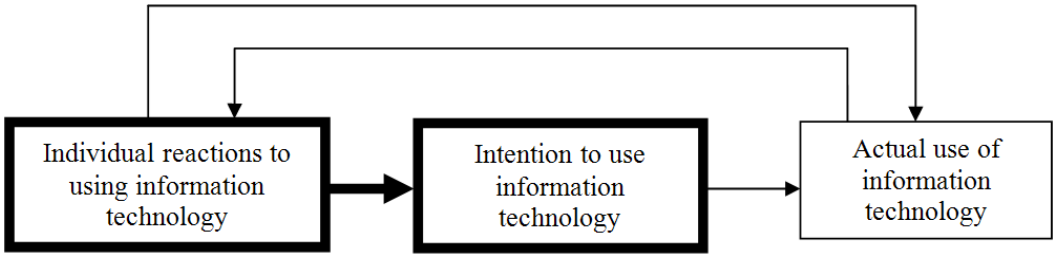

Figure 3.2: Basic concept underlying user acceptance models in Information Systems

Adapted from Venkatesh et al. (2003); thicker shapes denote the focus of this dissertation.

Venkatesh et al. (2003) consolidated the constructs of the eight theories in order to formulate a unified theory of acceptance and use of technology (UTAUT). UTAUT was then empirically tested at three different points in time: after initial training and before system use (pre-usage), after one month of system use (initial use), and after three months of system use (continued use) (Venkatesh et al. 2003). The process of IS adoption by consumers consists of a series of stages that occur over time (from pre-usage to post-usage) (Karahanna et al. 1999). This dissertation is particularly focused on the "pre-usage" stage of integrated PHR system adoption process. UTAUT holds that, in the pre-usage stage of IS adoption process, individual expectations regarding performance (performance expectancy) as well as effort (effort expectancy) associated with using a system are the two major determinants of behavioural intention to use the system. As a result, representative constructs for these two types of individual expectations are incorporated in the model of **Figure 3.1**, as explain below.

One of the root constructs of performance expectancy in UTAUT is the construct of perceived usefulness (PU) from the technology acceptance model (TAM) (Davis 1989; Davis et al. 1989). Following Davis (1989), PU in the context of this dissertation is defined as the extent to which an individual believes that an integrated PHR system is capable of being used advantageously in managing his/her health. PU has been consistently incorporated in the literature as a measure of individual performance expectations regarding the use of a system (e.g., Venkatesh and Davis (2000), Compeau and Higgins (1995b)). Consistent with the literature, PU is incorporated in the model of Figure 3.1 as direct determinant of behavioural intention (BI).

As explained above, effort expectancy is another major determinant of behavioural intention. Most of the root constructs of effort expectancy in UTAUT (e.g., perceived ease of use) relate to the effort that is required to learn how to operate a system. For example, one of the items of the measurement scale for the perceived ease of use construct is "Learning to operate the system would be easy for me" (Davis 1989). However, using an integrated PHR system can entail efforts beyond just learning to operate the system. An integrated PHR system owner/user must expend an ongoing and significant maintenance effort to keep his/her account up-to-date. Otherwise, the presence of outdated, inaccurate, or incomplete information in his/her record could result in the wrong health care decisions being made to the detriment of the user (Tang et al. 2006). Therefore, for the context of this dissertation, a construct and associated measurement scale that captures such ongoing effort is more appropriate. Among the root constructs of effort expectancy in UTAUT, complexity (CPLX) construct from the model of personal computer use (MPCU) (Thompson and Higgins 1991) captures such ongoing effort. CPLX, in the context of this dissertation, is defined as the degree to which an integrated PHR system is perceived as relatively difficult to understand and use. An example item from the measurement scale for CPLX is

"Using the system involves too much time doing mechanical operations (e.g., data input)" (Thompson and Higgins 1991). The measurement scale for CPLX also captures the effort required to learn how to operate the system in the following example item: "It takes too long to learn how to use the system to make it worth the effort". Therefore, CPLX is incorporated in the model of Figure 3.1 as a direct (negative) determinant of both BI and PU.

A construct that is not part of UTAUT, but has been consistently shown to have an effect on user perceptions of information systems, especially in the early stages of adoption, is that of self-efficacy (Compeau and Higgins 1995b; Venkatesh 2000; Venkatesh et al. 2003). Computer self-efficacy refers to an individual's belief of having the capability to use computers (Compeau and Higgins 1995b). This definition can be extended to the belief of having the capability to use an internet application such as an integrated PHR system (PHR self-efficacy). Since this dissertation aims to understand the pre-usage intentions to use an integrated PHR system, it is important to consider investigating the influence of self-efficacy on adoption. Consequently, PHR self-efficacy (SE) is incorporated in the model of Figure 3.1 as a direct determinant of both PU and CPLX.

Social influence, defined as "a person's perception that most people who are important to him think he should or should not perform the behavior in question", is suggested to be another determinant of technology use according to the underlying theories of UTAUT (Venkatesh et al. 2003). However, since PHR systems are new and adoption rates for PHR systems are currently low (Archer et al. 2011), not many individuals are familiar with such systems, and as a result, participants of this study would not be able to respond to this constructs measurement items simply because they would not know if other people think they should use such systems. In addition, since the current study is focused on the pre-usage stage of adoption and since research has shown that at this stage of adoption social influence does not predict behavioural intention (Venkatesh et al. 2003), it was decided to not include this construct in the research model of this study. Nevertheless, some social influence aspects of the PHR adoption decision are captured in the research model of this study through the perceived autonomy support and relatedness factors as described in Section 3.3 of this dissertation.

There are several advantages for employing the model of Figure 3.1 for the theoretical development of this study. First, there has been extensive empirical research supporting the consistency and viability of the incorporated constructs and relationships in the model (e.g., Adams et al. (1992), Compeau and Higgins (1995b), Agarwal and Karahanna (2000), Venkatesh et al. (2003), Karahanna et al. (2006)). As of April 2013, there are over 6,500 citations listed on Google

Scholar to the article that introduced UTAUT[3]. Second, the constructs and relationships have been consistently shown to be viable across different contexts (King and He 2006) and stages of IS use, from pre-usage to continued use (Kim and Son 2009). Third, the simplicity of this model makes it an attractive option to integrate with a theory (SDT) that is relatively new to the IS literature. This integration is explained below this paragraph.

Benbasat and Zmud (2003) suggest that in IS research, particularly adoption research, the IS "nuances" involved must be clarified for any investigation of possible variables of focus. Recall from the previous chapter that an integrated PHR system empowers the individual owner in his/her health management (Ball et al. 2007; Beckjord et al. 2012). In other words, the PHR system supports a change in the role of the individual in health management, from passive to active. Thus, the PHR system can be useful for the individual owner only if he/she understands and accepts a more active role as well as new responsibilities associated with the active role (Tang et al. 2006). Such behavioural change in patients is difficult, and as a first step it requires motivation (Tang et al. 2006). From the Psychology literature, a theory of motivation that is potentially useful for the context of integrated PHR system adoption by individuals is SDT. SDT explains the mechanism through which individuals become motivated to take more active (rather than passive) roles in engaging in different types of behaviours including individual health care (Ryan and Deci 2000). This theory is also considered to be the guiding principle of patient empowerment (Aujoulat et al. 2007). It is also believed that this theory is well suited to apply for understanding the role of information technology in consumer-based health care (Beckjord et al. 2012). Finally, given the frequent calls for theory development in this context (e.g., Pingree et al. (2010)), integrating SDT with the IS adoption model of Figure 3.1 is promising.

3.2.2 Self-Determination Theory (SDT)

SDT represents a broad framework for the study of human motivation and personality. SDT begins with the assumption that human beings are active organisms with evolved tendencies toward growing, mastering new skills, applying their talents responsibly, learning, and integrating new experiences into a sense of self (Ryan and Deci 2000). Such tendencies, however, do not work automatically, and they require ongoing support and nutriments from the social environment. Without such ongoing support, human spirit can be diminished, and individuals might reject growth and responsibility (Ryan and Deci 2000). Examples of people with varying degrees of self-motivation, from active

[3] As of January 2013, the numbers of Google Scholar citations for the articles that introduced the eight underlying theories of UTAUT were 20,000+ for TAM, 16,700+ for TRA, 2,000+ for MM, 20,500+ for TPB, 3,700+ for C-TAM-TPB, 1,400+ for MPCU. 5,000+ for IDT, and 20,000+ for SCT.

motivated individuals to passive amotivated ones are abundant (Ryan and Deci 2000). SDT is concerned with understanding conditions and social contexts that cause these differences in motivation, both within and between individuals. Such differences result in individuals having various degrees of energy and motivation in different domains, situations, and cultures (Ryan and Deci 2000). In addition, research guided by SDT is concerned with understanding the implications of such varying motivations for an individual's behaviours, development, performance, and well-being (Deci and Ryan 1985b; Deci and Ryan 1991; Ryan 1995).

SDT is an organismic [4] dialectic approach in that the dialectical interchange between an active organism (i.e., human) and its social context is the basis for predictions about its motivations and behaviours (Deci and Ryan 1985b; Deci and Ryan 2000). In SDT, the influence of this dialectic on human motivation and its consequent outcomes is explained in terms of satisfaction or thwarting of three basic psychological human needs for autonomy, competence, and relatedness (Deci and Ryan 2000; Ryan and Deci 2000). The need for autonomy refers to an individual's desire to self-organize his/her behaviour, when he/she feels volitional in doing so (Deci and Ryan 1985b) (Ryan et al. 1989). Competence concerns the individual's belief about his/her capabilities in performing an action in a social context (Deci and Ryan 1980; Elliot and Thrash 2002). The need for relatedness refers to the individual's desire to feel socially connected and supported, especially by important people, such as a manager, teacher, or health care provider.

In approaching the main goal of this dissertation, which is to explain consumers' intention to use integrated PHR systems, the nature of the change in consumers' roles in managing their health is investigated. As described in the previous chapter, the new roles require consumers to be more actively (rather than passively) involved in managing their health. The major advantage of employing SDT in this study is that SDT sheds light on mechanisms through which individuals become motivated to take more active (rather than passive) roles in developing different types of behaviours including individual health care (Ryan and Deci 2000). Research guided by SDT shows the influence of environmental (e.g., physician behaviour) and consumers' personality characteristics on motivation (Ryan and Deci 2000). According to SDT, such an influence can be most parsimoniously described in terms of satisfaction/thwarting of the three basic needs for autonomy, competence, and relatedness (Ryan and Deci 2000). Throughout the years, SDT has been successfully applied (Deci and Ryan 1985b; Deci and Ryan 2000; Ryan and Deci 2000) in many research domains including education (e.g., Hayamizu (1997), Miserandino (1996)), organizations (e.g., Baard et al. (2004), Lynch et al. (2005)), sport and physical activity (e.g.,

[4] Of or relating to an organism; of the nature of an organism; at the level of the organism; organic. ("organismic, adj.". OED Online. June 2013. Oxford University Press. http://www.oed.com/view/Entry/132442?redirectedFrom=organismic (accessed June 25, 2013))

Chatzisarantis et al. (1997)), religion (e.g., Ryan et al. (1993)), health care (e.g., Ryan et al. (2008), Williams et al. (2009), Williams et al. (2005), Williams et al. (1996)), parenting (e.g., Roth et al. (2009), Grolnick and Seal (2008)), virtual environments and media (e.g., Przybylski et al. (2012), Ryan et al. (2006), and Rigby and Przybylski (2009)), close relationships (e.g., Moller et al. (2010), La Guardia and Patrick (2008)), and psychotherapy (e.g., Sheldon et al. (2003a), Ryan et al. (2011)).

SDT is an empirically derived macro-theory, and since its introduction in the early 1970's (Deci and Ryan 2012), it is developed to address different, albeit related issues surrounding human motivation and personality (Deci and Ryan 2000; Deci and Ryan 2012; Ryan and Deci 2000). SDT comprises the following five formal mini-theories each of which is developed to explain and address various facets of motivation such as its properties, determinants and consequences. The following five mini-theories of SDT are described below in further detail: cognitive evaluation theory (CET) is concerned with the effects of social environments on intrinsic motivation; organismic integration theory (OIT) explains the development of autonomous extrinsic motivation; causality orientations theory (COT) concerns individual differences in motivational orientations; basic psychological needs theory (BPNT) explains the functioning of the three basic human needs, and goal contents theory (GCT) sheds light on the effects of different goal contents on well-being and performance. The five mini-theories together shape the SDT process model of Figure 3.3.

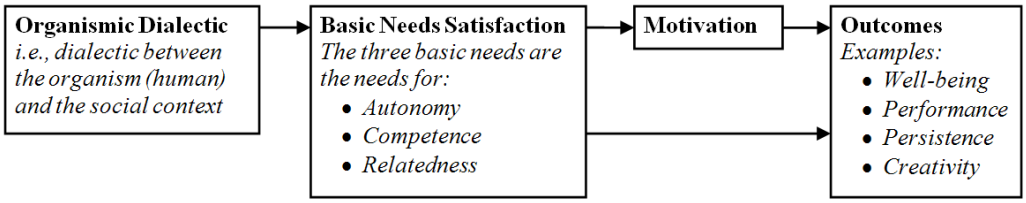

Figure 3.3: Self-determination theory causal process model (Deci and Ryan 2000; Ryan and Deci 2000; Ryan et al. 2008; Sheldon et al. 2003b)

3.2.2.1 Cognitive Evaluation Theory (CET)

Similar to most motivation theories (e.g., Calder and Staw (1975), Scott et al. (1988), Pritchard et al. (1977), Porac and Meindl (1982), Pinder (1976), and Davis et al. (1992)), SDT proposes two general types of human motivation (Ryan and Deci 2000): intrinsic and extrinsic. Within SDT, the construct of intrinsic motivation describes the natural tendency of humans toward assimilation, mastery, spontaneous interest, and exploration that represents a principal source

of enjoyment and vitality throughout life (Ryan and Deci 2000). In other words, intrinsic motivation refers to motivation to perform an activity for its own sake and for the inherent satisfaction of the activity itself (Ryan and Deci 2000). In contrast, extrinsic motivation refers to the performance of an activity in order to achieve an outcome separable from the activity itself, such as attaining a reward or avoiding a punishment (Ryan and Deci 2000).

SDT's first mini-theory, CET, concerns intrinsic motivation. It explains the effects of social and contextual factors on intrinsic motivation, and highlights the importance of the three basic needs in fostering intrinsic motivation (Ryan and Deci 2000) (Figure 3.4). CET specifies two main processes through which social and contextual events affect intrinsic motivation (Ryan and Deci 2000). First, events such as making a choice that support the need for autonomy enhance intrinsic motivation. On the other hand, events such as being punished undermine intrinsic motivation by thwarting the need for autonomy. Second, events such as receiving positive feedback that support the need for competence enhance intrinsic motivation, whereas events such as receiving negative feedback that thwart the need for competence diminish intrinsic motivation. As a matter of fact, a sufficiently negative feedback, conveys a feeling of incompetence to the individual, and it would leave the individual amotivated (i.e., without motivation and intention). In addition to the two main processes, further research guided by SDT has shown that, in interpersonal settings, feeling of relatedness and a secure relational base enhances intrinsic motivation (Ryan and Deci 2000). In summary, situations which convey an internal (to the individual) locus of causality facilitate intrinsic motivation. In contrast, situations which convey an external locus of causality undermine intrinsic motivation.

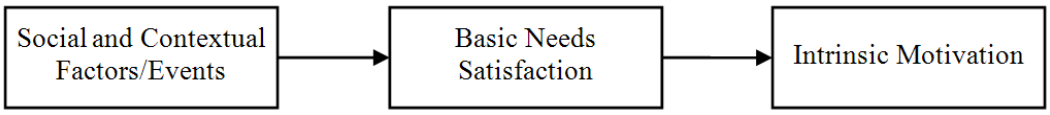

Figure 3.4: Cognitive evaluation theory causal process model (a mini-theory of SDT) (Deci and Ryan 2012)

Research has shown that the needs for autonomy, competence, and relatedness must be supported together for intrinsic motivation to flourish (Ryan and Deci 2000). Finally, research guided by CET has resulted in specifying factors and contexts that facilitate/undermine intrinsic motivation. It is critical to mention that individuals will be intrinsically motivated to perform activities that have intrinsic value to them. Extrinsically motivated activities are the subject of SDT's next mini-theory, organismic integration theory.

3.2.2.2 Organismic Integration Theory (OIT)

The main issue that OIT addresses is whether extrinsic motivation can become self-determined. Within OIT, the concept of *internalization* distinguishes different types of extrinsic motivation (Ryan and Deci 2000). Internalization refers to people's "taking in" a value so that it will stem from their sense of self (Ryan and Deci 2000). The more internalized a behaviour, the more self-determined it will be (Ryan and Deci 2000). As seen in the middle section of Figure 3.5, the least internalized type of extrinsic motivation is called *introjected* extrinsic motivation based on which "people adopt an ambient value or practice, and are motivated to maintain it, as they should, in order to maintain self-approval or avoid guilt". The second level of internalization of extrinsic motivation is *identification* which "involves an individual's personally identifying with the value of a behavior and thus fully accepting it as his/her own". The third form of internalization is *integration* in which individuals integrate the value of a behavior with other aspects of their core values and practices". Integrated motivation shares many qualities with intrinsic motivation although it is still considered extrinsic, as it drives individuals to engage in behaviours to attain outcomes that are separable from the inherent enjoyment of doing the activity itself (Ryan and Deci 2000).

The three levels of internalization, when put together with externally regulated behaviours (i.e., non-internalized, performed for external rewards or punishments), intrinsically motivated behaviours and amotivated behaviours form the continuum of self-determination (Figure 3.5). The more self-determined a behaviour for an individual, the more actively (rather than passively) engaged in the behaviour the individual would be (Ryan and Deci 2000). In addition, the more self-determined a behaviour, the more persistence, behavioural quality, and well-being there will be for the individual (Deci and Ryan 2012; Ryan and Deci 2000).

Behaviour:	Non Self-Determined →				Self-Determined
Motivation:	Amotivation	Extrinsic Motivation			Intrinsic Motivation
		External	Introjected	Identified	Integrated	
Perceived Locus of Causality:	Impersonal	External	Somewhat External	Somewhat Internal	Internal	Internal

Figure 3.5: Self-determination continuum (adapted from Ryan and Deci (2000))

Research guided by SDT, and in particular by OIT, shows that supporting the three basic needs for autonomy, competence, and relatedness facilitates internalization of behaviour, in a given situation (Figure 3.6). On the other hand, situations that thwart the three needs impair the internalization of behaviour (Ryan and Deci 2000).

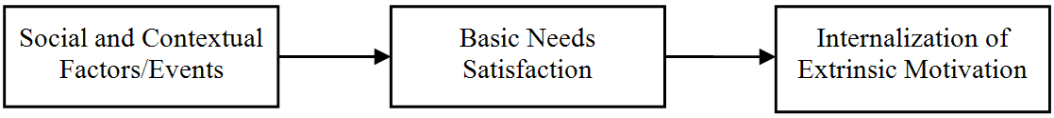

Figure 3.6: Organismic integration theory causal process model (a mini-theory of SDT) (Deci and Ryan 2012)

3.2.2.3 Causality Orientations Theory (COT)

COT is concerned with individual differences in motivation. An individual's causality orientations refer to motivational orientations that are relatively stable in the individual. COT describes and assesses three types of causality orientations: autonomy orientation, controlled orientation, and impersonal or amotivated orientation (Deci and Ryan 1985a; Deci and Ryan 1985b; Deci and Ryan 2012).

The autonomy orientation, or autonomous causality orientation (ACO) which is in the scope of this dissertation, refers to a person's tendency toward being autonomous in general, across different domains and times. The other two types of causality orientations are defined here, but fall outside the scope of this dissertation. Each individual is said to demonstrate each of the three orientations to some extent, and any or all of the orientations may be used to predict outcomes (Deci and Ryan 2012; Ryan and Deci 2000). Example outcomes include work performance (Baard et al. 2004), and persistence in health behaviours (Williams et al. 1996).

The controlled orientation refers to a person's general tendency to being controlled (vs. autonomous). Finally, the impersonal orientation refers to being generally amotivated. The three causality orientations parallel the previously mentioned (Figure 3.5) types of motivation, namely, autonomous motivation, controlled motivation, and amotivation.

3.2.2.4 Basic Psychological Needs Theory (BPNT)

BPNT was originally formulated to account for the effect of the satisfaction of the three basic psychological needs for autonomy, competence, and

relatedness on psychological health and well-being (Ryan and Deci 2000). BPNT, as well as further research conducted based on this mini-theory (e.g., Baard et al. (2004), and Sheldon et al. (2003a)), suggest that basic needs satisfaction mediates the effect of social context on outcomes such as well-being and performance (Ryan and Deci 2000) (Figure 3.7). Social contexts that support these needs would positively influence well-being and performance and other outcomes. On the other hand, social context that thwart the three needs will have a negative effect on the outcomes.

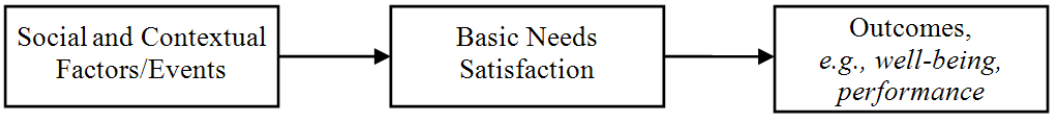

Figure 3.7: Basic psychological needs theory causal process model (a mini-theory of SDT) (Deci and Ryan 2012)

3.2.2.5 Goal Contents Theory (GCT)

GCT is concerned with the effect of different types of life goals on human functioning and psychological well-being (Ryan and Deci 2000). Life goals are differentiated as intrinsic (i.e., directly satisfying basic needs) and extrinsic (i.e., not directly satisfying the basic needs, and perhaps opposing to them). GCT asserts that contrary to intrinsic goals such as personal growth, extrinsic goals such as financial success are more likely associated with lower levels of psychological well-being, and lower levels of performance in activities related to the goals.

To sum up the introduction provided on SDT, Figure 3.8 presents a schematic causal process model and the research framework of self-determination theory.

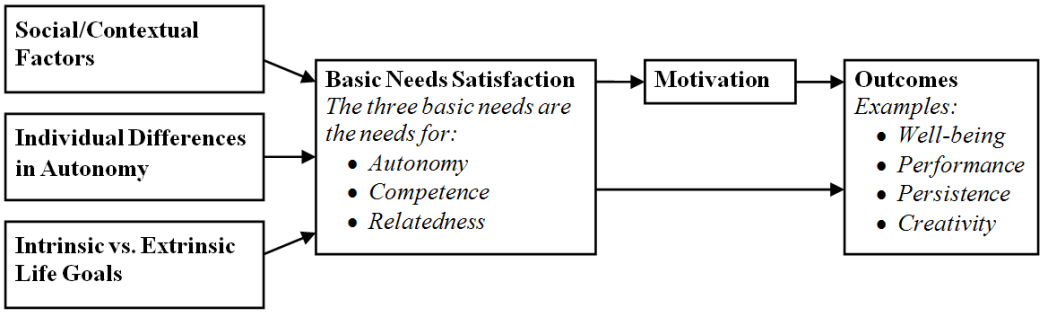

Figure 3.8: Self-determination theory causal process model and research framework (Deci and Ryan 2000; Ryan and Deci 2000; Ryan et al. 2008; Sheldon et al. 2003b)

3.3 Proposed Theoretical Model

Earlier in this chapter, a model of technology adoption was developed for the purpose of this dissertation (Figure 3.1). The review of the literature presented so far in this chapter demonstrates the viability of integrating this technology adoption model with SDT for the purpose of explaining an individual's decision to start using an integrated PHR system. The integrated model, which is the proposed theoretical model of this dissertation, is presented in Figure 3.9. The proposed model suggests that behavioural intention to start using an integrated PHR system is influenced by an individual's perceptions regarding usefulness (perceived usefulness, PU) and effort (complexity, CPLX) associated with using an integrated PHR system. Prior research on IS adoption suggests that these perceptions (i.e., internal beliefs about the system) mediate the influence that any external variable might have on BI (Brown et al. 2010; Davis et al. 1989; Venkatesh and Bala 2008). Therefore, the external variables of Basic Needs Satisfaction (BNS) and PHR Self-Efficacy (SE) are incorporated in the model as antecedents of PU and CPLX. The theoretical justifications of the relationships in the proposed model are presented in the next section of this chapter.

The proposed model is unique and original in that it integrates SDT and a technology adoption model for the purpose of explaining integrated PHR system adoption. As such, it considers a previously unexplored concept which is the changing role of consumers in the management of their health, facilitated by consumer-based health care in general, and the use of integrated PHR systems in particular.

The proposed theoretical model was used to structure the following research questions (RQ) which are in line with the objectives of this dissertation which were presented in Section 3.1. These research questions help develop a number of specific hypotheses that aim to gather empirical evidence on integrated PHR system adoption. The hypotheses are presented and described in the next section of this chapter.

RQ1: *How do individuals' perceptions regarding the use of integrated PHR systems influence their behavioural intention to use such systems?*

RQ2: *How does PHR self-efficacy influence an individual's perceptions regarding the use of integrated PHR systems?*

RQ3: *How does the basic needs satisfaction in the context of health management influence an individual's perceptions regarding the use of integrated PHR systems?*

RQ4: *How do the environmental factors (physician support, in this dissertation) and personality factors (autonomous causality orientation, in this dissertation) in the context of health management influence basic needs satisfaction?*

RQ5: *How appropriate is the proposed theoretical model in predicting an individual's adoption of integrated PHR systems?*

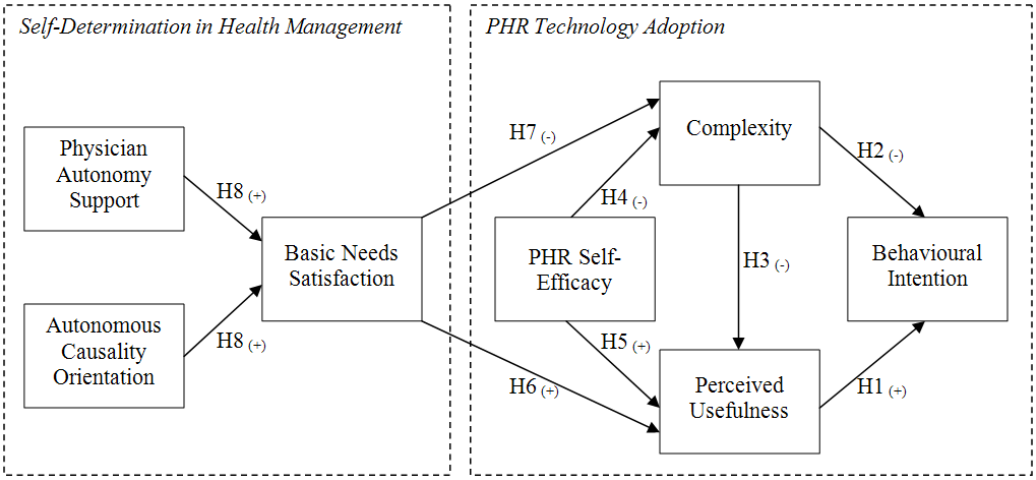

Figure 3.9: Proposed theoretical model of this study

In addition to the factors included in the proposed model, this dissertation aims to gain understanding on the following aspect of integrated PHR system adoption. Personal attributes and characteristics of individuals will be investigated for their possible influences on intention to use integrated PHR systems. Based on this objective, the following research question is proposed:

RQ6: *How do individual characteristics (age, gender, Internet experience, education level) influence an individual's adoption of integrated PHR systems?*

3.4 Hypotheses

RQ1 pertains to the investigation of possible associations among individual perceptions regarding the use of integrated PHR systems and his/her behavioural intention to use such systems. Individuals' beliefs and perceptions regarding information systems differ across various stages of IS adoption process (Karahanna et al. 1999). Of particular interest to this dissertation, in the pre-usage stage, adoption of information systems is suggested to be determined mainly by perceptions of usefulness and effort associated with using the system (Karahanna et al. 1999). Specifically, as explained in Section 3.2.1 of this chapter, PU and CPLX have been previously shown to be determinants of intention to use technology (Davis 1989; Davis et al. 1989; Thompson and Higgins 1991; Venkatesh and Bala 2008; Venkatesh et al. 2003; Venkatesh et al. 2012). In

addition, complexity, which is incorporated in this dissertation as a measure of effort associated with using the system, negatively influences PU (Venkatesh and Davis 2000; Venkatesh et al. 2003); this association is shown to be stronger in early stages of technology adoption when the individual does not have experience in using the technology (Venkatesh and Davis 2000; Venkatesh et al. 2003). Based on the above discussion, the followings are hypothesized:

H1: *A higher level of perceived usefulness associated with using integrated PHR systems positively influences an individual's intention to use such systems.*

H2: *A higher level of complexity associated with using integrated PHR systems negatively influences an individual's intention to use such systems.*

H3: *A higher level of complexity associated with using integrated PHR systems negatively influences an individual's perceived usefulness of such systems.*

RQ2 aims to examine the possible influence of PHR self-efficacy on an individual's perceptions regarding the use of integrated PHR systems. Prior studies have shown individuals with higher levels of self-efficacy will perceive less effort in using technology (e.g., Venkatesh (2000)). In addition, self-efficacy has been shown to have a positive impact on expectations regarding performance related outcomes of technology (Compeau and Higgins 1995b). Performance related outcomes are incorporated in the proposed model as part of perceived usefulness. Based on this discussion, the followings are hypothesized:

H4: *A higher level of an individual's self-efficacy regarding the use of integrated PHR systems negatively influences his/her perceptions of complexity of such systems.*

H5: *A higher level of an individual's self-efficacy regarding the use of integrated PHR systems positively influences her/his perceived usefulness of such systems.*

RQ3 pertains to investigating possible associations between basic needs satisfaction in the context of health management and an individual's perceptions regarding the use of integrated PHR systems. As mentioned earlier in this chapter, for an integrated PHR system to be useful, the individual owner should understand and accept a more active role in his/her health management. Also, recall that such a change in role requires motivation. According to SDT, such motivation is fueled by the satisfaction of the basic needs (Ryan and Deci 2000). Higher levels of the satisfaction of the basic needs in the context of health management would result in health management behaviours to become more internalized for the individual, thus making him/her more self-determined in managing his/her health (Ryan and Deci 2000). It is argued in this dissertation that an individual who is more self-determined in health management, would have

more positive perceptions regarding the use of integrated PHR systems. This argument is made based on the following logical justification: (i) PHR systems, specially integrated ones, are suggested to support consumers' self-determination in managing their health (e.g., Parker and Thorson (2008), Ball et al. (2007), Williams et al. (2007)); (ii) consumers desire to become empowered and self-determined in managing their own health (e.g., Parker and Thorson (2008)), and (iii) perceptions of usefulness and effort associated with using an IS are considered motivational factors to use that IS (Davis et al. 1992). Based on (i), (ii), and (iii), it is reasonable to hypothesize that consumers with higher levels of self-determination in managing their health would have more positive perceptions regarding the use of a technology that supports their reaching what they desire.

Beckjord et al. (2012), in a survey of consumers' perceptions regarding the use of PHR systems, found out PHR system functionalities that were rated highest among survey respondents were the ones that aligned with the satisfaction of SDT's basic needs. Roca and Gagné (2008) applied SDT in the context of continued intention to use e-Learning software in the work place, and hypothesized that the three basic needs would positively influence PU. While acknowledging the value of their work, they hypothesized the influence of each of the three needs individually. However, the authors of SDT mention that satisfaction of the three needs must happen together to have positive effects on motivational factors (Deci et al. 2001; Gagné 2003; Ryan and Deci 2000). As a result, in (Roca and Gagné)'s study, the influence of relatedness on PU did not turn out to be significant. Competence, however, was shown to have a significant positive effect on both PU and perceived ease of use (i.e., effort).

In the current study, Basic Needs Satisfaction (BNS) was measured as a second-order construct following Deci et al. (2001). As such, each of three basic needs for autonomy, competence, and relatedness were modeled as first-order constructs as depicted in Figure 3.10. The three first-order constructs are not included in Figure 3.9 (the proposed model of this study) in order to avoid crowdedness in the figure.

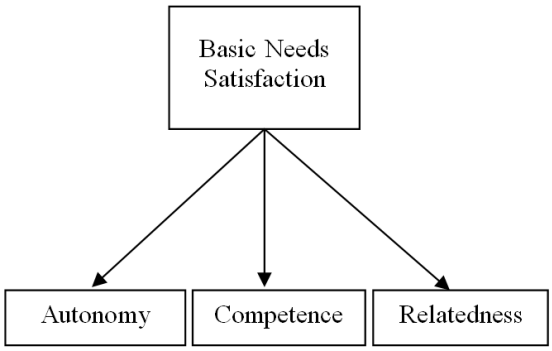

Figure 3.10: Modeling of basic needs satisfaction as a second-order construct

Lastly, the authors of Roca and Gagné (2008) did not include the need for autonomy in their model; instead, they included perceived autonomy support, and showed the positive influence of this factor on PU. In a similar work in the context of continued use of e-Learning technology, Sørebø et al. (2009) investigated the influence of the three needs, individually, on PU. They showed a significant influence of competence, while influences of autonomy and relatedness were shown to be non-significant.

Based on SDT, higher levels of basic needs satisfaction in the context of health management would result in more internalized motivation to health management (Ryan and Deci 2000). In other words, the higher an individual's level of basic needs satisfaction, the more inherent enjoyment she/he would have in managing her/his health. In addition, integrated PHR systems support such internalized motivation through their suggested support for self-determination (Ball et al. 2007; Parker and Thorson 2008; Williams et al. 2007). Consequently, it is argued in this dissertation that individuals with higher levels of internalized (or intrinsic) motivation to manage their health would be more intrinsically motivated to use integrated PHR systems. Given that in the context of technology use, Fagan et al. (2008) have shown that intrinsic motivation to use technology influences perceived ease of use (i.e., perception of effort) of technology, it can be argued that basic needs satisfaction in the context of health management negatively influences consumers perceptions of effort associated with using integrated PHR systems for health management.

Based on the above discussions, the followings are hypothesized:

H6: *A higher level of basic needs satisfaction in the context of health management positively influences an individual's perceived usefulness of integrated PHR systems.*

H7: *A higher level of basic needs satisfaction in the context of health management negatively influences an individual's perceptions of complexity of integrated PHR systems.*

RQ4 relates to two issues. First, it aims to examine the influence of physician autonomy support (PAS) on an individual's basic needs satisfaction in the context of health management. Second, it pertains to understanding the influence of an individual's autonomous causality orientation (ACO) on his/her basic needs satisfaction in the context of health management.

Recall that according to SDT, self-determination flourishes in an environment that supports the satisfaction of the basic needs. In particular, in a health care context, the orientation of a physician (autonomy supportive vs. controlling) has shown to influence the satisfaction of the three needs in the patient (Ryan and Deci 2000). For integrated PHR systems to be useful, health care providers in general and physicians in particular, must support the changing roles of their patients by encouraging them to maintain their records, and by appropriately trusting information provided by patients (Tang et al. 2006). Several studies that have employed SDT in different contexts have shown the positive influence of individual's perceived autonomy support (from a super-ordinate, e.g., physician) on the satisfaction of the basic needs. Examples include the positive influence of physician autonomy support in the context of diabetes self-management (Williams et al. 1998; Williams et al. 2005), physician autonomy support in the context of patient weight loss ((Edmunds et al. 2007; Williams et al. 1998; Williams et al. 2005), supervisor autonomy support in a work organization (Deci et al. 1989; Deci et al. 2001; Edmunds et al. 2007; Richer and Vallerand 1995), and parent autonomy support in promoting children's pro-social behaviour (Gagné 2003). Thus, in this study the following is hypothesized:

H8: *A higher level of perceived physician autonomy support positively influences an individual's level of basic needs satisfaction in the context of health management.*

Recall from SDT that an individual's personality trait of autonomous causality orientation is positively associated with basic needs satisfaction. Several studies that have employed SDT in different contexts have shown this positive association. Examples contexts include weight loss (Williams et al. 1996), work organization (Baard et al. 2004), promoting pro-social behaviour in children (Gagné 2003). Thus, the following is hypothesized:

H9: *A higher level of an individual's autonomous causality orientation is positively associated his/her level of basic needs satisfaction in the context of health management.*

RQ5 pertains to examining the appropriateness of the proposed theoretical model in predicting adoption of integrated PHR systems. As discussed in the next

chapter (Research Methodology) these questions will be answered by examining the explained variance in the endogenous variable (behavioural intention) of the proposed model as well as the relative goodness of fit of the structural model. Therefore, no hypothesis is suggested in association with this research question. Finally, RQ6 pertains to understanding the influence of individual characteristics on the adoption of integrated PHR systems; again, no hypothesis is suggested in association with this question. Consumer attributes, as well as data required to validate the proposed model, will be collected using the instrument proposed and presented in the next chapter (Research Methodology).

CHAPTER 4: Research Methodology

This chapter describes the research methodology employed to validate the research model presented in Chapter 3. As such, this chapter presents an overview of research settings and data collection procedures, measurement instrument, data analysis techniques, and participants of the study.

4.1 Data Collection

This research employs a cross-sectional survey method in order to test the hypotheses in the proposed model of Figure 3.9. Surveys are the typical approach to empirically validate adoption models (Webster and Trevino 1995). In addition, surveys are one of the most widely used methods in information systems (IS) research (Sivo et al. 2006). Data collection was done through an online survey in order to gather measurement scales for the model factors as well as to gather individual characteristics (demographics, details of previous computer and internet use, etc.), and control variables. Since the focus of this research is on understanding the "pre-usage" stage of integrated PHR system adoption process, the online survey was administered to individuals with no prior experience in using any type of PHR systems. This section provides details on the following data collection elements: data collection procedure, measurement instrument, development of an online video clip for the purpose of introducing integrated PHR systems, pre-test of the measurement instrument, study pilot, research ethics, and recruitment of participants.

4.1.1 Data Collection Procedure

In order to reduce the effect of common method variance (explained later in this chapter), and also to reduce the cognitive load on participants, the entire survey was divided into two parts (Part 1 and Part 2) such that each part would be completed by participants in one sitting (one sitting per part). Each of the survey parts only contained approximately half of the questions. Using LimeSurvey[5], an open source survey application, the two parts of the survey for this study were programmed and were hosted on the website of the DeGroote School of Buisness. Finally, for the purpose of this study, integrated PHR systems were introduced to participants using an online video clip as described later in this chapter. Table 4.1 provides an overview of the data collection procedure followed in this

[5] http://www.limesurvey.org/

dissertation. Entire contents of the two parts of the survey are provided in Appendix A of this dissertation.

Table 4.1: Data collection procedure

Data Collection Steps	Descriptions
1- Invitation to complete Part 1 of the survey	Potential participants were invited to complete Part 1 of the survey.
2- Participants' consent to take part	Upon entering the website for Part 1, participants were presented with a letter of information about the study, and they were subsequently asked to sign an online consent form if they agreed to take part in the study.
3- Eligibility assessment	Participants who agreed to take part were presented with a set of questions to determine their eligibility for this study. The questions are provided in Section 4.1.2 (Measurement Instrument). Ineligible participants were prevented from starting the survey.
4- Completion of Part 1	Eligible participants were presented with the survey for Part 1. This part involved measurement items for Self-Determination Theory (SDT) factors as well as some demographics and control variables.
5- Responses to Part 1 were saved	Upon completion of Part 1, participants' responses were saved, and they were informed that they would be invited to complete Part 2 of the survey at a later time.
6- Invitation to complete Part 2 of the survey	Those participants who completed Part 1 were invited to complete Part 2 of the survey.
7- Participants' consent to complete Part 2	Upon entering the website for Part 2, participants were presented with the letter of information about the study, and they were subsequently asked to sign a consent form if they agreed to complete Part 2.
8- Participants watched the video clip	Participants who agreed to take part were asked to watch the online video clip that was created to introduce integrated PHR systems.

Data Collection Steps	Descriptions
9- Completion of Part 2	After watching the entire clip, participants were presented with the survey for Part 2. This part involved measurement items for technology adoption factors as well as some demographics, control variables, and open-ended questions.
10- Responses to Part 2 were saved	Upon the completion of Part 2, participants' responses were saved.
11- Data collection completed	Each participant was assigned a unique ID which was saved with responses to both parts of the survey. This ID was used to match and merge the responses of each participant to both parts of the survey, thus making the full data set for this study.

4.1.2 Measurement Instrument

The measurement instrument of this study contained closed-ended questions related to the variables in the proposed model, participants' demographics, and control variables. In order to ensure content validity, measurement scales were selected from the extant literature, and in some cases, they were slightly adapted to reflect the context of this study. The instrument also contained two open-ended questions designed to gather data on participants' perceptions regarding the use of integrated PHR systems. The operationalization of the study variables and the design of open-ended questions are discussed in this section.

As seen in Figure 3.9, the proposed research model of this study contains two groups of variables, namely technology adoption variables and self-determination theory variables. The first group includes behavioural intention, perceived usefulness, complexity, and PHR self-efficacy. The second group includes basic needs satisfaction, physician autonomy support, and autonomous causality orientation. The measurement scales for the two groups of variables are discussed below in separate tables. The full measurement instrument can be found in Appendix A of this dissertation, as part of the entire survey content.

The adapted measurement scales for technology adoption variables are presented in Table 4.2. The table also provides a description of the adaptation for each scale. In addition, for each scale the table provides source(s) in which validities and

reliabilities of the original scales are established. All the scales in Table 4.2 are 7-item Likert scales.

Table 4.2: Measurement scales for technology adoption variables

Items	Source(s)
Behavioural Intention (BI) Adaptation: For each item in this scale, the name of the system was changed to "online[6] PHR"; the purpose of the system was changed to "managing health", and since a fictitious integrated PHR system rather than an actual available system was presented to participants, the phrase "If available to me" was added.	
BI1: If available to me, I intend to use an online PHR in the near future to help manage my health. **BI2**: If available to me, I predict I would use an online PHR in the near future to help manage my health. **BI3**: If available to me, I plan to use an online PHR in the near future to help manage my health.	Venkatesh et al. (2003)
Perceived Usefulness (PU) Adaptation: For each item in this scale, the name of the system was changed to "online PHR", and the purpose of the system was changed to "managing health".	
PU1: Overall, I find an online PHR would be useful for managing my health. **PU2**: I think an online PHR would be valuable to me in terms of managing my health. **PU3**: The information contained in an online PHR would be useful for managing my health. **PU4**: The functionalities provided by an online PHR would be useful for managing my health.	Paul (2003)

[6] Since the respondents of the questionnaire were recruited from the general public, the use of jargons was avoided in developing the questionnaire. As a result, instead of "integrated PHR system", the term "online PHR" was used in the questionnaire. In addition, the same term was used in the video clip introduction to integrated PHR systems. Furthermore, as seen in Appendix A (online survey content), before each group of questions, participants were clearly instructed to respond based on what they had seen in the video clip.

Items	Source(s)
Complexity (CPLX) Adaptation: For each item in this scale, the name of the system was changed to "online PHR".	
CPLX1: Using an online PHR would take too much time from my normal duties. **CPLX2**: Working with an online PHR seems so complicated; it would be difficult to understand what is going on. **CPLX3**: Using an online PHR involves too much time doing mechanical operations (e.g., data input). **CPLX4**: It would take too long to learn how to use an online PHR to make it worth the effort.	Thompson and Higgins (1991)
PHR Self-Efficacy (SE) Adaptation: For each item in this scale, the name of the system was changed to "online PHR".	
SE1: I am confident that I can use an online PHR if I was only provided with the online instructions for reference. **SE2**: I am confident that I can use an online PHR even if there is no one around to show me how to do it. **SE3**: I am confident that I can use an online PHR even if I have never used such a system before. **SE4**: I am confident that I can use an online PHR if I have just seen someone using it before trying it myself. **SE5**: I am confident that I can use an online PHR if I just have the online "help" function for assistance.	Tan and Teo (2000)

The references from which measurement scales for self-determination theory variables were obtained are presented in Table 4.3. The table also provides a description of the adaptation for the basic needs satisfaction scale. The scales for physician autonomy support and autonomous causality orientation were used without adaptation since the original scales fit the context of this study. Finally, for each scale the table provides source(s) in which validities and reliabilities of

the original scales are established. All the scales in Table 4.3 are 7-item Likert scales.

Table 4.3: Measurement scales for self-determination theory variables

Scale	Source
Basic Needs Satisfaction (BNS) This scale includes 21 items of which, 7 items relate to the need for autonomy, 6 items relate to the need for competence, and 8 items relate to the need for relatedness. Recall from the previous chapter that the three basic needs in self-determination theory are the needs for autonomy, competence, and relatedness. Each item in this scale relates to only one of the three needs. As such, the questions related to autonomy are coded as BNS_A; the competence related questions are coded as BNS_C, and the relatedness questions are coded as BNS_R. Finally, for each item in this scale, the context for which satisfaction of basic needs was being assessed was changed to "managing health". As an example, below is an item that relates to the need for autonomy: **BNS_A1**: I feel like I am free to decide for myself how to manage my health.	Deci et al. (2001)
Physician Autonomy Support (PAS) The 6-item Health Care Climate Questionnaire (HCCQ) was used.	Williams et al. (1999)
Autonomous Causality Orientation (ACO) The three causality orientations (autonomy, control, and impersonal) were measured using the General Causality Orientations Scale (GCOS), 12 7-point Likert items per causality orientation. For each of the three orientations, one score is calculated for each individual by summing the values of the corresponding 12 items. Recall from Section 3.2.2.3 of this dissertation that self-determination theory distinguishes between three types of causality orientations in each person: autonomous orientation, controlled orientation, and impersonal orientation. While the focus of this research is only on autonomous orientation, due to the design of the scale, questions related to all the three types must be asked together to ensure validity.	Deci and Ryan (1985a)

Recall from the previous chapter (Section 3.3) that the sixth research question of this study pertains to the investigation of the impact of individual characteristics (age, gender, Internet experience, and education level) on an individual's adoption of integrated PHR systems. Previous research has examined the influence of these individual characteristics on technology adoption (e.g., Compeau and Higgins (1995b)). Therefore, related questions were included in the survey of this study.

In addition to the abovementioned closed-ended questions, two open-ended questions were included in the survey of this study. The two questions were designed to collect data on participants' perceptions regarding the use of integrated PHR systems in order to gain further insights on consumer preferences and opinions regarding integrated PHR system adoption. Recall from the previous chapter that in the research model of this study (Figure 3.9), behavioural intention is the endogenous variable. Research on IS adoption shows that perceptions of using information systems are major factors that determine an individual's behavioural intention to use such systems (Davis 1989; Davis et al. 1989; Venkatesh et al. 2003). Therefore, the two questions were designed to ask participants to describe what about integrated PHR systems would result in their intention (or the lack thereof) to use such systems. As such, data on participants' responses to the following two open-ended questions were also collected to be examined in this study:

- What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?
- What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?

The survey of this study also included questions related to several control variables whose influences on integrated PHR system adoption were proposed to be examined. Table 4.4 presents a list of those "control variables" and the associated questions.

Table 4.4: Measurement of control variables of this study

Control Variable	Associated Survey Question	Source
Perceived Health Status	1- How would you evaluate your health in general? 2- Compared to women/men your age how would you evaluate your health? *(7-point "bad" to "excellent")*	Lafky and Horan (2008) Questions were obtained from Kaplan and Baron-

Control Variable	Associated Survey Question	Source
		Epel (2003)
Chronic Illness	Do you currently live with any chronic condition/disease? *(Yes, No, Prefer not to say)*	(Morton (2011); Smith et al. (2012))
Frequency of Doctor Visit	How many times have you visited your family doctor in the past 12 months? *(Never, Once, Twice, Three times, Four times, Five times, More than five times)*	Lafky and Horan (2008)
Years with Family Doctor	How many years have you been with your current family doctor?	None. This question was included specifically to control the influence of it on the physician autonomy support variable.
Family Health Responsibility	Are you responsible for managing the health of anybody other than yourself? Examples: Parents, children, other family members. *(Yes, No)*	None. This question was included to control for the influence of it on the perceived usefulness of integrated PHR systems.
Use of Paper Records	Do you currently collect or have you previously collected your health records in a paper-based form? *(Yes, No)*	None. This question was included to control for the influence of a prior somewhat similar experience in managing health record.

Control Variable	Associated Survey Question	Source
Information Privacy Concerns[7]	For each statement below, select the option that best describes your opinion about an online PHR similar to the one in the video clip. * *(7-point "strongly disagree" to "strongly agree")* 1- I am concerned that I would have to store too much information about myself in an online PHR account. 2- I am bothered that I would have to store my personal information in an online PHR account. 3- I am concerned about my privacy when using an online PHR. 4- I have doubts as to how well my privacy would be protected on an online PHR. 5- My personal information could be misused if I use an online PHR. 6- My personal information could be accessed by unknown parties if I use an online PHR.	(Asim et al. (2011); Shoniregun et al. (2010)) Questions were obtained from Pavlou et al. (2007)
Information Security Concerns	For each statement below, select the option that best describes your opinion about an online PHR similar to the one in the video clip. *(7-point "strongly disagree" to "strongly agree")* 7- I would feel secure in providing sensitive information (e.g., my health records) when using an online PHR. 8- I would feel totally safe	

[7] Given the focus of this dissertation which is examining the role of self-determination theory factors in PHR system adoption, privacy and security concerns were not included in the research model of this study in order to preserve the parsimony of the proposed model. However, since several studies have suggested consumers' privacy and security concerns to be major barriers of PHR system adoption, questions related to these two variables were included in the survey in order to control for the effects they might have had on integrated PHR system adoption.

Control Variable	Associated Survey Question	Source
	providing sensitive information about myself when using an online PHR. 9- I would feel secure sharing sensitive information on an online PHR. 10- The security issue of sensitive information would be a major obstacle to my using an online PHR. 11- Overall, an online PHR is a safe place to store/send sensitive information.	
Household Income	What is your household income? *Less than $40,000* *$40,000 - $79,999* *$80,000 - $119,999* *$120,000 - $159,999* *More than $160,000* *Prefer Not to Say*	Lafky and Horan (2008)
Retirement	Are you retired? *(Yes, No, Prefer Not To Say)*	Lafky and Horan (2008)

Finally, the survey of this study included four questions that were intended to determine the eligibility of survey invitees to participate in the study. Only persons living in Canada (the target population of this study), above the age of eighteen (ethical consideration), with a family physician (the measurement items of physician autonomy support relate directly to the participants' family physician), and with no prior experience in using PHR systems of any type (the focus of this study is on pre-usage stage of PHR system adoption) were eligible to participate in this study.

4.1.3 PHR Introduction Video Clip

Since this study is targeted at individuals with no prior experience in using PHR systems, an online video clip was created and used to introduce such systems to study participants. The purpose of the video clip was to provide participants with introductory information about integrated PHR systems and to show them how an integrated PHR system can be used through a few real life

scenarios. The video clip was displayed to the participants as part of completing the survey as explained under data collection procedure in Table 4.1. This section provides an overview of the process of creating the video clip. As such, the followings are discussed: advantages and justification for using a video clip, content of the clip, video clip development steps, and technical considerations.

4.1.3.1 Why Use A Video Clip?

A video-based introduction to integrated PHR systems was preferred to training participants on an actual system for the following reasons. First, as described in Chapter 2 of this dissertation, PHR systems are relatively new phenomena. As a result, at the time of designing this study, there were not many integrated PHR systems available to the author. A few available PHR system vendors were contacted; however, of those systems whose vendors responded, none provided the range of features and functionalities suggested in the literature. Second, creating the video clip by the author provided great flexibility in terms of delivering information to participants as well as introducing the range of PHR functionalities sought in this study. Third, presenting a fictitious integrated PHR system in the video clip instead of an actual existing system helped avoiding possible effect of any commercial brand on perceptions of study participants regarding the system. Fourth, as described later in this chapter, the video clip was created based on information gathered from multiple sources including published research papers, review websites, expert opinions, and a number of available PHR systems. It is believed that this approach of creating the video clip would enhance the generalizability of findings of this study by presenting an integrated PHR system with a comprehensive set of features and functionalities. Fifth, using an online video clip would allow reaching a wider audience regardless of their demographics, geographical location, and schedule, thus improving the sample of this study in terms of its representativeness of the Canadian population. Finally, Davis et al. (1989) suggest that, in the absence of an actual system, video mockups can help shape the perceptions of consumers regarding the system. Such video mockups can be used to "create realistic facades of what the system consists of".

Introducing integrated PHR systems to study participants using a video clip was favoured over using text-based material, still images, and slides. Multimedia material, such as video clips, can introduce the dynamic features of a product (e.g., an integrated PHR system) to consumers in a richer format (Raney et al. 2003). Increasingly, commercial websites employ video clips to present product features (Jiang and Benbasat 2007a; Jiang and Benbasat 2007b).

Using a video clip provides greater vividness in presenting product features to consumers compared to text-based material and static images (Jiang

and Benbasat 2007b). This is because video presentations incorporate ongoing visual stimuli and sound effects (Coyle and Thorson 2001). Vividness is defined as "the representational richness of a mediated environment as defined by its formal features; i.e., the way in which an environment presents information to the senses" (Steuer 1992). Jiang and Benbasat (2007a) showed that, in an online shopping website, higher vividness in presenting a product would result in higher perceived diagnosticity of the website. Perceived diagnosticity of a website refers to "consumers' perceptions of the ability of a website to convey relevant product information that can assist them in **understanding and evaluating the quality and performance of products** sold online" (Jiang and Benbasat 2005). Finally, Jiang and Benbasat (2007b) showed that in an online shopping context, compared to using static picture presentation of products, using narrated video clips resulted in consumers' higher levels of understanding of products in terms of actual product knowledge.

Given the focus of this study which was the pre-usage stage of integrated PHR system adoption process, the objective of the created video clip was to provide an initial introduction to a full range of integrated PHR system features and functionalities rather than providing a deep understanding of a selected set of functionalities. Experimental research has shown that, for the purpose of introducing products to consumers on a website, narrated video clips facilitate greater breadth of recall compared to text and image-based presentations (Li et al. 2012b).

In terms of the effectiveness of various representation formats (e.g., text, images, video) for introducing decision making tasks, research has shown that multimedia representations are never less effective than text-based representations in reducing perceived equivocality of the introduced tasks (Lim and Benbasat 2000). This is especially relevant to the current study in that the video clip incorporated tasks and scenarios in order to introduce integrated PHR systems. An overview of the contents of the video clip will be presented later in this section. Finally, examples of research showing the effectiveness of video clips are abundant for various educational purposes (e.g., Battersby et al. (1993), Hu and Hui (2012), Joseph et al. (2006), Wang et al. (2008), Woods and Marcks (2005)) as well as for software skills training (e.g., Compeau and Higgins (1995a), Gist et al. (1988), Mun and Davis (2003)). The lengths of the video clips created and used in these examples range from 8 to 30 minutes.

4.1.3.2 Video Clip Content

In terms of content, the created video clip consisted of two main segments: explanation of concepts and demonstration of functionalities. This is consistent with prior work in the domain of software skills training using video clips. e.g., Mun and Davis (2003). The first segment involved conveying general information

regarding integrated PHR systems through a series of narrated text-based slides. In this segment, participants were informed of the objective of the video clip, definition of integrated PHR systems, functional and informational purposes of integrated PHR systems, how to create an account on and start using an integrated PHR system, and various methods of entering and updating health information on the system.

The second and the larger segment of the video clip involved an overview of integrated PHR systems features and functionalities as well as presenting three fictitious system usage scenarios. Scenarios were employed in this study following the demonstration of their success by Lankton and St. Louis (2005) in assessing consumer perceptions of health care information systems. Scenarios are "task-based expressions of human machine interactions and can include textual descriptions, screen layouts (either drawn on paper or created using a computer application), and graphical stories" (Lankton and St. Louis 2005). Scenarios are typically used for obtaining perceptions of potential users of various information systems (Carroll and Rosson 1992; Lankton and St. Louis 2005; Van Buskirk and Moroney 2003), and they can help explain beliefs, attitudes, and intentions towards using information systems (Lankton and St. Louis 2005; Van Buskirk and Moroney 2003).

In developing the scenarios for this study, all the effort was put to include as many integrated PHR system features and functionalities as possible, and to make the scenarios simple and easy to understand. In addition, the three scenarios were developed in such way that they covered a wide range of health and wellness needs, and targeted audiences with various demographics.

4.1.3.3 Video Clip Development Process

For the purpose of presenting integrated PHR system functionalities and the scenarios, the following steps were taken as summarized in Figure 4.1.

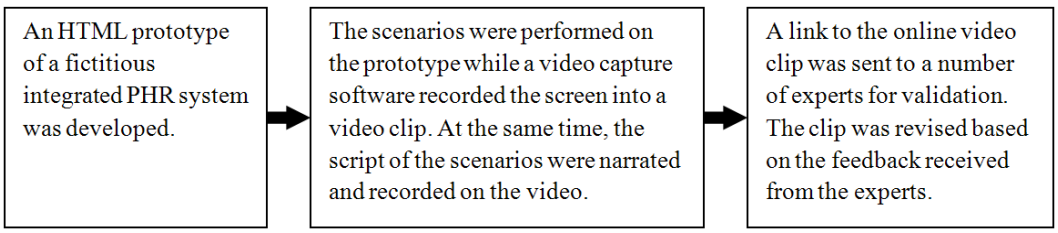

Figure 4.1: The process of creating the PHR introduction video clip

An HTML[8] prototype of a fictitious integrated PHR system was developed which included the main page of the system as well as all the pages required to present the written scenarios. The prototype was developed based on the review of the literature presented in Chapter 2 of this dissertation. In addition, four existing online PHR systems[9] were reviewed in order to guide the design of the prototype. Furthermore, content of a website[10] that provides reviews of existing PHR systems was considered in developing the prototype. Using the prototype in the video clip was favoured over using still images in order to provide study participants with better clues for evaluating different aspects of a typical PHR system. Using the prototype allowed for a model-based training of participants on using integrated PHR systems. Model-based training is a software training method in which trainees watch someone else perform tasks within a software application before trying to reenact it themselves (Mun and Davis 2003). Prior research has shown that such behaviour modeling is a highly effective form of computer skill training, and it results in better training outcomes when compared to other methods (Mun and Davis 2003) such as lecture-based instruction (Compeau and Higgins 1995a; Johnson and Marakas 2000), computer-aided instruction (Gist et al. 1988), and self-study from a manual (Simon and Werner 1996). According to Bandura (1986) such a behaviour modeling enhances learning by causing trainees to "transform what they observe into succinct symbols to capture the essential features and structures of the modeled activities" (Mun and Davis 2003). These symbols play an influential role in the early stages of learning by guiding the actions of trainees (Bandura 1986). A few snapshots of the HTML prototype can be seen in Appendix B of this dissertation.

After the HTML prototype was developed, the scenarios were followed one by one on the prototype, and a video capture software package was used in order to record the screen while the tasks in the scenarios were being completed. At the same time as the video was being recorded, the script of scenarios was narrated and recorded into the video[11].

Finally, the resultant draft of the video clip was uploaded on Youtube, and a link to it was sent to a number of experts in order to ensure the contents of the clip represented typical functionalities of an online integrated PHR system. The experts included four information systems faculty members at the DeGroote

[8] Hypertext Markup Language

[9] Web addresses for the four PHR websites:

- www.myoscar.org
- www.telushealthspace.com/
- www.microsoft.com/healthvault
- www.webmd.com/health-manager

[10] www.phrreviews.com

[11] The video clip is available to watch at this web address:
http://www.youtube.com/watch?v=XFBrErOcq9w

School of Business, McMaster University, with extensive research experience in the areas of IS adoption, eHealth, and PHR systems. In addition, three MSc e-Health students working as interns on the MyOscar[12] project, an active open-source integrated PHR system, provided feedback on the video clip. Subsequently, the video clip was revised based on the feedback received from the experts.

4.1.3.4 Technical Considerations

The following section describes the technical considerations regarding the video clip. First, the final video clip was 13 minutes and 25 seconds long which, as mentioned earlier, is consistent with prior research on both software skill training and educational video clips. Second, the video was uploaded onto the video sharing website YouTube, and it was embedded in one of the pages of the online survey. Third, a JavaScript code was embedded in the video clip that, for an amount of time equal to the length of the clip, prevented participants from moving on to the next page of the survey website. The JavaScript code can be found in Appendix A as part of the online survey content. Fourth, all the video playback control buttons were disabled to ensure participants did not skip any part of the video while watching it. Fifth, the video dimensions were set to automatically fit to the screen size of the viewer (i.e., the maximum possible size for each viewer). Sixth, the quality and specifications of the video were tested on several different types of computers and hand-held devices, with various screen sizes, screen resolutions, operating systems, and web browsers.

4.1.4 Recruitment of Participants

Participants were recruited through Research Now™[13], a commercial market research firm with a consumer panel that includes over 400,000 Canadians. The invitations were sent out balanced based on participant location, age, and gender, according to the 2011 Canadian Census Profile provided by Statistics Canada (Statistics Canada 2012). Participants were invited by Research Now via an email that contained a hyperlink to the website for Part 1 of the survey. Each participant was assigned a unique ID by Research Now, and this ID was stored once the participant entered the survey website. Once a participant completed Part 1 of the survey, this ID was used to invite the participant to fill out Part 2 of the survey. Each participant received the invitation to Part 2 of the survey, on average, a day and a half after he/she completed Part 1.

[12] www.myoscar.org
[13] http://www.researchnow.com/en-CA.aspx

Compared with researcher-administered survey strategies, mail (and email) surveys are not at risk of interviewer bias as they are self-administered (Sivo et al. 2006). In addition, email recruitment helped overcome physical limitations in reaching for a wider audience across the target population (Canadian public) which, in turn, would enhance the representativeness of the drawn sample. The representativeness of the sample would be further enhanced by random sampling of the target population; thus it would enhance generalizability of the findings of the study (Newsted et al. 1998).

4.1.5 Instrument Pretest, Study Pilot, and Research Ethics

Prior to conducting data collection for the study, a pre-test of the instrument was conducted by inviting PhD students and three IS faculty members at the DeGroote School of Business to complete the survey and provide their feedback on the instrument. Their feedback and responses to survey questions resulted in minor revisions to the questions as well as data collection procedures. Upon finalizing the online survey, a pilot was conducted through Research Now with the purpose of diagnosing any possible flaws in data collection procedures. As a result, 20 participants filled out the survey. The pilot study did not result in any changes in either data collection procedures or the measurement instrument. Therefore, the 20 data cases were included in the final data set for this study. Finally, prior to conducting any sort of data collection, an ethics application was submitted to and was approved by the McMaster Research Ethics Board.

4.2 Data Analysis

This section provides an overview of major data analysis procedures and techniques employed in this study. Further details are provided in the next chapter along with the results of analyses. This section provides an overview of the following: assessment of common methods bias, validation of the research model of Figure 3.9, analysis of the impact of individual characteristics and control variables on integrated PHR system adoption, examination of data gathered on participants' responses to the open-ended questions, and sample size requirements for this study.

4.2.1 Common Method Bias

Common method bias (CMB) refers to the variance (common method variance) attributable to the measurement method rather than the hypothesized

relationships among items and their respective latent variables or among latent variables (Bagozzi et al. 1991; Marsh and Hocevar 1988; Straub et al. 2004). Although there are arguments that advise common method variance (CMV) does not make significant differences in IS research (Malhotra et al. 2006), such variance is suggested to be a main concern in self reported studies like the current study, and it can be a threat to the validity of the findings of the study (Podsakoff et al. 2003; Sharma et al. 2009). Therefore, it was decided to design the survey of this study following the guidelines suggested by Podsakoff et al. (2003) in order to minimize the threat of CMV. In addition, it was decided to assess the potential presence of CMB in the findings of this study as suggested by Straub (2009). The procedures for prevention and detection of CMB are explained below this paragraph.

In order to minimize CMV, the following actions were taken. First, as explained at the beginning of this chapter, the survey of this study was divided into two parts, and each part was completed by participants in a separate sitting. The time between completing the two parts of the survey for each participant ranged from 12 hours to 8 days, with an average of 36 hours in between completing the two parts of the survey. Such a *temporal separation of measurement* (Podsakoff et al. 2003) reduces the possibility of participants' responding to Part 2 questions based on what they remember from Part 1 questions, thus reducing the effect of consistency motif on the responses. Consistency motif is suggested to be a source of CMV (Podsakoff et al. 2003) (Podsakoff and Organ 1986). Second, the survey questions were ordered such that the questions for the endogenous variables were presented to participants before the questions for the exogenous variables. Such *counterbalancing* of the order of questions is suggested to reduce the threat of CMV (Podsakoff et al. 2003). Third, participants of this study were informed that data collection for this study was being conducted anonymously. Protecting respondent anonymity and reducing *evaluation apprehension* is another factor that is suggested to reduce CMV (Podsakoff et al. 2003). Fourth, the risk of CMV was believed to be lessened by the inclusion of a number of negatively worded items in the measurement instrument of this study (Lindell and Whitney 2001).

Although all attempts were made to alleviate the threat of CMV in this study, the influence of CMV on the results of the study needs to be assessed (Straub 2009). Chin et al. (2012) and Podsakoff et al. (2003) provide lists of prevalent techniques that can be used to control for and detect CMV. Each of these techniques possesses specific characteristics and limitations. Based on an examination of their specifications and limitations, two techniques that were applicable to the current study were selected to be conducted. The two techniques were Harman's one factor test (Podsakoff et al. 2003; Podsakoff and Organ 1986; Podsakoff et al. 1984), and unmeasured latent marker construct technique (Liang

et al. 2007; Richardson et al. 2009). Technical details of these procedures are presented in the next chapter along with the results.

4.2.2 Research Model Validation

Structural equation modeling (SEM) was used to validate the proposed research model of this study. SEM allows for the analysis and investigation of unobservable variables that are indirectly measured from observable variables (Chin 1998a; Chin 1998b). In particular, SEM approach of Partial Least Squares (PLS) was used in this study. The choice of SEM approach depends on the objectives of specific research (Gefen et al. 2011). Accordingly, PLS was chosen for evaluating the proposed model of this study for the following reasons: First, PLS gives optimum prediction accuracy because of its prediction orientation (Fornell and Cha 1994), and this characteristic of PLS is well suited to the overall objective of this study which is to understand what factors would predict consumers' intention to use integrated PHR systems. Such prediction is offered in PLS by determining the portion of the variance in the endogenous variable that is explained by exogenous variables. Second, in situations where the phenomenon being researched is relatively new, or where the theoretical model is in the early stages of development, the PLS approach is more suitable (Chin and Newsted 1999). As mentioned in previous chapters of this study, both PHR systems and PHR system adoption are relatively new phenomena. Furthermore, the proposed research model was developed and evaluated for this study for the first time. Third, as mentioned in the previous chapter, the construct of basic needs satisfaction was modeled [14] and measured in this study as a second-order construct. PLS is a strong and flexible approach for evaluating models with higher order constructs (Chin 2010a; Chin 2010b; Hair et al. 2011; Roldán and Sánchez-Franco 2012).

PLS analyses were conducted and reported in this study following a two step approach as suggested by Chin (2010b). In the first step, quality of the measurement model was assessed in terms of reliability and validity (measurement model evaluation). Tables 4.5, 4.6, and 4.7 provide a summary of techniques employed for the evaluation of measurement model quality. Construct reliability refers to the extent to which a set of items are consistent in measuring what they intend to measure (Straub et al. 2004). Individual item reliability refers to the extent to which each item is an adequate measure of its corresponding construct (Churchill Jr 1979). Discriminant validity is indicative of whether constructs in the model are conceptually distinct and whether measurement items adequately discriminate model constructs (Chin 2010b; Straub et al. 2004). While construct reliability is an issue of measurement within a construct, validity is an issue of measurement between constructs (Straub et al. 2004).

[14] The modeling and estimation of the second-order factor using PLS is explained in Chapter 5.

Table 4.5: Summary of individual item reliability tests included in the measurement model evaluation

Test Criteria and Acceptance Rule	Notes
Corrected Item-Total Correlation > 0.40	• Corrected item-total correlation of an item is the coefficient of the correlation between the item and a total score for the remaining items of the item's construct (Cohen and Cohen 1975). • Items with a coefficient value below 0.4 would be eliminated from further stages of analysis (Churchill Jr 1979; Doll and Torkzadeh 1988; Kerlinger 1978; Torkzadeh and Lee 2003). Such a purification of measures must be done at the early stages of research before any analysis of factors (Churchill Jr 1979). • While there is no accepted standard cutoff, as a rule of thumb, values above 0.40 or 0.50 are considered high enough (Doll and Torkzadeh 1988; Kerlinger 1978; Torkzadeh and Lee 2003). For the purpose of this study, 0.40 was selected as the cutoff value to drop an item because (1) PLS estimates are more robust with more information (i.e., number of items, in this case), therefore, items must be dropped with caution, and (2) weak items are factored in PLS with low loadings (Henseler et al. 2009).
Item Loading > 0.50	While an item loading of at least 0.707 is suggested to be high enough to consider an item as part of a construct, when scales are adapted for a different context, or in the early stages of theory development, the 0.707 guideline is too stringent (Barclay et al. 1995; Chin 1998a; Chin 1998b). Since, in PLS, weak indicators are factored in by lower weights, it is a good idea to keep items, to the extent it is possible, to ensure content validity (Hair et al. 2011; Roldán and Sánchez-Franco 2012). However, all of the abovementioned references suggest eliminating very weak indicators (Roldán and Sánchez-Franco 2012). Gefen et al. (2000)suggest keeping items with loading above 0.50.

Table 4.6: Summary of construct reliability tests included in the measurement model evaluation

Test Criteria and Acceptance Rule	Notes
Cronbach's Alpha > 0.70	• Alpha is a measure of internal consistency of a construct (Cronbach 1951). • 0.70 is the minimum acceptable value for Alpha in early stages of theory development or in adaptations of measurement instruments (Nunnally and Bernstein 1994). Alpha of 0.80 is considered to be a strict minimum for advanced stages of instrument development (Nunnally and Bernstein 1994).
Composite Reliability (CR) > 0.70	• CR is a measure of internal consistency reliability of a construct as compared with other constructs in the model, whereas Cronbach's Alpha is only on the basis of the single construct (Werts et al. 1974). • CR above 0.70 is acceptable for adapted instruments. CR above 0.80 is a more strict threshold for advanced stages of instrument development (Nunnally and Bernstein 1994).
Average Variance Extracted (AVE) > 0.50	• AVE is the amount of variance that is captured by the construct in relation to the amount of variance due to measurement error (Fornell and Larcker 1981). • AVE greater than 0.50 is acceptable, and it means more than 50% of the variance in indicators is accounted for by the latent variable and not measurement error (Chin 1998b; Fornell and Larcker 1981).

Table 4.7: Summary of discriminant validity tests included in the measurement model evaluation

Test Criteria and Acceptance Rule	Notes
Each measurement item should have a higher loading on its corresponding construct than on other constructs (i.e., greater loading than cross-loading) (Chin 1998b).	Typically, a table is constructed in which rows represent measurement items and columns represent model constructs, and each cell contains the loading of a measurement item (row) on a construct (column) in the model. First, by looking at each column, indicator loadings must be greater than cross-loadings. This means that the latent variable presented in the specific column relates with its own indicators than with indicators of other constructs. Second, by scanning the rows, each indicator must have loadings greater than cross-loadings. This means that the indicator adequately distinguishes its corresponding construct from other constructs (Chin 2010b).
The square root of the AVE of each construct must be greater than correlations of that construct with other constructs in the model.	For discriminant validity to hold, a construct must be more strongly related with its own measure than with other constructs, and this is investigated by examining the overlap in variance between constructs (Chin 1998b).

The second step of the two step approach of conducting and reporting the PLS analyses of this study involves the evaluation of the validity of the proposed theoretical model (structural model evaluation). Table 4.8 presents a summary of criteria used in PLS for the purpose of evaluating the proposed model of this study.

Table 4.8: Summary of criteria used to evaluate the structural model using PLS

Evaluation Criteria	Calculation	Notes
Coefficient of Determination (R^2): The proportion of variance in a dependent variable explained by its antecedents (Rao 1973).	Obtained from PLS software.	• R^2 is a measure of the success of predicting the dependent variable from the independent variables (Chin 1998b; Chin 2010b). • R^2 should be high enough to achieve adequate explanatory power (Urbach and Ahlemann 2010). • R^2 should be at least 0.10 (Falk and Miller 1992).
PLS Path Estimates: Coefficients (β), Signs, and Significances	Obtained from PLS software.	• Significances were determined using bootstrapping technique. Bootstrapping is an approach for examining the precision and stability of PLS results (Chin 1998b; Chin 2010a; Chin 2010b). As such, a number of resamples with replacement (typically 500) is created from the original sample to obtain 500 estimates for each parameter in the PLS model. Then, *t*-tests for each estimated parameter in the PLS model is calculated from the 500 bootstrap estimates for that parameter (Chin 2010a; Efron and Tibshirani 1993), thus determining the statistical significances of the parameters.

Evaluation Criteria	Calculation	Notes
Effect size (f^2) is used to determine whether an independent variable (IV) has substantive impact on a dependent variable (DV) (Chin 2010b).	PLS results are calculated once with the IV included in the model, and once with the IV excluded from the model. Then, the effect size is calculated based on R^2 of the DV as formulated below: $$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$	f^2 of 0.02, 0.15, 0.35 can be viewed as small, medium, large effects respectively (Chin 2010b; Cohen 1988).
Q^2 (Cross-validated redundancy) represents a measure of **predictive relevance of the model**, i.e., how well observed values are reconstructed by the model (Chin 2010b).	Calculated by PLS software following an approach suggested by (Geisser (1975); Wold (1985)).	Q^2 (Cross-validated redundancy) is used to examine the predictive relevance of the structural model. $Q^2 > 0$ implies the model has predictive relevance, whereas $Q^2 < 0$ represents a lack of predictive relevance (Chin 2010b).
Goodness of Fit (GoF) of the Model: **Absolute GoF** can be used to examine the PLS model in terms of overall (both measurement and structural levels) prediction performance (Tenenhaus et al. 2004; Vinzi et al. 2010).	Calculated using PLS software output as the geometric mean of the average communality index and the average R^2. $$GOF = \sqrt{\overline{Communality} * \overline{R^2}}$$	The baseline values of 0.1(low fit), 0.25 (medium fit), and 0.36 (high fit) can be used to assess the overall fit of the model (Tenenhaus et al. 2005; Wetzels et al. 2009).

Evaluation Criteria	Calculation	Notes
Relative GoF is a normalized version of the absolute GoF, and it is bounded between 0 and 1 (Vinzi et al. 2010).	Absolute GoF is normalized by relating each term in the above formula for absolute GoF to the corresponding maximum value (Vinzi et al. 2010).	Relative GoF >.9 speaks in favour of the model in terms of the fit of the model to the observed data (Vinzi et al. 2010).

Finally, PLS analyses were conducted using SmartPLS[15] software due to its ease of use as well as its capability of executing the range of procedures reported in Chapter 5 of this dissertation (Temme et al. 2010).

4.2.3 Analysis of the Impact of Individual Characteristics and Control Variables

Recall from the previous chapter that the sixth research question of this study pertains to understanding the influence of individual characteristics on the adoption of integrated PHR systems. In order to examine the influence, two different procedures were conducted. The first procedure involved examining the changes caused by each individual characteristic (e.g., age) in the explained variance of every endogenous construct in the proposed model. The second procedure involved examining the significance of PLS path coefficients for relationships between each individual characteristic and every construct in the model. These two procedures were also employed for examining the impact of a number of control variables whose data were collected in this study. Technical details of these procedures are presented in Chapter 5 along with the results.

4.2.4 Examination of the Open-Ended Questions

Recall that the survey of this study employed two open-ended questions in order to gather insights on the perceptions of participants regarding the use of integrated PHR systems. The questions asked participants to point out the reasons why they would/would not use an integrated PHR system. Responses to these two questions were examined and summarized in terms of frequency of occurrences of each reason provided by participants. Results of this examination are presented in Chapter 5 of this dissertation.

4.2.5 Sample Size Requirements

There are two criteria that would impose minimum sample size requirements on this research: minimum number of data cases (i.e., participants)

[15] SmartPLS; Version: 2.0.M3; http://www.smartpls.de.
All default settings were used:

- Path Weighing Scheme: Mean 0 Var 1, Max Iterations 300, Abort Criterion 1.0E-5, Initial Weights 1
- Bootstrapping: No sign changes
- Blindfolding: Omission Distance = 7

required for running the PLS analyses (30 for this study) and minimum number of cases required to achieve an acceptable statistical power in detecting a desired effect size for the relationships in the proposed model (76 for this study). As such, minimum sample size for this dissertation study would be 76, the larger of the two. Details of minimum sample size calculation are discussed below.

The minimum number of data cases required to validate the proposed research model using PLS is calculated as ten times the most number of predictors, i.e., ten times the larger of the following two numbers (Barclay et al. 1995; Chin et al. 2003): (i) number of predictors in the measurement block (i.e., variable) with the most number of predictors. In a research model containing only reflective variables, this number is always 1 (Chin et al. 2003). In such a case, for each variable the only predictor is the latent variable itself that is theorized to predict its associated indicators; (ii) the largest number of paths leading to a single dependent variable.

In the proposed model of this dissertation (Figure 3.9), all the variables are reflective; thus, the number of predictors in the variable with the most number of predictors is 1. Perceived usefulness has the largest number of paths (3) leading to it. Therefore, the minimum sample size required to validate the proposed research model of this study using PLS is 30 (10 x 3).

Another criterion that imposes a minimum sample size requirement on this research is the minimum number of cases required to achieve an acceptable statistical power in detecting a desired effect size for the relationships in the proposed model. Consistent with common practice in IS, this study targeted detecting at least *medium* effect sizes (Roldán and Sánchez-Franco 2012). The minimum sample size required to achieve an acceptable statistical power (i.e., power of 0.80) in detecting medium effect sizes for a model with 3 predictors is 76 (Chin and Newsted 1999; Cohen 1988; Roldán and Sánchez-Franco 2012).

CHAPTER 5: Data Analysis and Results

This chapter describes how the data for this study were obtained and analyzed. Results of the analyses are also presented here. In particular, this chapter involves the followings. First, administration of the online survey of this study is discussed, followed by description of treatments to the data prior to main analyses. Then the demographics of participants are presented and discussed. Further, analysis of the proposed research model is presented followed by the analysis of the impact of individual characteristics and control variables. Finally, this chapter concludes with the examination of data collected through open-ended questions.

5.1 Survey Administration

Recall from the methodology chapter that data collection for this study was conducted using a cross-sectional survey method. Recruitment of participants was done via e-mail invitations sent by a market research firm (Research Now). The recruitment of participants and the administration of the survey of this study ran from August 1, 2012, to August 17, 2012. Recall that the entire survey was divided into two parts (Part 1 and Part 2), such that each of the two parts was completed by each participant in a separate sitting (Table 4.1). In total, 6423 persons were invited, of which 508 individuals completed Part 1, and 173 completed Part 2 as well.

Response rate in survey research refers to the percentage of people who complete the survey among all people invited to complete it (Shaughnessey et al. 2012). Several survey characteristics may influence the response rate of a survey (Cook et al. 2000). For example, length of a survey is frequently suggested to influence its response rate (Chin et al. 2008). As a result, it is impossible to indicate a single standard response rate that would apply to any survey regardless of survey characteristics. For example, in a review that involved survey research published in top-tier IS journals[16], Sivo et al. (2006) noted that response rates of surveys had a wide range from 3% to 100%. The response rate for Part 1 of the survey of this study was 7.91%, for Part 2, it was 34.06%. Considering the length of the survey, participants' having to watch a video clip, and participants' having to complete the survey in two sittings, the obtained response rates are reasonable.

[16] The reviewed journals included the Journals of Association for Information Systems, Information Systems Research, Management Information Systems Quarterly, European Journal of Information Systems, Management Science, and Journal of Management Information Systems.

In survey research, sample representativeness is more important than response rate (Cook et al. 2000). Stratified random sampling is an approach that increases sample representativeness (Shaughnessey et al. 2012). As such, the population of interest is divided into subpopulations from which random samples are drawn. Recall from the methodology chapter that the survey for this study was targeted at the Canadian general public. For the purpose of this study, the Canadian population was divided into various subpopulations based on age, gender, and geographical location (Canadian province of residence). The proportions of the subpopulations were determined based on the 2011 Canadian population census (Statistics Canada 2012). In collecting data for this study, a cap was placed on the number of participants recruited from each of the determined subpopulations. Participants were asked to indicate their age, gender, and province of residence at the beginning of the survey. The online survey tool (LimeSurvey) allowed for placing the caps. Section 5.3 of this dissertation presents the demographic information in the final data set of this study.

As mentioned previously, the response rates of this study fall within the range for those of previously published articles in top-tier IS journals. In addition, a stratified random sampling technique was employed to increase the representativeness of the sample of this study. However, further steps were taken in order to examine the possibility of non-response bias in the data set of this study. Non-response bias refers to bias arisen in situations wherein a particular group of people is not represented in a study's sample as a result of the group's choosing not to participate in the study (i.e., not to respond) (Sivo et al. 2006).

The group of respondents of this study (i.e., 173 who completed both parts of the survey of this study) was compared to two groups of non-respondents (i.e., those invitees who did not complete Part 1 and those who did not complete Part 2). The comparisons were conducted based on socioeconomic information as suggested by Sivo et al. (2006)[17]. As such, means of socioeconomic information for the abovementioned groups were compared using independent-samples *t*-tests (Meyers et al. 2006). This test can be used to determine if two groups (i.e., samples) are significantly different from each other. Different variations of the test can be used for samples of equal/unequal sizes and with equal/unequal variances assumed. Variance equalities were tested using Levene's test for equality of variances (Meyers et al. 2006). The tests involved in the mean

[17] Sivo et al. (2006) also suggest comparing samples based on demographic information. However, as mentioned earlier in this section, demographic information was used as part of conducting the stratified random sampling technique. As a result, some of the "non-respondents" were in fact those who were prevented from completing the survey on the account that at least one of the demographic quotas they belonged to was full at the time they entered the survey website. In other words, proportions of demographics were enforced as part of the sampling of this study. Therefore, using demographic information for the purpose of examining non-response bias would have been misleading for this study. Consequently, only socioeconomic information (education level and household income) were used.

comparisons were conducted using IBM SPSS statistical software package (IBM SPSS 2011). Demographic and socioeconomic information (age, gender, education level, household income) of all the study invitees (6423 persons) were obtained from Research Now. Results of the comparisons showed no significant difference (.05 level) between respondents and non-respondents. Hence, it was concluded that non-response bias was not a concern for generalizing the findings of this study.

5.2 Data Treatment

Raw data from the two parts of the survey were merged using a unique ID assigned to each participant by Research Now. This procedure resulted in a data set containing 173 data cases. As a first step of data treatment, the values of negatively worded items were reverse coded by subtracting the values of each from 8. Before conducting the main analyses of this study, this data set was investigated for data anomalies, outliers, and cases with missing data (Meyers et al. 2006). Results of the investigations are provided in this subsection.

Participants of the study answered four mandatory questions regarding the video clip immediately after watching it in order to ensure they did not leave their computers during playback of the clip. The four questions can be found in Appendix A of this dissertation. Responses to these questions were examined in order to investigate possible relationships between the responses to the four questions, and the rest of the survey questions. To this end, the following two procedures were conducted. First, for each respondent a score was calculated by counting the number of correct answers to the four questions. Then, participants were grouped based on their calculated scores. Next, the means of items in Part 2 survey were compared across the created groups. Including Part 1 items was irrelevant since those items were asked before displaying the clip. For the purpose of mean comparisons, One-way Analysis of variance (ANOVA) was employed. One-way ANOVA is a technique used to compare means of values across two or more samples (i.e., groups) (Meyers et al. 2006).The means of the items were not significantly different ($p<0.05$) across the groups.

In addition to investigating the association between the survey responses and the overall score of each participant on the video-related questions, for each of the four video-related questions, respondents were divided into two groups of those who answered correctly and those who answered incorrectly. One-way ANOVA and independent-samples *t*-test were conducted to compare the means of Part 2 items for each pair of groups. The means of the items were not significantly

different in any of the comparisons[18] ($p<0.05$). In summary, it was concluded that participant responses were not influenced by how well they did in answering video-related questions. As a result, no data case was eliminated from the study in association with the responses to the video-related questions.

The data set was further examined to find any patterns of "gaming" by participants. It was noted that five of the participants provided the same answer to all the questions in the survey (both parts). It was believed that these respondents only completed the survey for the purpose of collecting incentives. Therefore, data cases for these five (5) respondents were removed from the data set.

Following Bliemel (2006) and Ruhi (2010), the reverse coded items were used to identify inattentive participants. To this end, for each of the three variables that had reverse coded items, the average score for reverse coded items was subtracted from the average score for the forward coded items. If the magnitude of the calculation for a participant was more than half the scale range, then the associated respondent was identified as being inattentive in responding to questions. As a result, six (6) data cases associated with inattentive participants were eliminated from the data set. Although appropriate measures (e.g., incentives) are taken by Research Now to ensure that participants pay adequate attention while answering all the questions, given the length of the surveys and inclusion of the video clip, removing total 11 cases out of 173 (6%) for gaming patterns and inattentively is reasonable.

The data set was also investigated in order to identify univariate outliers, by drawing box plots (Meyers et al. 2006; Tabachnik and Fidell 2001) for each item that was included in the main PLS (Partial Least Squares) analysis. As a result, three data cases were identified as outliers each having an extreme value for one item only. Since the univariate outliers were very few (less than 2%), it was decided not to eliminate the associated data cases (Cohen et al. 2003; Meyers et al. 2006).

Next, in order to identify multivariate outliers, Mahalanobis distance (Meyers et al. 2006) for each data case was calculated. For each case, the Mahalanobis distance statistic measures the "distance" to the group multivariate mean. Each case is examined using the chi-square distribution with an alpha of 0.001. Cases that fall beyond this threshold are considered multivariate outliers. In this dissertation, all the items included in the main PLS analysis were used for the calculation of Mahalanobis distance. As a result, three (3) cases were identified as multivariate outliers and were investigated for possible elimination from the study as suggested by Meyers et al. (2006). As a result, it was noted that for one of the three cases, total time spent on the surveys was considerably low. The log files of

[18]For some of the questions, the number of incorrect answers was less than 5. As a result, ANOVA was not conducted for those questions. Conducting ANOVA requires at least 5 data cases for each group (Meyers et al. 2006).

the online surveys were examined to calculate the time each participant spent on the survey. The other two cases were also carefully examined, and it was noted that the corresponding participants had only answered one of the four video check questions correctly. Consequently, these three data cases were removed.

Finally, the data set was examined in order to find data cases with missing values. The following items were found to have missing values with the number of data cases in brackets: participant education level (6 cases), retirement status (3 cases), household income (6 cases), and chronic disease affliction (3 cases). The missing values were replaced using mean substitution (Meyers et al. 2006).

To sum up, after eliminating 5 data cases for gaming patterns, 6 data cases for inattentively, and 3 multivariate outliers, 159 valid data cases remained and were used in all subsequent analysis procedures detailed in this chapter (N=159).

5.3 Participant Demographic and Socioeconomic Information

Consistent with guidelines on how to present results of information systems research, particularly those employing PLS (Chin 2010b), this section presents the characteristics of the study participants.

5.3.1 Geographical Location, Gender, and Age

Demographic characteristics of participants are presented in Table 5.1 (geographical location), Table 5.2 (gender), and Table 5.3 (age).

Table 5.1: Geographical location (Canadian province) of participants

Province	Frequency	Percent	Percentage in the 2011 Canadian Census
Alberta	18	11.3	10.5
British Columbia	22	13.8	13.5
Manitoba	6	3.8	3.5
New Brunswick	2	1.3	2.5
Newfoundland	1	0.6	1.5
Nova Scotia	5	3.1	2.5
Ontario	61	38.4	38.5
Prince Edward Island	0	0	1

Province	Frequency	Percent	Percentage in the 2011 Canadian Census
Quebec	39	24.5	23.5
Saskatchewan	5	3.1	3
Total	159	100	100

Table 5.2: Gender of participants

Gender	Frequency	Percent	% in the Canadian Census
Female	83	52.2	51
Male	76	47.8	49
Total	159	100	100

Table 5.3: Age of participants*

Age Group**	Frequency	Percent	% in the Canadian Census
18 -34	48	30.2	27
35-49	32	20.1	26
50+	79	49.7	45
Total	159	100	100

** Minimum: 19; maximum: 82; Mean =48.16; Standard deviation: 16.113*
*** The participant recruitment company (Research Now) was only able to target participants based on the three age groups outlined in this table.*

5.3.2 Internet Experience

Participants responded to two questions that were asked about their experience in using the internet in terms of the number of years they have been using it as well as the average hours per day spent online. Table 5.4 presents the summary of responses to these two questions.

Table 5.4: Participants' internet experience (N=159)

Internet Experience	Mean	Std. Deviation
Years of using the internet	16.6	6.517
Time spent online (hours per day)	3.67	2.433

5.3.3 Education Level

Participants were asked to indicate their level of education. Table 5.5 presents the summary of responses to this question.

Table 5.5: Participants' education level

Education Level	Frequency	Percent
Secondary school or less	23	14.5
Some university or college	36	22.6
University or college degree	71	44.7
Some graduate work	4	2.5
Graduate degree	25	15.7
Total	159	100

5.4 Research Model Validation

Recall that research questions of this study pertained to validating a proposed research model for integrated PHR system adoption. This section describes and presents the results of various steps taken to validate the proposed model. The following subsections describe and present the results of assessing the measurement model, common method bias, the structural model, effect sizes, predictive relevance of the proposes model, goodness of fit of the model, and a saturated model.

5.4.1 Measurement Model Evaluation

As explained in the previous chapter, the first step in validating the research proposed model using PLS was the measurement model evaluation. As such, validities and reliabilities of the measurement scales/items needed to be assessed and confirmed before the validity of the proposed theoretical model was evaluated. This section presents the results of the measurement model evaluation for this study.

Recall from the previous chapters (Sections 3.4, and 4.2.2) that the basic needs satisfaction construct was modeled and measured as a second-order factor. The procedures of measurement model evaluation for the second-order factor must be the same as those performed for the first-order factor (Agarwal and Karahanna 2000; Chin 2010b). As a result, this section is divided into two parts of first-order measurement model evaluation, and second-order measurement model evaluation.

5.4.1.1 First-Order Measurement Model Evaluation

Recall from the previous chapter (Section 4.2.2) that evaluation of the measurement model started with reliability assessments. First, individual item reliability tests were conducted. As a result, five items that did not meet the acceptance criteria were dropped from the study. Individual item reliabilities were established (corrected item-total correlations>0.4; loadings>0.5) after eliminating these items (Table 5.6). Therefore, all further analyses in this dissertation exclude these items. Second, construct reliability tests were conducted (Table 5.7). All the constructs in the study met the acceptance criteria of this study (AVE>0.5; CR>0.7; Cronbach's Alpha >0.7) suggesting that reliability holds for all the variables in this study.

Table 5.6: Results of individual item reliability assessment for the 1st-order model

Construct	Item	Item Loading	Corrected Item-total Correlation
BI	**BI1**	.981	.957
	BI2	.975	.943
	BI3	.979	.952
PU	**PU1**	.945	.902
	PU2	.955	.919
	PU3	.934	.883
	PU4	.953	.915
CPLX	**CPLX1**	.856	.759
	CPLX2	.867	.740
	CPLX3	.868	.780
	CPLX4	.887	.772
SE	**SE1**	.690	.538
	SE2	.885	.804
	SE3	.898	.817
	SE4	.773	.655
	SE5	.892	.807
BNS-Autonomy	**BNS_A1**	.670	.555
	BNS_A2R*	Item dropped	
	BNS_A3	.844	.643
	BNS_A4R	Item dropped	
	BNS_A5	.821	.541

Construct	Item	Item Loading	Corrected Item-total Correlation
	BNS_A6	.575	.506
	BNS_A7R	.589	.501
BNS-Competence	**BNS_C1R**	.686	.473
	BNS_C2	.686	.536
	BNS_C3	Item dropped	
	BNS_C4	.638	.441
	BNS_C5R	.678	.447
	BNS_C6R	.820	.64
BNS-Relatedness	**BNS_R1**	.908	.828
	BNS_R2	.881	.770
	BNS_R3R	Item dropped	
	BNS_R4	.585	.495
	BNS_R5	.895	.849
	BNS_R6R	Item dropped	
	BNS_R7R	.608	.433
	BNS_R8	.832	.735
ACO[19]	**ACO**	N/A	N/A
PAS	**PAS1**	.89	.842
	PAS2	.914	.875
	PAS3	.896	.843
	PAS4	.891	.844
	PAS5	.944	.918
	PAS6	.934	.906

***** *"R": item was negatively worded, and it was reverse coded for the analysis.* ***BI****: Behavioural Intention;* ***PU****: Perceived Usefulness;* ***CPLX****: Complexity;* ***SE****: PHR Self-Efficacy;* ***BNS****: Basic Needs Satisfaction;* ***BNS_A****: Basic Needs Satisfaction (Autonomy);* ***BNS_R****: Basic Needs Satisfaction (Competence);* ***BNS_R****: Basic Needs Satisfaction (Relatedness);* ***PAS****: Physician Autonomy Support;* ***ACO****: Autonomous Causality Orientation*

[19] ACO is a personality index with 12 items. The score for this variable should be the sum of its 12 items (Deci and Ryan 1985a). Consequently, this variable should be estimated in PLS with equal weights (i.e., 1) for each of the 12 items. As a result, individual item reliability, AVE, and CR do not apply to this variable. Nevertheless, Cronbach's alpha was estimated to be .803 for the 12 items which is above the threshold of .7 indicating acceptable construct reliability. In addition, reliability of this scale is established many times in the literature (*see* Ryan and Deci (2000)).

Table 5.7: Results of construct reliability assessment

Construct	AVE	Composite Reliability (CR)	Cronbach's Alpha
BI	.957	.985	.977
PU	.896	.972	.961
CPLX	.756	.925	.893
SE	.692	.917	.885
BNS-Autonomy	.502	.831	.761
BNS-Competence	.501	.830	.743
BNS-Relatedness	.635	.910	.877
ACO	N/A	N/A	.803
PAS	.831	.967	.959

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation*

Followed by the reliability assessment, the first-order measurement model was evaluated in terms of validity. To this end, first, a matrix of item loadings and cross-loadings was generated (Table 5.8), and it was used to examine discriminant validity. The loading of each item on its associated factor was compared to cross-loadings (loading on other factors). All items had higher loadings on their associated factors compared to cross-loadings (rows of the matrix). In addition, all factors loaded higher with their associated items compared to other factors (columns of the matrix). Second, the square root of the AVE of each construct was compared with correlations of that construct with other constructs in the model. To this end, Table 5.9 was created. As seen in the table, every value along the diagonal (square root of AVE) is greater than all the values on the corresponding row and column. Hence, it was concluded that there was confidence in the discriminant validity of the items and the factors of the first-order measurement model of this study.

Table 5.8: Matrix of loadings and cross-loadings for the first-order measurement model (All loadings significant at 0.001)

	Constructs								
Items ↓	**BI**	**PU**	**CPLX**	**SE**	**BNS-A**	**BNS-C**	**BNS-R**	**ACO**	**PAS**
BI1	**.981**	.784	-.472	.352	.149	.214	.204	.186	.118
BI2	**.975**	.773	-.478	.314	.107	.219	.175	.191	.096
BI3	**.979**	.773	-.500	.367	.134	.231	.214	.198	.128
PU1	.780	**.945**	-.443	.342	.198	.228	.216	.261	.134
PU2	.791	**.955**	-.405	.290	.198	.276	.255	.274	.121
PU3	.699	**.934**	-.487	.405	.245	.295	.298	.345	.130
PU4	.736	**.953**	-.444	.372	.199	.237	.228	.244	.058
CPLX1	-.498	-.403	**.855**	-.438	-.115	-.257	-.162	-.212	-.112
CPLX2	-.365	-.350	**.867**	-.627	-.157	-.368	-.144	-.328	-.042
CPLX3	-.455	-.419	**.867**	-.450	-.193	-.299	-.249	-.281	-.170
CPLX4	-.408	-.460	**.888**	-.610	-.179	-.292	-.201	-.338	-.152
SE1	.349	.292	-.458	**.690**	.161	.171	.236	.273	.061
SE2	.239	.287	-.569	**.885**	.168	.243	.178	.302	-.025
SE3	.279	.287	-.551	**.898**	.147	.238	.157	.209	-.020
SE4	.211	.282	-.423	**.773**	.132	.237	.189	.196	-.022
SE5	.375	.387	-.584	**.892**	.131	.228	.166	.204	-.001
BNS_A1	.079	.095	-.023	.143	**.670**	.423	.336	.261	.270
BNS_A3	.098	.180	-.159	.135	**.844**	.501	.468	.483	.403
BNS_A5	.170	.239	-.168	.114	**.821**	.377	.491	.374	.510
BNS_A6	-.074	.038	-.010	.066	**.575**	.246	.189	.104	.150
BNS_A7R*	.074	.133	-.204	.168	**.589**	.436	.458	.247	.288
BNS_C1R	.216	.198	-.413	.296	.229	**.686**	.223	.173	.200
BNS_C2	.192	.202	-.107	.116	.418	**.686**	.443	.291	.241
BNS_C4	.230	.284	-.149	.136	.444	**.638**	.472	.303	.284
BNS_C5R	.070	.111	-.223	.176	.469	**.678**	.412	.373	.294
BNS_C6R	.107	.176	-.311	.209	.438	**.820**	.399	.404	.245
BNS_R1	.147	.178	-.165	.191	.391	.480	**.908**	.461	.578
BNS_R2	.164	.225	-.258	.254	.450	.501	**.881**	.481	.566
BNS_R4	.200	.166	-.038	.059	.297	.236	**.585**	.168	.375
BNS_R5	.151	.229	-.124	.124	.377	.450	**.895**	.449	.562
BNS_R7R	.217	.252	-.225	.196	.386	.442	**.608**	.473	.392
BNS_R8	.126	.210	-.185	.188	.390	.460	**.832**	.511	.514
ACO	.196	.296	-.336	.284	.462	.443	.499	**1.000**	.311
PAS1	.144	.155	-.133	.025	.442	.304	.491	.298	**.890**
PAS2	.075	.048	-.107	-.035	.415	.271	.505	.269	**.914**
PAS3	.134	.138	-.149	.022	.500	.402	.518	.322	**.896**
PAS4	.094	.114	-.073	-.074	.472	.322	.490	.264	**.891**
PAS5	.106	.086	-.141	-.001	.489	.347	.505	.264	**.944**
PAS6	.082	.097	-.137	.045	.426	.302	.489	.277	**.934**

***** *"R" indicates that the item was negatively worded, and it was reverse coded for the analysis.*

Table 5.9: : Construct correlation matrix and discriminant validity assessment for the first-order measurement model

	BI	PU	CPLX	SE	BNS-A	BNS-C	BNS-R	ACO	PAS
BI	**.978**								
PU	.794	**.947**							
CPLX	-.494	-.470	**.870**						
SE	.352	.371	-.627	**.832**					
BNS-A	.133	.222	-.186	.177	**.709**				
BNS-C	.226	.273	-.350	.269	.568	**.707**			
BNS-R	.202	.263	-.217	.219	.687	.550	**.797**		
ACO	.196	.296	-.336	.284	.462	.443	.549	**1.000**	
PAS	.117	.117	-.136	-.003	.503	.359	.674	.311	**.912**

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **BNS_A**: Basic Needs Satisfaction (Autonomy); **BNS_R**: Basic Needs Satisfaction (Competence); **BNS_R**: Basic Needs Satisfaction (Relatedness); **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation.*

5.4.1.2 Second-Order Measurement Model Evaluation

Before presenting the results of the second-order measurement model evaluation, this sub-section explains the modeling of the second-order factor (Basic Needs Satisfaction) of this study. BNS was modeled as a second-order factor in PLS, following Agarwal and Karahanna (2000) and Calvo-Mora et al. (2005). As such, the proposed model of this study was altered by replacing the second-order-factor (BNS) with the three first-order factors (Autonomy, Competence, and Relatedness). These three factors were linked to other factors in the proposed model according to the way the second-order factor was theorized to be linked to the other factors. Then, PLS was run on the altered model. As one part of the output of the PLS software, for every data case (i.e., participant response), factor scores were provided. The scores are calculated for each factor based on the weighted sum of the factor's indicators. Weights of the indicators are calculated as part of the PLS algorithm. The scores for the three factors of autonomy, competence, and relatedness were provided in three separate columns each having 159 rows (one row for each data case, recall that in this study N=159). The three columns were then appended to the original data set as three new items. The new items were named BNS1, BNS2, and BNS3 representing autonomy, competence, and relatedness factors, respectively. This new data set was used for all further analyses in this dissertation. The three new items of

BNS1, BNS2, and BNS3 were modeled as reflective indicators of BNS (Deci et al. 2001).

Results of individual item reliability assessment of the second-order measurement model are presented in Table 5.10. As seen in the table, corrected item-total correlations for the three items are greater than 0.4, and the three items are all greater than 0.5. Therefore, it is concluded that the second-order measurement model is of acceptable item reliability. The second-order measurement model exhibited acceptable construct validity as seen in Table 5.11.

Table 5.10: Results of individual item reliability assessment for the second-order model (Basic Needs Satisfaction)

Construct	Item	Loading	Corrected Item-total Correlation
BNS	**BNS1**	.871	.712
	BNS2	.805	.609
	BNS3	.893	.699

Table 5.11: Construct reliability for the second-order measurement model

	AVE	Composite Reliability (CR)	Cronbach's Alpha
BI	.957	.985	.977
PU	.896	.972	.961
CPLX	.756	.925	.893
SE	.692	.917	.885
BNS	.734	.892	.819
ACO	1.000	N/A	.803
PAS	.831	.967	.959

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation*

Followed by the reliability assessment, the second-order measurement model was evaluated in terms of validity. A matrix of item loadings and cross-loadings was generated, and it is presented in Table 5.12. As seen in the table, all items had higher loadings on their associated factors compared to cross-loadings (rows of the matrix). In addition, all factors loaded higher with their associated items compared to other factors (columns of the matrix). The results of the

assessment presented in the table suggest that discriminant validity holds for the second-order measurement model of this study.

Table 5.12: Matrix of loadings and cross-loadings for the second-order measurement model (All loadings significant at 0.001)

Items ↓	**Constructs**						
	BI	**PU**	**CPLX**	**SE**	**BNS**	**ACO**	**PAS**
BI1	**.981**	.785	-.472	.352	.221	.186	.118
BI2	**.975**	.773	-.478	.314	.195	.191	.096
BI3	**.979**	.773	-.500	.367	.227	.198	.128
PU1	.780	**.945**	-.444	.342	.249	.261	.134
PU2	.791	**.955**	-.405	.290	.284	.274	.121
PU3	.699	**.934**	-.487	.405	.327	.345	.130
PU4	.736	**.953**	-.445	.372	.258	.244	.058
CPLX1	-.498	-.403	**.856**	-.438	-.205	-.212	-.112
CPLX2	-.365	-.350	**.866**	-.667	-.251	-.328	-.043
CPLX3	-.455	-.419	**.868**	-.450	-.287	-.281	-.170
CPLX4	-.408	-.460	**.888**	-.610	-.258	-.338	-.152
SE1	.349	.292	-.458	**.690**	.225	.273	.061
SE2	.239	.287	-.568	**.885**	.226	.302	-.025
SE3	.279	.287	-.550	**.898**	.207	.209	-.020
SE4	.211	.282	-.422	**.773**	.216	.196	-.022
SE5	.375	.387	-.583	**.892**	.202	.204	-.001
BNS1	.133	.222	-.186	.177	**.871**	.462	.504
BNS2	.226	.273	-.350	.269	**.805**	.443	.359
BNS3	.202	.263	-.217	.219	**.893**	.549	.674
ACO	.196	.296	-.336	.284	.570	**1.000**	.311
PAS1	.144	.155	-.134	.025	.543	.298	**.890**
PAS2	.075	.048	-.108	-.035	.528	.269	**.913**
PAS3	.134	.138	-.149	.022	.614	.322	**.897**
PAS4	.094	.114	-.074	-.074	.550	.264	**.891**
PAS5	.106	.086	-.141	-.001	.581	.264	**.944**
PAS6	.082	.097	-.138	.045	.521	.277	**.934**

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation.*

As the second test of discriminant validity, the square root of the AVE of each construct was compared with correlations of that construct with other constructs in the second-order model. To this end, Table 5.13 was created. As seen in the table, every value along the diagonal (square root of AVE) is greater than all the values on the corresponding row and column. Hence, it was concluded that there was confidence in the discriminant validity of the items and the factors of the second-order measurement model.

Table 5.13: Construct correlation matrix and discriminant validity assessment for the second-order measurement model

	BI	**PU**	**CPLX**	**SE**	**BNS**	**ACO**	**PAS**
BI	**.978**						
PU	.794	**.947**					
CPLX	-.494	-.470	**.870**				
SE	.352	.371	-.627	**.832**			
BNS	.219	.295	-.288	.257	**.857**		
ACO	.196	.296	-.336	.284	.570	**1.000**	
PAS	.117	.117	-.137	-.003	.612	.311	**.912**

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation*

5.4.1.3 Common Method Bias (CMB)

Recall from the previous chapter that two techniques were used in this study in order to examine the presence of CMB, namely Harman's one factor test, and unmeasured latent marker construct technique. This section provides brief descriptions as well as results of running these two techniques on the data set of this study. The results suggest that CMB is not likely to be a concern for this study.

Harman's One Factor Test

In Harman's one factor test (Podsakoff and Organ 1986), all the items of the research model are entered into a factor analysis. Then, the results of the unrotated solution to a principal components analysis (PCA) are examined to assess the number of factors that account for the variance among the items. CMB exists if (i) items tend to load on a single general factor (i.e., one single factor

emerges from the factor analysis), or (ii) one factor explains more than half of the variance in all the items. As described below, results of this test are not suggestive of the presence of CMB in this study.

All 26 items in the research model of this study were entered in a factor analysis. The unrotated solution to the PCA suggested 5 factors with eigenvalue greater than 1. The first factor accounted for 35.360 percent of the variance and the 5 factors together accounted for 78.224 percent of the variance in data. The eigenvalue of the last factor was 1.155. Several items loaded on components other than the first extracted factor. As a result, it was concluded that the study items do not load on a single general factor (i). Next, a factor analysis with one factor was performed and it explained 35.360 percent of the variance, while the 5 factor solution explained 78.224 percent of the variance. Concisely, the one factor solution did not explain more than half of the variance in the data set items (ii).

Unmeasured Latent Marker Construct Technique

The second technique used in this dissertation to assess the presence of CMB was the unmeasured latent marker construct technique (Podsakoff et al. 2003). Following Liang et al. (2007), this technique was implemented in this study using Partial Least Squares[20] (PLS). As such, a new factor was added to the PLS model of this study in order to capture method influence. The indicators of this new factor (i.e., common method factor) consisted of all the indicators of other variables in the research model of this study. In addition, the common method factor was linked to all other factors in the model. In order to investigate for the presence of CMB (Williams et al. 2003), PLS results must be reviewed as follows.

First, statistical significances of factor loadings of the common method factor must be examined. Second, for each indicator, the variance explained by its principal factor must be compared to the indicator's variance explained by the method factor. Following Liang et al. (2003), the squared loadings of principal constructs were interpreted as the variance explained caused by the principal constructs (R_1^2), whereas the squared values of the method factor loadings were interpreted as the variance explained by method (R_2^2). CMB is unlikely to be a serious problem if the method factor loadings are statistically insignificant, and the indicators' principal variances are substantially greater than their method variances (Liang et al. 2007; Podsakoff et al. 2003; Williams et al. 2003).

[20] While Chin et al. (2012) acknowledge that running this technique using PLS is common in the IS literature, they also question the usefulness of it in detecting CMB. Nevertheless, it was decided to employ this technique as conducting an additional test would increase the likelihood of detecting CMB in the event that it was present in the data set of this study.

Results of employing the technique are presented in Table 5.14. As seen in the table, none of the method factor loadings are statistically significant. In addition, the average variance explained by the principal factors is 0.814, while the average variance explained by the common method factor is 0.003. The ratio of 248:1 shows a very small magnitude of variance explained by the method compared to variance explained by the principal constructs. Consequently, CMB is unlikely to be a concern for this dissertation study.

Table 5.14: Results of conducting the unmeasured latent marker construct technique for the assessment of common methods bias

Construct	Indicator	Principal Factor Loading	R_1^2	Method Factor Loading	R_2^2
BI	**BI1**	.978***	.957	.003 n.s.	.000
	BI2	.989***	.977	-.038 n.s.	.001
	BI3	.953***	.907	.034 n.s.	.001
PU	**PU1**	.932***	.868	.015 n.s.	.000
	PU2	.992***	.984	-.047 n.s.	.002
	PU3	.865***	.748	.088 n.s.	.008
	PU4	.997***	.994	-.055 n.s.	.003
CPLX	**CPLX1**	.898***	.807	.048 n.s.	.002
	CPLX2	.888***	.788	-.003 n.s.	.000
	CPLX3	.872***	.760	-.078 n.s.	.006
	CPLX4	.823***	.678	.036 n.s.	.001
SE	**SE1**	.585***	.342	.141 n.s.	.020
	SE2	.921***	.849	-.051 n.s.	.003
	SE3	.940***	.884	-.062 n.s.	.004
	SE4	.828***	.686	-.068 n.s.	.005
	SE5	.848***	.718	.064 n.s.	.004
BNS	**BNS1**	.940***	.883	-.101 n.s.	.010
	BNS2	.780***	.608	.055 n.s.	.003
	BNS3	.851***	.724	.048 n.s.	.002
PAS	**PAS1**	.870***	.757	.047 n.s.	.002
	PAS2	.938***	.880	-.054 n.s.	.003
	PAS3	.867***	.753	.055 n.s.	.003
	PAS4	.907***	.822	-.036 n.s.	.001
	PAS5	.948***	.898	-.007 n.s.	.000
	PAS6	.938***	.880	-.004 n.s.	.000
ACO	**ACO1**	1.000***	1.000	.000 n.s.	.000
Average			.814		.003

**** p<.001; n.s. non-significant*

Average ratio = 248:1

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction; **PAS**: Physician Autonomy Support; **ACO**: Autonomous Causality Orientation.*

5.4.2 Structural Model Evaluation

Figure 5.1 presents the results of the PLS analysis conducted on the proposed model of this study. Table 5.15 presents the individual hypotheses and their associated path coefficients, t-statistics, significance levels, and validation results. According to the results, eight out of nine hypotheses are supported. In order to confirm the insignificance of the hypothesis that was not supported, the SE→PU was removed, and the model was re-estimated. Removing this path did not result in any changes to the results of other hypotheses.

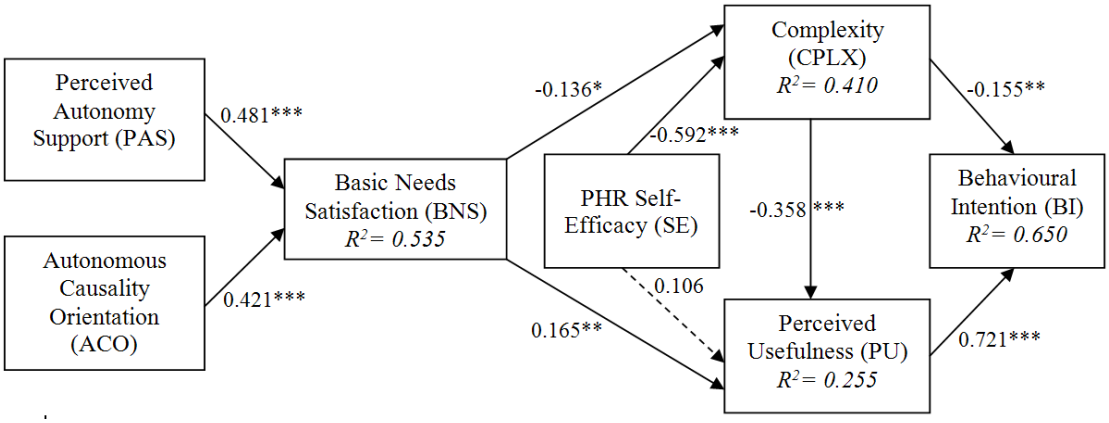

Figure 5.1: PLS Results for the proposed research model of this study

**p < .05; **p < .01; ***p < .001; -----non-significant path*

Table 5.15: Validation of the study hypotheses

Hypothesis	Path	Path Coefficient	t-Statistic	Sig. Level	Validation Result
H1	PU→BI	.721	10.599	.000	Supported
H2	CPLX→BI	-.155	2.712	.007	Supported
H3	CPLX→PU	-.356	4.253	.000	Supported
H4	SE→PU	.106	1.160	.248	Not Supported
H5	SE→CPLX	-.592	10.208	.000	Supported
H6	BNS→CPLX	-.136	2.059	.041	Supported
H7	BNS→PU	.165	2.626	.009	Supported
H8	ACO→BNS	.421	7.576	.000	Supported
H9	PAS→BNS	.481	8.996	.000	Supported

5.4.3 Effect Sizes

Table 5.16 presents the effect sizes (direct effects) corresponding to every pair of dependent and independent variable in the research model of Figure 5.1. Recall from the previous chapter (Section 4.2.2) that effect sizes of above .02, .15, and .35 can be viewed as small, medium, large effects respectively.

Table 5.16: Effect sizes for direct effects (α=0.05)

	Dependent Variable			
Independent Variable ↓	**BI**	**PU**	**CPLX**	**BNS**
PU	.571			
CPLX	.079	.168		
SE		.039	.361	
BNS		.048	.040	
ACO				.239
PAS				.280

Table 5.17 presents the effect sizes for sums of indirect effects in the proposed model. Indirect effect refers to the influence of a variable, through other variables, on a dependent variable.

Table 5.17: Effect sizes for sums of indirect effects

	Dependent Variable		
Independent Variable ↓	**BI**	**PU**	**CPLX**
CPLX	.128		
SE	.110	.077	
BNS	.038	.015	
ACO	.015	.027	.020
PAS	.009	.012	.009

Finally, Table 5.18 presents the sizes of total effects. Total effect for each pair of dependent and independent variable is calculated as the sum of associated indirect effects plus the associated direct effect.

Table 5.18: Effect sizes for total effects

	Dependent Variable			
Independent Variable ↓	**BI**	**PU**	**CPLX**	**BNS**
PU	.571			
CPLX	.206	.168		
SE	.110	.116	.361	
BNS	.038	.063	.040	
ACO	.015	.027	.020	.239
PAS	.009	.012	.009	.280

5.4.4 Predictive Relevance (Q^2) of the Model

Table 5.19 presents the cross validated redundancy (Q^2) for the endogenous variables in the research model of this study. Recall from the previous chapter (Table 4.8) that Q^2 was used to examine the predictive relevance of the structural model. $Q^2>0$ implies the model has predictive relevance, whereas $Q^2<0$ represents a lack of predictive relevance.

Table 5.19: Cross validated redundancy (Q^2) for the endogenous variables

Endogenous Variable	Q^2
BI	.615
CPLX	.292
PU	.221
BNS	.340

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction*

5.4.5 Goodness of Fit of the Model (GoF)

Recall from Table 4.8 that GoF of the model refers to the overall (both measurement and structural levels) prediction performance of the model. The absolute GoF for the proposed model was 0.610 indicating a high fit of the model. Recall from the previous chapter (Section 4.2.2) that absolute GoF values of 0.36, 0.25, and 0.1 are considered high, medium, and low fit respectively. Next, the relative GoF was 0.921. A value above 0.9 speaks in favor of the fit of the model (Vinzi et al. 2010).

5.4.6 Saturated Model Analysis

In order to explore possible non-hypothesized relationships among the variables of the research model of this study, a saturated model was created by establishing all possible links among all the variables in the originally proposed model of this study. Then, PLS path estimates and R^2 for the variables in the model were examined. Results of these examinations are presented below.

Table 5.20 summarizes PLS results for the non-hypothesized paths that were added to the research model of Figure 5.1. As seen in Table 5.20, four non-hypothesized paths had statistically significant path coefficients (path numbers: 3, 5, 9, and 11). Although there was no theoretical justification for these paths, in order to investigate their possible influences on the explanatory power of the proposed model of this study, changes in the R^2 (variance explained) of the model variables were compared across the proposed model and the saturated model.

Table 5.21 presents the R^2 of the variables before and after adding the non-hypothesized paths. As seen in the table, the changes are non-significant (f^2<.02) in all cases except for CPLX for which f^2 is .031. Recall that f^2 values of .02, .15, .35 refer to small, medium, and large effect sizes respectively. Therefore, the change in R^2 of CPLX is considered small. In addition, the newly added paths that lead to CPLX (non-hypothesized path numbers 2 and 7 in Table 5.20) were not statistically significant. As a result, it was concluded that the non-hypothesized paths did not have a significant influence on the explanatory power of the proposed model of this study.

Table 5.20: PLS results for non-hypothesized paths – saturated model analysis

Path Number	Non-Hypothesized Paths	β	p	Validation
1	ACO→BI	-.073	.253	rejected
2	ACO→CPLX	-.134	.106	rejected
3	ACO→PAS	.304	.000	supported
4	ACO→PU	.084	.325	rejected
5	ACO→SE	.195	.035	supported
6	PAS→BI	.054	.495	rejected
7	PAS→CPLX	-.092	.189	rejected
8	PAS→PU	-.046	.603	rejected
9	PAS→SE	-.244	.014	supported
10	BNS→BI	-.034	.642	rejected
11	BNS→SE	.303	.004	supported
12	SE→BI	-.006	.998	rejected

***β**: PLS Path Coefficient; **p**: Significance Level (p<.05 significant)*

Table 5.21: Changes in R^2 of the study variables – saturated model analysis

Model	BI	PU	CPLX	SE	BNS	PAS
Original Model of this Study	.650	.255	.410		.535	
Saturated Model	.657	.261	.428*	.132	.532	.097
ΔR^2	.007	.006	.018		-.003	
f^2	.019	.008	.031		-.006	

** Removing the two non-significant paths (PAS→CPLX, ACO→CPLX) from the saturated model changes the R^2 of CPLX from .428 back to .410.*

5.5 Analysis of the Impact of Individual Characteristics and Control Variables

Recall from the previous chapter (Section 4.1.2) that participants were asked questions regarding their individual characteristics as well as regarding several control variables. Two different procedures were conducted using PLS in order to analyze the responses to these questions as explained below this paragraph.

The first procedure was conducted to investigate the impact of these variables on the research model in terms of the effect size of each of the variables on R^2 of the endogenous constructs in the research model. To this end, for each individual characteristic/control variable, one controlled model was created by adding the variable with paths leading to all constructs in the model. Each effect size is calculated by comparing the R^2 of the endogenous constructs in the uncontrolled model and in the controlled model (Chin 1998b). Table 5.22 presents the results of this analysis. The impact of each control variable on the model was examined individually. Effect sizes (f^2) of .02, .15 and .35 are considered small, medium and large effects respectively (Chin 2010b; Cohen 1988). As seen in the table, the impacts of control variables are marginal in most cases. "Security concerns" is the only control variable that has considerable impact on BI. As seen in the table, the influences of the Internet experience on PU, perceived health status on BNS, chronic illness on CPLX, family health responsibility on PU, information privacy concerns on PU, information security concerns on BI, information security concerns on PU, and information security concerns on CPLX are all small. The influence of information privacy concerns on CPLX is medium. The remaining effects are not considerable (f^2<.02).

Table 5.22: Effect of control variables on R^2 of dependent variables (f^2)

	Variable	BI	PU	CPLX	BNS
Individual Char.	Age	.000	.003	.000	.000
	Gender (1=Female, 2=Male)	.012	.003	.000	.002
	Internet Usage Hours per Day	.003	.007	.005	.002
	Internet Experience in Years	.000	**.054**	.000	.011
	Education Level	.000	.019	.012	.002
Control Variables	Perceived Health Status	.000	.007	.017	**.092**
	Chronic Illness (1=Y, 2=N)	.000	.001	**.021**	.004
	Frequency of Doctor Visit	.014	.001	.000	.018
	Years with Doctor	.000	.001	.000	.000
	Family Health Responsibility (1=Y, 2=N)	.000	**.022**	.003	.000
	Use of Paper Records (1=Y, 2=N)	.009	.014	.014	.002
	Information Privacy Concerns	.012	**.063**	**.164**	.002
	Information Security Concerns	**.036**	**.122**	**.054**	.011
	Household Income	.000	.003	.014	.000
	Retired (1=Y, 2=N)	.003	.005	.000	.011

Bold values indicate considerable effects (f2>.02).

***BI**: Behavioural Intention; **PU**: Perceived Usefulness; **CPLX**: Complexity; **SE**: PHR Self-Efficacy; **BNS**: Basic Needs Satisfaction*

The second procedure was conducted to examine the relationship between individual characteristics/control variables and all the factors in the research model of this study. To this end, in PLS, individual characteristics/control variables were linked to every factor in the model one at a time. Table 5.23 presents the results of the conduced PLS analyses. Significant relationships are indicated in the table in bold font.

After conducting the above analyses (Table 5.22 and Table 5.23), all the variables (individual characteristics and control variables) with significant paths to any of the variables in the proposed model of this study were subject to further analysis in PLS as follows. Following Liang et al. (2007), first, the variables were added to the proposed model one by one, and each time the significant links from Table 5.23 were established and PLS algorithm was run. In no case were the results (significances) of the hypotheses of this study changed. Second, instead of adding the variables one by one, all the variables were added to the research model at once having established all the significant paths from Table 5.23. Similarly, running the PLS algorithm did not result in any changes to the results of the hypotheses of this study. Hence, it was concluded that the control variables

and the individual characteristic variables did not create any bias in the conclusions of the hypotheses of this study.

Table 5.23: Impact of control variables on model constructs

	Variable	Stat.	BI	PU	CPLX	SE	BNS	PAS	ACO
Individual Characteristics	Age	β	-.009	-.044	.003	-.138	.021	**.331**	**.288**
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	.001	.001
	Gender (1=Female, 2=Male)	β	.067	-.039	-.008	.133	-.047	**-.160**	**-.176**
		p<	n.s.	n.s.	n.s.	.050	n.s.	.050	.050
	Internet Use: Hours per Day	β	.040	.070	.061	.133	.041	-.107	-.125
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	Internet Experience in Years	β	.020	**-.196**	.022	-.031	.080	.080	.032
		p<	n.s.	.010	n.s.	n.s.	n.s.	n.s.	n.s.
	Education Level	β	-.029	.116	.096	.030	.044	-.071	**.175**
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	.010
Control Variables	Perceived Health Status	β	-.012	-.076	.111	**.306**	**.215**	-.045	**.196**
		p<	n.s.	n.s.	n.s.	.001	.001	n.s.	.010
	Chronic Illness (1=Y, 2=N)	β	-.020	.016	.115	.111	.048	-.015	-.120
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	Frequency of Doctor Visit	β	**.**070	.029	-.018	-.067	**-.106**	.123	**.176**
		p<	. n.s.	n.s.	n.s.	n.s.	.050	n.s.	.050
	Years with Family Doctor	β	.013	-.031	-.018	-.024	-.003	**.171**	.021
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	.010	n.s.
	Family Health Responsibility (1=Y, 2=N)	β	-.026	**-.126**	.048	-.062	.024	-.044	.033
		p<	n.s.	.050	n.s.	n.s.	n.s.	n.s.	n.s.
	Use of Paper Records (1=Y, 2=N)	β	-.054	-.101	.092	-.026	.026	-.060	-.117
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	Information Privacy Concerns	β	-.076	**-.236**	**.307**	**-.301**	-.036	-.136	-.100
		p<	n.s.	.010	.001	.001	n.s.	n.s.	n.s.
	Information Security Concerns	β	-.122	**-.313**	**.191**	**-.339**	-.079	**-.158**	-.043
		p<	n.s.	.001	.010	.001	n.s.	.050	n.s.
	Household Income	β	.026	.036	-.088	.042	.021	-.065	.015
		p<	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	Retired (1=Y, 2=N)	β	-.044	.064	-.014	**.151**	-.075	**-.178**	**-.175**
		p<	n.s.	n.s.	n.s.	.050	n.s.	.010	.010

***β**: PLS path coefficient; **p**: p-value; **n.s.**: non-significant;*
Bold values indicate significant relationships;

5.6 Examination of Open-Ended Questions

Recall from the previous chapters (Sections 3.3 and 4.1.2) that the survey of this study utilized two open-ended questions in order to gather insights on the opinions of participants regarding integrated PHR systems. An examination of the responses to the two open-ended questions confirmed the quantitative findings of this study. This section highlights some of the participant responses to the two questions and summarizes all the responses to the questions. In addition, in the next chapter of this dissertation, some of the findings of the examination of the open-ended questions are discussed in relation to the research questions of this study.

5.6.1 First Open-Ended Question

Question: "What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?"

In total, 161 of study participants provided an answer to this question. Responses from all participants (including those that were removed from the PLS analysis as part of data treatment) were reviewed, and all the reasons mentioned by the participants were extracted. In total, 70 reasons were extracted from the responses. Then, the number of times each reason was mentioned was noted. In addition, the extracted reasons were categorized based on their similarities, resulting in 9 categories of reasons. Table 5.24 shows the full list of reasons, the number of times each was mentioned, and their associated categories.

Majority of reasons pertain to different aspects of perceived usefulness of integrated PHR systems. The reason that was mentioned more than any other reason was "my access to my health records" which was mentioned by 33 (20.5%) of the respondents. For example, one participant provided the following answer to this question:

> *"The ability to have an accessible record of all of my health info and procedures is appealing to me. I like the fact that I can be informed when I speak to health care professionals; less time can be spent accessing info in the office if I bring it myself."*

Ability to have all the records "in one place" seems to be another important motivator to use an integrated PHR system. Twenty eight (17.4%) of the respondents mentioned this as a reason that could motivate them to use an integrated PHR system. For example, the following are responses that relate to this concept:

> *"health records all in one place and don't need to request information from the doctor to see your medical file."*

"having all my information in one place would allow access for all doctors etc that you would need to see"

"Records all in one place that will not be misplaced."

Improved communication with health care professionals was also among the top reasons mentioned by participants. Thirteen (8.1%) of the respondents valued integrated PHR systems for what they thought would potentially improve communication with health care professionals in various ways. For instance, below are some of the related responses:

"Being able to have my health records at hand would enable me to see patterns; make recommendations; give me an idea of what questions I need to ask my doctor, and provide 100% accurate information. An online PHR would also give me an added opportunity to seek medical advice through communications with my doctor at other than just scheduled appointments."

"Practical to have access to my health record when needed, good way to communicate with my doctor without necessarily having to go to her office."

"potential communication with my doctor without having to go in for an appointment"

"Monitoring" and "tracking" health status together were mentioned by 26 (16.1%) of the respondents. Below are a few examples of such responses:

"Monitoring any changes in health, and the exercise tracking. I am trying to build to a 5K, and being able to track progress that easily would be great."

"It would be good to have all my medications, appointments etc. available in one place. It would also be handy to have a record of family health problems, so that when new health concerns arose, I could see if here was a family history of that sort of problem. Right now, I have no medical problems which would need to be monitored on an ongoing basis, but that might change eg. heart problems, diabetes, other chronic diseases, and then it would be good to have the records available on a regular basis."

"I have diabetes so would like to keep the tracking easier"

Finally, 20 (12.4%) of the participants indicated that there would be no reason ("none") that would motivate them to use an integrated PHR system. More details of such negative attitude regarding integrated PHR systems could be seen in the examination of responses to the second open-ended question which directly asks for reasons that would discourage participants from using integrated PHR systems. Nevertheless, below are the two responses that provided an explanation as to why they would not be motivated to use an online PHR:

"None. I would refuse to. I know too much about computers, the net, security, ID theft, and hackers... Amongst other things."

"None, I don't believe the data would be secure"

Table 5.24: Summary of responses to the first open-ended question
(Sorted by total number of times each category of reasons was mentioned by all participants)

Question: What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
33	My access to my health records	Usefulness	227
28	All my health records in one place		
20	Availability of my health records		
16	Convenience		
13	Improved communication with health care professionals		
13	Monitoring		
13	Tracking		
9	Record keeping		
5	Informative		
5	Ability to see my test results		
5	Access to my health records by my doctors		
4	Full picture of my health		
4	Ability to import records from different facilities/offices		
4	Access to my medical history		
4	Efficiency		
4	Organizing my health information		
3	Managing diabetes		
3	Control over my health records		
3	Exercise tracking		
3	Connecting my multiple doctors		
3	Managing appointments		
2	Manage chronic condition		
2	Manage blood pressure		
2	Chronological view of my health records		
2	My doctor changes from time to time		
2	Prescription refill		

Question: What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
2	Sharing information with health care professionals		
2	Visual information		
1	High accuracy of information		
1	Manage blood cholesterol		
1	Ability to know better what my doctor does for me		
1	Consistency		
1	Longevity		
1	Detailed records		
1	Support from health care providers		
1	Ongoing monitoring		
1	Continued care		
1	Printing records		
1	Access to my records in emergency situations		
1	Family history		
1	Managing health of family		
1	Family informed of my health		
1	Access by emergency staff		
1	Proactive role in my own care		
1	Ease of managing health using PHR		
1	Better health care		
20	"None"	None	20
8	Ease of use	Complexity	17
5	Simplicity		
3	Ease of data entry		
1	No manual entry		
6	If I have a health condition	Conditions	14
3	Age		
2	Access by anyone involved in my health care		
1	Starting to use at young age		
1	If I had to		
1	Universal usage		
10	High security	Security	10
3	My doctor's encouragement	Doctor's	6

Question: What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
2	My doctor's support of PHR use	influence	
1	My doctor's recommendation		
2	If my doctor spent time on PHR	Doctor's participation	5
1	My doctor's participation		
1	My doctor's contribution to my records in my PHR		
1	My doctor stores records electronically		
4	If it is free of charge	Cost	4
1	Physical location of data base (in Canada or not)	System	4
1	Availability of mobile applications		
1	Trial option		
1	Ability to use devices		
2	No response	No response	2
2	"Not sure"	Not sure	2
1	Online support	Support	1

5.6.2 Second Open-Ended Question

Question: "What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?"

In total, 164 of study participants provided an answer to this question. Responses from all participants (including those that were removed from the PLS analysis as part of data treatment) were reviewed, and all the reasons mentioned by the participants were extracted. In total 55 reasons were extracted from the responses. Then, the number of times each reason was mentioned was noted. In addition, the extracted reasons were categorized based on their similarities, resulting in 20 categories of reasons.

Table 5.25 shows the full list of reasons, the number of times each was mentioned, and their associated categories.

Majority of the participants mentioned either security or privacy concerns as reasons not to use integrated PHR systems. Security-related concerns were mentioned by 91 (55.5%) of the respondents, and privacy-related concerns were mentioned by 28 (17.1%) of the respondents. Below are a few examples of responses to this question that included either security or privacy concerns:

"The potential for access by third parties is worrisome. Insurance companies, employers, etc. should not have to opportunity to access this information."

".....banks and credit card systems have been hacked in the past with little effort....why would I put my personal/private health information "out there"- Next thing you know companies will be paying someone to hack the system to see if a potential employee is "healthy enough" to hire."

"Fear of Big Brother monitoring me, and deciding what's best for me, regardless of my own feelings, views on life, etc.I've had a whiff of this with compliance issues regarding the use of a C-PAP machine. Luckily my sleep apnea can be controlled without a machine, so the medical sleep mafia has backed off, and I no longer have to fear losing my driver's licence, essential to earning my livelihood. I could see this being an issue in psychiatric care too, where my views on therapy differ significantly from the current pill-based practice. The thought that the state could force unwanted medications on me is really scary, and I would be concerned that such interference could become reality with web-based records."

"Security fears (too many players involved, human error, cyber-crime etc)"

"Security. No matter how safe, or what precautions are taken, this information is vulnerable. A banking site and reverse and fraud caused by hackers, but with the case of access to information, there is no possible reversal should information become jeopardized."

"1. Privacy issues, especially in light of recent news about data security/privacy breaches.2. Incomplete information. I don't presently have access to all information from my healthcare providers…"

Various forms of cost associated with using an integrated PHR system seem to be another hurdle for participants' decision to start using one. Possible monetary cost of using an integrated PHR system was mentioned by 11 (6.7%) of the respondents; time required to maintain an account was mentioned by 27 (16.5%) of the respondents, and effort of maintaining an account was mentioned by 15 (9.1%) of the respondents. Here are a few example related responses:

"Too much effort and time is required to enter and maintain data pertaining to my health. The expense associated with obtaining the various digital monitoring devices would be prohibitive."

"the time it would take to do the complete process"

"too time consuming, keeping it constantly up to date, too much time on devices already"

Participants seemed to put a lot of value in their doctor being involved with their possible use of integrated PHR systems. Different forms of lack of doctor participation were mentioned by 24 (14.6%) of the respondents as prohibitory in terms of using integrated PHR systems. Among the responses were *"if my doctor did not use it"* (6 times), *"if my doctor did not participate"* (5 times), *"if my doctor was not interested"* (5 times), and *"doctors do not have time for PHRs"* (twice). The following are a few examples of full responses to this question that relate to participation of doctors:

> *"my doctor not downloading results from blood tests and mammograms or other tests into the database"*
>
> *"…Not sure any doctor would have the time to connect with so many hundreds of patients in this way. …"*
>
> *"Willingness or ability of my doctor to share electronic data."*
>
> *"Also, given the state of the present medical system, doctors don't even have time to see patients, never mind reviewing on line health records."*
>
> *"my doctor not using the PHR"*
>
> *"I don't think the system is in place to make it useful to me - I don't think the hospitals, my doctors or the pharmacies use a PHR-"*
>
> *"Family doctors do not have the time to monitor their patients health charts.. they would never use it, and would never email you back... they would get frustrated and not like the system."*

Finally, 28 (17.1%) of the respondents responded that there would be no reason ("none") that would discourage them from using an online PHR. None of the participants who provided "none" as the answer to this question provided any further details. However, the responses to the first open-ended question could provide more insight on reasons why participants liked the idea of using integrated PHR systems.

Table 5.25: Summary of responses to the second open-ended question

(Sorted by total number of times each category of reasons was mentioned by all participants)

Question: What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
61	Security	Security	91
11	Cyber crime (hack, identity theft)		
11	Unauthorized access		
3	Confidentiality		

Question: What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
2	It is online and risky		
2	Reliability of computers		
1	Sensitivity of information		
27	Time consuming	Complexity	50
7	Data entry effort		
5	Effort		
2	Keeping my information current		
1	Effort of collecting all my records		
5	Complexity		
2	Hard to learn		
1	Not easy to use		
25	Privacy	Privacy	31
3	Fear of big brother control over my life		
3	Mis-use of information		
28	None	"None"	28
6	My doctor's not using PHR	Doctor's participation	24
5	My doctor not participating		
5	My doctor not being interested in PHR		
2	Doctors do not have time for PHR		
1	Doctor not contributing to records		
1	My doctor sharing information electronically		
1	My doctor not storing records electronically		
1	Incompatibility of my doctor's system		
1	My doctor's not willing to share my records electronically		
1	My doctor is not on computers yet		
7	Cost	Cost	11
2	Do not have computer / old computer		
1	Cost of devices		
1	No money to buy computer		
6	No need (e.g., no health issues, etc.)	Conditions	7
1	Past records lost		
2	Human error	Quality	4
1	Inaccuracy of information		

Question: What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?			
# of Times Mentioned	**All Reasons Extracted from Participants' Responses**	**Assigned Category**	**Total for Category**
1	Incomplete information		
4	Not good with computers	Self efficacy	4
2	Trustworthiness of the provider	Trust	2
2	Lack of personal touch with doctors	Personal Touch	2
1	Need to be self-directed and self-motivated	Personality	2
1	I am used to my doctor managing my health		
2	No response	No response	2
1	My doctor's discouraging	Doctor's influence	2
1	My doctor's not supporting my use of PHR		
1	Apathy	Apathy	2
1	Boring		
2	Health care system not ready	Facilitating conditions	2
1	Accessibility options	Accessibility options	1
1	I do not have health expertise	Competence	1
1	Could lead to becoming a hypochondriac	Consequence	1
1	Don't like computers	Don't like computers	1
1	Government run IT	Government run IT	1
1	Physical location of data base	System	1

CHAPTER 6: Discussion and Conclusion

The findings of this research are discussed in this chapter. As such, Section 6.1 provides and discusses answers to the research questions of this dissertation. Section 6.2 discusses the contributions of this dissertation to theory and practice. Section 6.3 elaborates on strengths and limitations of this study. Section 6.4 provides directions for future research in the context of integrated PHR system adoption and application of self-determination theory (SDT) in information systems (IS) research. Finally, Section 6.5 concludes the chapter and this dissertation.

6.1 Answers to Research Questions

6.1.1 Research Question 1

RQ1: *How do individuals' perceptions regarding the use of integrated PHR systems influence their behavioural intention to use such systems?*

Related Hypotheses:

H1: A higher level of perceived usefulness associated with using integrated PHR systems positively influences an individual's intention to use such systems.

H2: A higher level of complexity associated with using integrated PHR systems negatively influences an individual's intention to use such systems.

H3: A higher level of complexity associated with using integrated PHR systems negatively influences an individual's perceived usefulness of such systems.

Based on the findings presented in the previous chapter of this dissertation, perceived usefulness (PU) of an integrated PHR system is the key influencing factor of behavioural intention (BI) to use such systems. Two arguments support this finding which is consistent with prior research in the context of IS adoption (e.g., Venkatesh and Davis (2000), Venkatesh et al. (2003)). First, the PU→BI association had a high, statistically significant beta coefficient of .721 (p-value < .001) which supports H1[21]. Second, this association

[21] PLS results are presented in Table 5.15

exhibited a large effect size[22] (f^2=.571). The effect size signifies the amount of variance in the dependent construct (BI) that is explained by the independent construct (PU). Recall from Chapter 4 (Table 4.8) that effect size values of .02, .15, and .35 correspond to small, medium, and large effect sizes.

The second hypothesis (H2) was proposed to examine the relationship between complexity (CPLX) of integrated PHR systems and BI. The CPLX→BI relationship had a statistically significant beta coefficient of -.155 (p-value<.01) which supports the negative influence of CPLX on BI. This relationship showed a small direct effect (f^2=.079). Consistent with prior research on IS adoption (e.g., Venkatesh et al. (2003)), this effect size is smaller than the effect size of PU→BI which signifies the relative importance of PU in determining BI. In addition, prior research has shown that the influence of perceptions of effort (CPLX, in the case of this dissertation) on BI is partially mediated by PU (e.g., Venkatesh and Davis (2000)). As a result, CPLX had a separate effect on BI which was through PU. The total effect size[23] of CPLX on BI was medium (f^2=.206). Total effect refers to the sum of direct and indirect effects.

The third hypothesis (H3) was analyzed to examine the association between CPLX and PU. Results of this dissertation study showed a statistically significant beta coefficient of -.356 (p-value < .001). Furthermore, the CPLX→PU association had a medium effect size (f^2=.168). Consistent with prior research, these findings support the hypothesis, and they suggest that perceptions of complexity (i.e., effort) associated with using an integrated PHR system negatively influence perceptions of usefulness of integrated PHR systems.

An examination of the responses to the two open-ended questions confirmed that perceptions of usefulness and effort associated with using integrated PHR systems are major determinants of participants' intention to use integrated PHR systems. Results of the examinations are presented in Section 5.6 of this dissertation (Table 5.24 and Table 5.25). Including repetitive ones, participants provided 312 reasons (70 unique ones) which would motivate/encourage them to use an integrated PHR system. Of those reasons mentioned, 227 (%72.76, biggest category) fall under the category of perceived usefulness, and 17 (%5.45, second biggest category) relate to the perceptions of effort (the lack thereof) associated with using such systems. On the other hand, participants provided 270 reasons (55 unique ones) which would prevent/discourage them from using integrated PHR systems. Of those reasons mentioned, 50 (%18.52, second biggest category after security concerns) relate to the perceptions of effort associated with using such systems.

[22] Direct effect sizes are presented in Table 5.16
[23] Total effect sizes are presented in Table 5.18

6.1.2 Research Question 2

RQ2: *How does PHR self-efficacy influence an individual's perceptions regarding the use of integrated PHR systems?*

Related Hypotheses:

H4: A higher level of an individual's self-efficacy regarding the use of integrated PHR systems negatively influences his/her perceptions of complexity of such systems.

H5: A higher level of an individual's self-efficacy regarding the use of integrated PHR systems positively influences her/his perceived usefulness of such systems.

The fourth hypothesis (H4) was proposed to examine the association between an individual's PHR self-efficacy (SE), and CPLX. Similar studies in information systems have previously shown that SE has a positive effect on perceived ease of use (similarly, a negative effect on complexity) (Venkatesh 2000). Results of this dissertation also suggest the same relationship by supporting H4. SE→CPLX had a statistically significant beta coefficient of -.592 (p-value < .001). This relationship exhibited a large effect size (f^2=.361). The large effect size is consistent with prior research indicating the important role of SE in determining perceptions of effort associated with using an IS in the pre-usage stage of technology adoption (Venkatesh 2000).

The fifth hypothesis (H5) was proposed to examine the association between SE and PU. According to the results of this dissertation, this hypothesis was not supported (beta coefficient = .106, p-value = .248). Compeau and Higgins (1995b) had shown a positive influence of SE on outcome expectations (conceptualized and measured similar to PU) where participants were recruited from individuals with various levels of experience in using the system in question. The study was conducted on a pool of data not corresponding to a specific technology adoption stage, whereas the current study only focuses on the pre-usage stage of adoption. Therefore, it is possible to explain the finding of this dissertation and argue that SE does not have a significant effect on PU in the pre-usage stage. To support this finding, it is worth mentioning that Venkatesh (2000) has shown that the effect of SE on BI in pre-usage stage is fully captured by the effort associated with using the system. Given the relatively high correlation between PU and BI (Table 5.13), it can similarly be argued that the effect of SE on PU in the pre-usage stage is fully captured by CPLX. This statement was tested and confirmed in this dissertation by running a PLS analysis in the absence of CPLX in the research model. The result showed a statistically significant positive relationship between SE and PU (beta coefficient=.321, p-value < .001) which supports the above argument.

Finally, in responding to the open-ended questions, low self-efficacy was mentioned 4 out of 270 times as a reason which would prevent/discourage a participant from using integrated PHR systems.

6.1.3 Research Question 3

RQ3: *How does the basic needs satisfaction in the context of health management influence an individual's perceptions regarding the use of integrated PHR systems?*

Related Hypotheses:

H6: A higher level of basic needs satisfaction in the context of health management positively influences an individual's perceived usefulness of integrated PHR systems.

H7: A higher level of basic needs satisfaction in the context of health management negatively influences an individual's perceptions of complexity of integrated PHR systems.

The sixth hypothesis (H6) was proposed to examine the association between basic needs satisfaction (BNS) and PU. Results of this dissertation showed that there is a statistically significant positive relationship between BNS and PU (beta coefficient = .165, *p*-value < .01). In addition, the results suggest a small effect size for this relationship (f^2=.048). These results suggest that individuals with higher levels of self-determination (i.e., higher BNS) in their health management would find an integrated PHR system more useful compared to those with lower levels of self-determination. The small effect size can be explained by the fact that this study was conducted in the pre-usage stage where participants had no prior experience in using an integrated PHR system. Although all the efforts were made in creating the PHR introductory video clip to ensure participants understood integrated PHR systems and how using such systems would change their role in managing their health, a full understanding of such a role change will only come after using the system over time. It is expected that such full understanding would result in a larger effect size of BNS on perceived usefulness of integrated PHR systems on the account that individuals with higher levels of self-determination would better appreciate the benefits of using an integrated PHR system to manage their health. Finally, the total effect size of BNS on PU is .063 (small). The total effect size takes both direct effect and indirect effect (through CPLX) into account.

The seventh hypothesis (H7) was proposed to examine the association between BNS and CPLX. The results showed a statistically significant negative relationship (beta coefficient = -.136, *p*-value < .05). The effect size of this relationship was small (f^2=.04). These results suggest that individuals with higher

levels of self-determination find it easier to use an integrated PHR system. Higher self-determination means higher motivation to take an active role in health management; therefore, they are likely to perceive less effort and complexity in using a system which is designed to help them take more responsibility in their health management. The small effect size can be explained in a similar way to the explanation provided in the previous paragraph regarding the small effect size of BNS→PU. That is, with full understanding of the role change brought about by the actual use of integrated PHR systems over time, more self-determined individuals would be likely to perceive less effort in using such systems. Based on SDT, more self-determined individuals are likely to have more intrinsic/internalized motivation to manage their health (Ryan and Deci 2000); thus, they are likely to perceive less effort (Fagan et al. 2008) associated with using a tool (integrated PHR system) that is designed to supported self-determination in health management (Ball et al. 2007; Parker and Thorson 2008; Williams et al. 2007).

6.1.4 Research Question 4

RQ4: *How do the environmental factors (physician support, in this dissertation) and personality factor (autonomous causality orientation, in this dissertation) in the context of health management influence basic needs satisfaction?*

Related Hypotheses:

H8: A higher level of perceived physician autonomy support positively influences an individual's level of basic needs satisfaction in the context of health management.

H9: A higher level of an individual's autonomous causality orientation is positively associated with his/her level of basic needs satisfaction in the context of health management.

The eighth hypothesis (H8) examined the association between physician autonomy support (PAS) and BNS. The results of this study showed a statistically significant positive relationship between these two constructs (beta coefficient of .481, *p*-value<.001). The effect size of this relationship was medium (f^2=.280). Consistent with prior research driven by SDT in other contexts, the results suggest individuals whose physicians are more supportive of their being more self-determined in managing their health, would exhibit higher levels of BNS.

The ninth and final hypothesis (H9) was proposed to investigate the relationship between the personality trait of autonomous causality orientation (ACO) and BNS. Results of this study showed a statistically significant positive relationship (beta coefficient of .421, *p*-value < .001). The effect size of this relationship was medium (f^2=.239). These results suggest that individuals with

higher levels of orientation toward autonomy exhibit more self-determination in managing their health compared to those with lower levels of autonomy orientation. Considering the effect sizes, it is interesting to point out that physician autonomy support is as important as this personality trait in determining an individual's self-determination in health management.

6.1.5 Research Question 5

RQ5: *How appropriate is the proposed theoretical model in predicting an individual's adoption of integrated PHR systems?*

The appropriateness of the theoretical model in predicting/explaining integrated PHR system adoption by individuals is discussed in terms of coefficient of determination (R^2) of the endogenous variable of the model, predictive relevance of the model (Q^2), and goodness-of-fit (GoF) of the model. The results are presented in Sections, 5.4.2, 5.4.4, and 5.4.5 of this dissertation.

The overall R^2 of the endogenous construct (behavioural intention) in the research model was .650, which indicates that a large portion of the variance (65%) in this construct was explained by the factors in the model, thus indicating the high predictive power of the research model. As explained under theoretical development of this study, Venkatesh et al. (2003) examined eight prominent theories of individual acceptance of information theory by running PLS analyses on all theories. As a result, for a pre-usage stage, R^2 for the behavioural intention (BI) factor in those theories ranged from .30 to .38 (p. 440). In addition, in the same paper, the unified theory of acceptance and use of technology (UTAUT) was proposed and validated resulting in an R^2 of .52 for BI in a pre-usage stage (p.465) and .77 for a pooled data set (relating to all three stages of adoption process, namely, pre-usage, initial use, and post usage). In summary, the R^2 for the endogenous variable of this study compares well to the results of a prominent similar study.

In addition to R^2 of the endogenous variable, the predictive relevance (Q^2) of the model was .615 which implies the model has predictive relevance ($Q^2>0$). Finally, the absolute and relative GoF indexes were calculated for the model, and they were .610 and .921 respectively. Absolute GoF above .36 indicates a high fit of the model to the observed data. Finally, a relative GoF value of above 0.9 is considered favourable. In summary, the results of this research show that the model appropriately explains an individual's adoption of integrated PHR systems.

6.1.6 Research Question 6

RQ6: *How do individual characteristics (age, gender, internet experience, education level, etc.) influence an individual's adoption of integrated PHR systems?*

Recall that the analyses presented in Section 5.5 of this dissertation suggested that the individual characteristics did not have any influence on the hypotheses of this study. The results showed that one of the individual characteristics had a considerable, however small, effect on one of the dependent variables of the theoretical model of this study. Individual's experience in using internet (measured in terms of years of internet use) had a small (f^2=.054), yet significant (p-value<.01) negative effect (β=-.196) on the PU of integrated PHR systems. A similar finding was reported by Nysveen and Pedersen (2004) in a study on the effect of internet experience on consumers' perceptions regarding interactive websites. In their study, it was shown that consumers with more internet experience perceived less usefulness in websites with interactive content (vs. statistic websites). Interactive content in that study referred to websites' containing personalized and community services. Since an integrated PHR system offers such services, the findings of this study regarding internet experience are consistent with that of Nysveen and Pedersen (2004). Further research is required to understand why such a negative association exists between internet experience and PU of internet websites in general and online [integrated] PHR systems in particular. The rest of the individual characteristics did not have effects of considerable size on model variables (f^2<.02).

6.2 Contributions

The overall goal of this research is to further our understanding of the factors which would influence an individual's intention to use an integrated PHR system. The findings provide several contributions to theory and practice that are summarized in the following sub-sections.

6.2.1 Contributions to Theory

From an academic perspective, this research makes important contributions by developing and validating a research model for the adoption of integrated PHR systems.

As indicated in Chapter 3 of this dissertation, the issue of adoption of integrated PHR systems is in the early stages of development. While this dissertation acknowledges the significance and contributions of previous studies on PHR system adoption, they are for the most part not deductive in nature and not grounded in theory. In addition, a number of studies have been conducted on PHR system adoption that are either disease specific, targeted at a specific population (e.g., elderly, children), or conducted on non-integrated PHR system. This dissertation study bridges these gaps by developing and validating the first

adoption model that is targeted at the general public, focuses on integrated PHR systems, is not disease specific (i.e., relates to health and wellness management in general), is grounded in theory, and it employs a rigorous hypothetico-deductive method for validation of findings. Further, the explained variance of the endogenous variable (behavioural intention) in the research model (65%) as well as a positive predictive relevance (Q^2) indicates high explanatory power of the research model. Finally, based on obtained GoF values, the theoretical model fits well to the observed data.

In developing and validating an adoption model for integrated PHR systems, this dissertation study highlights the importance of considering the changing role of consumers from passive recipients of care to active partners in care. Although this model is specific to using integrated PHR systems for managing one's health, such a role change brought about by information technology could be observed in contexts other than health care. Examples of other contexts include, but are not limited to, educational settings and banking. Based on an extensive review of the literature presented in Chapter 3 of this dissertation, this study is the first to apply and validate SDT in order to understand integrated PHR system adoption, and it is also the first study to apply and validate SDT for explaining pre-usage intention to use any type of IS.

As a result of incorporating SDT in its research model, this study showed the importance of physician autonomy support in the adoption of integrated PHR systems by individuals. Similarly, the importance of considering the personality trait of autonomous orientation in integrated PHR system adoption was showed in this study. The R^2 of the BNS construct (Figure 5.1) is .535 indicating that physician autonomy support and autonomous orientation together explain a large portion of the variance in BNS, and thus are major determinants of self-determination in the context of health management. Finally, the measurement scales for the constructs of SDT were adapted and validated in this study for the context of health management and can be used in future studies.

Another theoretical contribution of this study is the validation of a parsimonious model of IS adoption (the technology adoption side of the research model in Figure 5.1) in the context of integrated PHR systems. Finally, the roles of individual characteristics (e.g., age, gender, etc.) in integrated PHR system adoption were examined, and the related findings were presented in Table 5.22 and Table 5.23.

6.2.1 Contributions to Practice

This study provides valuable implications and contributions to practice in terms of development, promotion, and facilitating the use of integrated PHR systems by consumers.

Based on the findings of this study, individuals with higher levels of PU exhibited higher levels of intention to use an integrated PHR system. Therefore, designers/developers of integrated PHR systems must consider incorporating features that are of importance to consumers. For example, the results of the examination of the open-ended questions in this study suggest that consumers put a lot of importance on ease of access to records, ease of communication with care providers, monitoring and tracking features, etc. Full details can be found in Table 5.24. Similarly, these findings can guide the promotion of integrated PHR systems by informing practitioners about what features to highlight more extensively. Furthermore, the findings can inform facilitating PHR use by various parties. For example, since consumers place high importance on ease of communication with care providers as mentioned above, health care providers may think of mechanisms to assign time to correspond to their patients through the PHR system, thus encouraging their patients to use integrated PHR systems to a higher extent.

Results of this study suggest that individuals who perceive the PHR system to be more complex exhibited lower levels of intention to use the system compared to those who perceived the system to be less complex. This finding highlights the importance of designing easy to use systems. For example, since the measurement scale for complexity in this study incorporated the ongoing effort of keeping the system updated with personal health information, various features of easy and automatic data entry can be considered in designing and developing integrated PHR systems. Such features must be highlighted in promoting the use of integrated PHR systems. In addition, providing training materials, as well as tutorials, would help potential users find the system easier to use, thus facilitating higher adoption.

Finally, findings of this study suggest that individuals with higher levels of self-determination in managing their own health would have more positive perceptions regarding the use of integrated PHR systems. In addition, physician autonomy support and individual's level of autonomous orientation were shown to positively influence self-determination. As a result, in order to promote and facilitate the use of integrated PHR systems, health care providers must generally support their patients' taking part in their health management. Finally, for individuals with a personality orientation toward being controlled (rather than being autonomous), rewards and punishments may promote a higher level of self-determination in health management (Ryan and Deci 2000), and consequently facilitating higher adoption rate for integrated PHR systems.

Table 6.1 summarizes the major findings of this study in terms of the supported hypotheses, the academic value added of the study, and practical implications of the findings.

Table 6.1: Value added of this dissertation study and example practical implications

Findings	Theories Used	References	Value added of this research	Example Practical Implications
Perceived usefulness positively influences behavioural intention.	Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT)	Davis (1989), Venkatesh et al. (2003)	Empirical support for a relationship not previously validated in the context of using integrated PHR systems for health management	Consider features deemed useful by consumers in: • Designing integrated PHR systems (e.g., monitoring and tracking features) • Promoting integrated PHR systems (highlight those features in advertisements) • Facilitating integrated PHR system use (provide incentive for health care providers to communicate with patients through integrated PHR systems).
Complexity negatively influences behavioural intention.	TAM, UTAUT, Model of PC Utilization	Davis (1989), Venkatesh et al. (2003), Thompson and Higgins (1991)	Empirical support for a relationship not previously validated in the context of using integrated PHR systems for health management	• Design easy to use/maintain integrated PHR systems • Train consumers in using integrated PHR systems • Provide technical support for facilitating usage

Findings	Theories Used	References	Value added of this research	Example Practical Implications
Self-efficacy negatively influences complexity	Social Cognitive Theory	(Bandura (1986); Bandura (1989); Compeau and Higgins (1995b))	Adapted and validated self-efficacy scale for integrated PHR systems; Empirical support for a relationship not previously validated in the context of using integrated PHR systems for health management	• Train consumers in using integrated PHR systems • Provide technical support for facilitating usage
Basic needs satisfaction (BNS) negatively influences complexity	Self-Determination Theory (SDT), Technology and PHR system adoption publications	Ryan and Deci (2000), (Ball et al. (2007); Beckjord et al. (2012); Davis et al. (1992); Hesse (2008))	Adapted and validated SDT scales for the context of personal health management; Empirical support for relationships not previously investigated	Health care providers must generally allow their patients to take part in their health management for individuals with a personality orientation toward being controlled (rather than being autonomous), rewards and punishments may promote a higher level of self-determination in health management (Ryan and Deci 2000), consequently facilitating higher adoption rate for integrated PHR systems.
BNS negatively influences perceived usefulness.				
Physician autonomy support positively influences BNS; Autonomous causality orientation is positively associated with BNS.	SDT	Ryan and Deci (2000)	Empirical support for relationships not previously validated in the context of personal health management	

6.3 Major Strengths and Limitations of the Study

6.3.1 Strengths

This dissertation study holds several strengths in terms of the review of the literature, theoretical development, and research methodology as described in this section.

6.3.1.1 Literature Review

As the first strength under this section, this dissertation builds on prior publications on the transformative potential of integrated PHR systems, and it presents the mechanisms of such a transformative potential in a structured format. In doing so, various components of the structure (Figure 2.1) are elaborated on, along with real-life examples which would facilitate a clearer understanding of the concept. The presented structure drives the whole of Chapter 2 of this dissertation in achieving the purpose of highlighting the changing role of consumers which was in the scope of this dissertation study.

Second, this dissertation synthesizes the related publications in order to provide a firm description of integrated PHR systems including a comprehensive list of typical integrated PHR system functionalities and data content. Benefits of integrated PHR systems are presented in a structured format with an eye on the benefits that would facilitate transformative changes in health care delivery and health management. In addition, different types of health record management systems are distinguished.

Third, a comprehensive review of PHR-related publications is conducted and presented in this dissertation along with categorizing them and describing their major features.

6.3.1.2 Theoretical Development

The major theoretical strength of this dissertation is integrating well-established theories from two disciplines (IS and Psychology) for the purpose of explaining a phenomenon (integrated PHR system adoption) that has its roots in both disciplines. This dissertation views integrated PHR systems as technological tools which would facilitate a change in the role of their users in a context of high significance (health management).

6.3.1.3 Research Methodology

First, utilization of constructs from the literature allowed for the integration of well-established theories from IS and Psychology literatures into a research model specific to the context of this study. The research model was then validated, and it exhibited large predictive and explanatory powers.

Second, since integrated PHR systems are relatively new, there are not yet many commercial systems available that would encompass the range of functionalities suggested in the literature. Using a video clip to introduce integrated PHR systems to study participants provided great flexibility in terms of presenting various features of such systems.

Third, the video clip included real-life scenarios involving a wide variety PHR functionalities. The scenarios also provided a variety of real-life cases that were targeted at a wide range of audiences in terms of demographics, health care needs, etc.

Fourth, the video clip was created based on content gathered from multiple sources including published research papers, review websites, expert opinions, and a number of commercially available PHR systems. This would help generalizability of the findings of this study on the account that the PHR system presented in the video clip encompassed all typical integrated PHR system functionalities.

Fifth, the video clip was composed of two main parts. In the first part, general information about integrated PHR systems was presented in text/audio format. In the second part, an HTML[24] prototype of a fictitious integrated PHR system was used in order to demonstrate the features of integrated PHR systems as well as to demonstrate the real-life scenarios which were presented as part of the video clip. The creation of the HTML prototype was one of the greatest strengths of the design of this study. It facilitated delivering a realistic look and feel of integrated PHR systems to participants; it allowed implementing complex features of integrated PHR systems with a low cost and great flexibility; it allowed presenting integrated PHR system functionalities without any effect of commercial brands.

Sixth, splitting the survey into two parts and allowing a reasonable time in between administering the two parts helped to reduce the risk of common methods bias (CMB). In addition, it reduced the cognitive load on participants which in turn reduced the risk of inattentive responses.

[24] Hypertext Markup Language

Seventh, collecting open-ended questions enriched the results of this study by supporting the conclusions derived from the quantitative analysis of close-ended items. For example, examining the responses to open-ended questions suggested that perceptions of usefulness and complexity (PU and CPLX) of integrated PHR systems are major determinants of the adoption of such systems, as revealed by the results of the deductive analysis. In addition, elaboration of the participants on matters that related to those two factors shed light on what might be considered useful/complex in a typical integrated PHR system. Findings may help in providing insights for practitioners in terms of how to design, develop, and promote integrated PHR systems.

Eight, participants were recruited from the general public which helped to mitigate the risk of having a biased sample. In addition, stratification techniques were used in order to have a balanced sample in terms of participant demographics.

Ninth, in analyzing the data for this dissertation, several statistical techniques were employed to corner the phenomenon under study. As such, quality of the collected data was carefully examined, and several control variables that were suspected to influence the conclusions of the study were examined. The analysis of the data related to control variables helped enrich the understanding gained from this study as well as it helped arriving at clear, logical conclusions.

6.3.2 Limitations

As with any study, the results of this dissertation are constrained by a number of limitations. This subsection summarizes the limitations of this study.

Generalizability is an issue that poses a limitation to the study similar to any other studies in social sciences. This research was carried out in a Canadian context; thus, findings from the research will not be immediately transferrable to other countries with different demographics, health care system characteristics, and cultures. For example, the role of culture is believed to be influential in research related to self-determination theory (e.g., Ryan and Deci (2011)), information systems in general (e.g., Leidner and Kayworth (2006)), and technology adoption in particular (e.g., McCoy et al. (2007)). Cultural views may influence self-determination, and they may play a role in the adoption of integrated PHR systems. Further research is required to determine the extent to which the findings of this study can be extended to other countries.

Data collection for this study was conducted by employing a cross-sectional survey design. Given that perceptions and intentions (CPLX, PU, and BI) regarding the use of integrated PHR systems could change over time, collecting data at one point could pose a threat of temporal instability in the

findings. Nevertheless, the focus of the study was only on one particular stage in the adoption process were individuals had no experience in using integrated PHR systems (i.e., pre-usage), and the selected method of data collection was deemed best in this case.

Behavioural intention was selected as the endogenous variable of the research model for this study. The "ideal" case would be to, first, measure perceptions of participants regarding the use of integrated PHR systems, then offer them the opportunity to use an actual integrated PHR system and, then, measure the extent of actual usage at a later point in time than when the perception measurement was conducted. Due to project feasibility restrictions, it was decided to measure intention rather than actual future usage. However, prior research has confirmed a high correlation between intention to use and future actual usage, and that BI could predict future usage adequately.

Data collection was conducted using an online survey, and participants were recruited through a market research firm. One could argue that a sample of people who are already on the internet filling out surveys might not be a good representative of the general public, and thus posing a threat of selection bias to the findings of the study. The market research firm that provided the participants of this study employs a variety of methods in recruiting participants (e.g., e-mails, TV advertisement, postal advertisement, etc.). In addition, the stratified random sampling was conducted in this study with the purpose of drawing a sample of participants whose demographics represented those of the general Canadian public, to the extent possible. Thorough statistical analyses presented in this dissertation suggest representativeness of the sample. Therefore, a claim can be made that the sample is the closest possible to being representative of the general public. Furthermore, validity and reliability of measurement scales match those in the reviewed literature which confirms the high quality of collected data.

As part of screening participants, those without a family physician were excluded from the study. However, since a major part of the research model was proposed to understand the role of a physician in the adoption of integrated PHR systems, it was deemed necessary to target only those with a family physician so they could respond appropriately to the questions pertaining to physician autonomy support.

Finally, recall from Section 4.1.3.1 of this dissertation that a video clip was created for the purpose of introducing integrated PHR systems to the study participants. In particular, it is worth noting that the PHR system presented in the video clip was not an existing system, rather a prototype of a fictitious integrated PHR system was developed and presented in the clip. However, all the effort was made (discussed in the methodology chapter) to develop a prototype that represents typical integrated PHR system functionalities, and whose development in actuality is feasible.

Despite the above limitations, this dissertation provided insights on integrated PHR system adoption which would be useful for researchers and practitioners. In addition, this study uncovered important issues that could be of interest to researchers in developing further studies in this context as well as in validating the findings of this study in other contexts.

6.4 Directions for Future Research

As a result of conducting this dissertation research, several issues were uncovered that promise to be interesting directions for future research. This subsection summarizes those directions.

The current study was focused on the pre-usage stage of integrated PHR system adoption process. As discussed previously in this chapter, in this stage consumers may not have a full understanding of the nature of the change in their roles (from passive to active) when using an actual integrated PHR system. Therefore, possible venues of future research are to validate the theoretical model of this study for actual users of integrated PHR systems, or to develop and validate an adoption model for actual users of integrated PHR systems. In such research, actual usage behaviour would be a better choice for the endogenous construct in the research model.

A longitudinal study can be designed in which data for SDT scales and perceptions of integrated PHR systems are collected at three points in time: pre-usage, initial usage, continued use. In such research, the influence of SDT factors at each point in time on perceptions and usage behaviour at later points can be investigated. In addition, the effect of PHR usage on the satisfaction of the three basic needs for autonomy, competence, and relatedness could be investigated by comparing the values for SDT factors across different points in time.

Using integrated PHR systems might influence an individual's level of basic needs satisfaction in health management (Hesse 2008). Thus, another venue for future research is to investigate such influence. In other words, research is needed to understand the influence of integrated PHR system usage on an individual's self-determination in managing his/her health.

Next, this study can be conducted in a way that various commercial PHR systems are introduced to participants. As such, the effects of brands and sponsorship (government vs. private) on integrated PHR system adoption can be investigated.

In this study, SDT was applied for the understanding of the adoption of integrated PHR systems on the grounds that using such systems would result in a change in the role of consumers, from passive recipients of care to active participants. This theory can be applied to understanding the usage of other types

of IS that require such role change. For example, research on distance learning and self-service technologies can benefit from the application of SDT.

As mentioned in the limitations section, cultural views can play a role in both IS adoption and the satisfaction of the three basic needs. Further cross-cultural research is needed to investigate such a role.

Recall from Section 5.5 of this dissertation (Table 5.22 and Table 5.23) that a number of individual characteristics and control variables were found to be associated with some of the factors in the research model of this study. Although implications of the results for this dissertation are previously discussed in this chapter, understanding of the nature of the associations was beyond the scope of this dissertation. However, further research is required to explain the results.

Participants took the time to provide answers to the two non-mandatory open-ended questions as part of completing the survey. Therefore, their responses were reflective of what they deemed important enough to share their thoughts on. Although anecdotal evidence of participants' major concerns, the responses to the open-ended questions revealed a number of factors that could guide future research in identifying most influential integrated PHR system adoption factors. For example, content analysis methods can be employed in order to extract patterns of responses which, in turn, can help identify the most influential adoption factors (Krippendorff 2012).

Recall from Chapter 3 of this dissertation that the construct of social influence was not included in the research model of this study because of current low PHR adoption rates and because of the focus of this dissertation on the pre-usage stage of PHR adoption. However, as the adoption rates of PHR systems increases over time, research is needed to understand the possible impact of social influence on PHR adoption at various later stages of the adoption process (i.e., initial usage and post-usage).

Finally, recall from Section 5.4.6 (saturated model analysis) that the results of this study suggested some of the non-hypothesized paths to be significant. Although those paths were not theoretically plausible, nor did they have a significant influence on the explanatory power of the model of this study, further research is needed to shed light on the nature of those associations (outlined in Table 5.20).

6.5 Conclusions

The objective of this dissertation study was to advance empirical research in understanding consumers' intention to use integrated PHR systems. To this

end, a theoretical model was proposed and validated which integrated theories from both IS and Psychology literatures. As such, the proposed model incorporated constructs, originally, from the technology acceptance model (TAM), the model of personal computer use (MPCU), social cognitive theory (SCT), and self-determination theory (SDT). The psychometric properties of the research instrument were assessed and validated.

In order to validate the proposed research model of this study, a hypothetico-deductive approach was taken. Data collection was conducted using an online survey targeted at the general public, and a sample of 159 cases were collected and used in the data analysis for this research. Since this study was focused on the pre-usage stage of the integrated PHR system adoption process, only individuals with no prior experience in using such systems were recruited to complete the survey. Partial Least Squares (PLS) method of structural equation modeling was employed to analyze the collected data, and to validate the proposed model. The results suggested that the proposed model had high predictive and exploratory powers.

Findings of this study suggested that consistent with prior studies in the area of IS adoption, perceptions of usefulness (PU) and effort associated with using IS are major determinants of the adoption of integrated PHR systems as well. In addition, the results suggested that individuals with higher levels of self-determination have more positive perceptions regarding the use of integrated PHR systems. As the major theoretical contribution of this study, this finding has benefits to both theory and practice. With respect to benefits to theory, findings of this research open the gateway to apply the significant body of research on SDT to the context of IS adoption as well as personal health management. With respect to practice, findings of this dissertation study can inform designers, developers and promoters of integrated PHR systems on how to more successfully go about their jobs. In addition, the results can inform health care providers on how to support and facilitate the use of integrated PHR systems for their patients.

Finally, lack of adoption of integrated PHR systems, in spite of their potential benefits, was a major motivation for conducting this study. As such, this study aimed to contribute to the IS literature by providing insights on the factors which would influence an individual's intention to use an integrated PHR system. In particular, the study considered the changing role of consumers in managing their health, and the implications of such a role change for integrated PHR system adoption. By employing a rigorous research methodology, this study accomplished its main goal of validating a theoretical model of integrated PHR system adoption.

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APPENDIX A: Online Survey Content

[Title:][25] A Study of Online Personal Health Records (PHR) - Part One

[Opening message:] You are invited to take part in this research study on online Personal Health Records (PHR). Please click "Next" to go to the following screen in order to view detailed information about this study as well as procedures involved in it.

Letter of Information/Consent

Principal Investigator: Dr. Khaled Hassanein, Phone: (905)525-9140 ext. 23956, E-mail: hassank@mcmaster.ca

Student Investigator: Vahid Assadi, Phone: (905)525-9140 ext. 26392, E-mail: assadiv@mcmaster.ca

Investigators' Institute and Research Sponsor: DeGroote School of Business, McMaster University, Hamilton, Ontario, Canada

Purpose of the Study: You are invited to take part in this study on online Personal Health Records (PHR). We are conducting this research for a PhD thesis to find out what factors contribute to individuals' intention to use PHR systems. In particular, this research will result in guidelines for the design of online PHRs.

Procedures involved in the Research: If you volunteer to participate in this study, we would ask you to do the following:

- Part One - To be done now:
    - Complete an online questionnaire to provide some information about yourself and your general interests and preferences.
- Part Two - Only if/after you participate in Part One, you will receive a link to participate in Part Two:
    - Watch an online video clip (13 minutes and 25 seconds) that involves an introduction to online PHRs. Please make sure your computer supports watching a Youtube video before agreeing to participate in our study.
    - Complete an online questionnaire to provide your initial opinion of online PHRs based on what you learn from the video clip, and to provide some basic information about yourself.

[25] [Brackets] are used here to provide further description. Text in brackets was not on the actual survey.

None of the questions will ask you about your clinical information. In addition, your answers to survey questions will not be matched to your identification information in any way, and collected data will be confidential.

Eligibility**:** In order to be eligible to participate in this study you MUST:

1. be currently living in Canada.
2. be over the age of 18 years.
3. have a family physician (doctor).
4. not have used an online Personal Health Record before.

Potential Harms, Risks or Discomforts: There are no foreseeable physical, psychological, emotional, financial or social risks associated with this study.

Potential Benefits: By participating in this study, you will help to discover ways to design online PHR more appropriate for the needs of people. The discovery of important factors leading to greater usage of online PHRs should greatly impact people performance and satisfaction with such systems. This will, in turn, help users get the most benefit from using the system. You will also learn about online PHRs and how you can employ such systems to better manage your health and well being if you find them useful to do so. Through this work, researchers and practitioners will gain a better understanding of users' preferences, resulting in practical design guidelines for PHR systems.

Compensation for Participation: You will be compensated by ResearchNow as outlined on ResearchNow terms and conditions.

Confidentiality: All information collected will be kept secure and in strict confidence. Only the researchers named above will have access to the data, which will be stored securely. Participants are anonymous and will not be identified individually in any reports or analyses resulting from this research project.

Participation and Withdrawal: You may withdraw at any time, should you choose to do so. Only participants who complete both parts will receive compensation.

Information about the Study Results: Subsequent to your participation in the study, you can find additional information about the study at the following web address: http://phd.degroote.mcmaster.ca/assadiv/phrinfo.htm
This web site also contains contact information through which you may reach the researchers, and will be updated with the results of the study once data analysis is complete.

Rights of Research Participants: You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through a McMaster Research Ethics Board (MREB). If you have questions regarding your rights as a research

participant, contact:

Research Ethics Officer,
McMaster University 1280 Main Street West, Gilmour Hall Room 306
Hamilton, Ont. L8S 4L8
TEL: 905-525-9140 ext. 23142

CONSENT: I understand the information provided for the study of online personal health records as described herein. My questions have been answered to my satisfaction, and by selecting "I AGREE" below, I agree to participate in this study. I understand that if I agree to participate in this study, I may withdraw from the study at any time. *

☐ I AGREE

Eligibility Assessment

The following four questions assess your eligibility to participate in our study. Please click "Next" after answering all the four questions.

Do you currently live in Canada? *[26]

- ○ Yes
- ○ No

Are you over the age of 18 years? *

- ○ Yes
- ○ No

Do you currently have a family physician (doctor)? *

- ○ Yes
- ○ No

Have you ever used an online personal health record? *

- ○ Yes
- ○ No

[26] An asterisk (*) denotes a mandatory question.

Survey Instructions

Survey Structure and Navigation:

This survey is organized into several groups of questions. Each group of questions will be presented to you on a separate page. On top of each page there is a short description about the questions on the page. Before answering questions, please read the descriptions carefully as they are important parts of our research, and to ensure consistency in our results we need every participant to have read the descriptions.
Once you answer questions on a page and proceed to a following page, you cannot go back. Please NEVER press the back button on your web browser.

Mandatory Questions:

A red asterisk (*) next to a question (or a group of questions) indicates a mandatory question. You cannot proceed to the next page without providing an answer to a mandatory question.

Finishing the Survey:

On the last page of questions, you will see a "Submit" button at the bottom of the screen. Only by clicking the submit button will your responses be saved on our computers and will you receive instructions on how to participate in Part Two of the study.

Ready to Start?

Please keep in mind that your answers to all the questions in this survey are anonymous and will be kept confidential. Please be honest and candid.

Thank you again for participating in this study and we hope you enjoy it!

Please click "Next" below to start the survey.

Which Province of Canada do you currently live in? *

- ○ Alberta (AB)
- ○ British Columbia (BC)

- ○ Manitoba (MB)
- ○ New Brunswick (NB)
- ○ Newfoundland and Labrador (NL)
- ○ Nova Scotia (NS)
- ○ Ontario (ON)
- ○ Prince Edward Island (PE)
- ○ Quebec (QC)
- ○ Saskatchewan (SK)

What is your gender? *

- ○ Female
- ○ Male

Which age group do you belong to? *

- ○ 18-24 years
- ○ 25-29 years
- ○ 30-34 years
- ○ 35-39 years
- ○ 40-44 years
- ○ 45-49 years
- ○ 50+ years

[Basic Needs Satisfaction]

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true each is for you: *

Note 1: "Managing your health" involves all the activities and tasks that you do to help you stay healthy, or manage any health condition you may encounter.

Note 2: In the following statements, a few examples of "people you interact with regarding your health management" are doctors, nurses, family members or friends who might help you in managing your health.

7-point "not at all true" to "very true"

The actual items are removed from this dissertation due to copyright.

[Control Variables]

Please answer the following questions about yourself:

How many years have you been with your current family doctor? * _____
How many times have you visited your family doctor in the past 12 months? *
Please choose only one of the following:

- ○ Never
- ○ Once
- ○ Twice
- ○ Three times
- ○ Four times
- ○ Five times
- ○ More than five times

[Physician Autonomy Support]

Doctors have different styles in dealing with patients, and we would like to know more about how you feel about your encounters with your family doctor. Reflecting back to your encounters with your family physician, indicate to what extent you agree with each of the following statements. *

Please choose the appropriate response for each item:

7-point "strongly disagree" to "strongly agree"

The actual items are removed from this dissertation due to copyright.

[General Causality Orientation]

The items on this page pertain to a series of hypothetical sketches. Each sketch describes an incident and lists three ways of responding to it. Please read each sketch, imagine yourself in that situation, and then consider each of the possible responses. Think of each response in terms of how likely it is that you would respond that way. We all respond in a variety of ways to situations, and probably most or all responses are at least slightly likely for you. If a response is very unlikely for you, select an option closer to the left end of the scale. If it is moderately likely, select an option in the mid range, and if it is very likely that you would respond that way select an option closer to the right end of the scale.

7-point "very unlikely" to "very likely"

The actual items are removed from this dissertation due to copyright.

[Closing message for Part 1 of the survey]Thank you for participating in the first part of this research. Your responses are now saved.
Please stay tuned as you will soon be invited to the second part of this research.

[Title:] A Study of Online Personal Health Records (PHR) - Part Two

[Opening message:] Thank you for participating in the first part of our research, and welcome to the second part.
Please click "Next" to go to the following screen in order to view detailed information about this study as well as procedures involved in it.

Letter of Information/Consent
Part 2 of 2

Principal Investigator: Dr. Khaled Hassanein, Phone: (905)525-9140 ext. 23956, E-mail: hassank@mcmaster.ca

Student Investigator: Vahid Assadi, Phone: (905)525-9140 ext. 26392, E-mail: assadiv@mcmaster.ca

Investigators' Institute and Research Sponsor: DeGroote School of Business, McMaster University, Hamilton, Ontario, Canada

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Purpose of the Study: You are invited to take part in this study on online Personal Health Records (PHR). We are conducting this research for a PhD thesis to find out what factors contribute to individuals' intention to use PHR systems. In particular, this research will result in guidelines for the design of online PHRs.

Procedures Involved in this Part of the Research**:** If you volunteer to participate in this study, we would ask you to do the following:

- Watch an online video clip (13 minutes and 25 seconds) that involves an introduction to online PHRs. Please make sure your computer supports watching a Youtube video before agreeing to participate in our study.
- Complete an online questionnaire to provide your initial opinion of online PHRs based on what you learn from the video clip, and to provide some basic information about yourself.

None of the questions will ask you about your clinical information. In addition, your answers to survey questions will not be matched to your identification information in any way, and collected data will be confidential.

Potential Harms, Risks or Discomforts**:** There are no foreseeable physical, psychological, emotional, financial or social risks associated with this study.

Potential Benefits**:** By participating in this study, you will help to discover ways to design online PHR more appropriate for the needs of people. The discovery of important factors leading to greater usage of online PHRs should greatly impact people performance and satisfaction with such systems. This will, in turn, help users get the most benefit from using the system. You will also learn about online PHRs and how you can employ such systems to better manage your health and well being if you find them useful to do so. Through this work, researchers and practitioners will gain a better understanding of users' preferences, resulting in practical design guidelines for PHR systems.

Compensation for Participation**:** You will be compensated by ResearchNow as outlined on ResearchNow terms and conditions.

Confidentiality**:** All information collected will be kept secure and in strict confidence. Only the researchers named above will have access to the data, which will be stored securely. Participants are anonymous and will not be identified individually in any reports or analyses resulting from this research project.

Participation and Withdrawal**:** You may withdraw at any time, should you choose to do so. Only participants who complete both parts will receive compensation.

Information about the Study Results**:** Subsequent to your participation in the study, you can find additional information about the study at the following web address: http://phd.degroote.mcmaster.ca/assadiv/phrinfo.htm
This web site also contains contact information through which you may reach the researchers, and will be updated with the results of the study once data analysis is complete.

Rights of Research Participants**:** You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through a McMaster Research Ethics Board (MREB). If you have questions regarding your rights as a research participant, contact:

Research Ethics Officer,
McMaster University 1280 Main Street West, Gilmour Hall Room 306
Hamilton, Ont. L8S 4L8
TEL: 905-525-9140 ext. 23142

CONSENT: I understand the information provided for the study of online personal health records as described herein. My questions have been answered to my satisfaction, and by selecting "I AGREE" below, I agree to participate in this study. I understand that if I agree to participate in this study, I may withdraw from the study at any time. *

☐ I AGREE

[Stratification Quota Check]

What is your gender? *

- ○ Female
- ○ Male

Which age group do you belong to? *

- ○ 18-24 years
- ○ 25-29 years
- ○ 30-34 years
- ○ 35-39 years
- ○ 40-44 years
- ○ 45-49 years
- ○ 50+ years

Which Province of Canada do you currently live in? *

- ○ Alberta (AB)
- ○ British Columbia (BC)
- ○ Manitoba (MB)
- ○ New Brunswick (NB)
- ○ Newfoundland and Labrador (NL)
- ○ Nova Scotia (NS)
- ○ Ontario (ON)
- ○ Prince Edward Island (PE)
- ○ Quebec (QC)
- ○ Saskatchewan (SK)

Video Clip Intro

In the following screen, you will see a video clip that introduces online Personal Health Records (PHR). Please note the following:

The video clip is 13 minutes and 25 seconds long.

Please watch the video in its entirety so you will be able to answer the questions that will follow the video clip.

You will not be able to fast forward/rewind the video as there are no control buttons available.

When watching the video clip, if you need to pause, simply click anywhere on the video; click again to resume watching.

The video is not trying to sell you anything, therefore, please provide your true assessment when answering the questions.

Once you answer questions on a page and proceed to a following page, you cannot go back. Please NEVER click the back button on your web browser.

Please make sure your speakers are connected and working before proceeding to the next page.

Please click "Next" when you are ready to watch the clip. The video clip starts playing automatically.

[Online Video Clip[27]]

If you need to pause, simply click anywhere on the video; to resume watching click again.

This video clip is 13 minutes and 25 seconds long[28].

[27] The HTML code for embedding the video clip in associated page of the online survey:

<*center*><*object* width="800" height="600">
<*iframe* class="youtube-player" type="text/html" width="800" height="600" src="http://www.youtube.com/embed/XFBrErOcq9w?version=3&hl=en_GB&rel=0; controls=0;autoplay=1;showinfo=0;disablekb=1;hd=1" frameborder="0"><*/iframe*>
<*/object*><*/center*>

[28] The JavaScript code embedded to prevent skipping the video before it is played in its entirety:

<*script* type='text/javascript'> $(document).ready(function() { minTime(800);
function minTime(minTime) {
var startTime = new Date();
$('#movenextbtn, #movesubmitbtn').click(function(){
var endTime = new Date();
if((endTime - startTime)/1000 <= minTime) { alert ('This video clip is 13 minutes and 25 seconds long. Please watch the entire video before advancing so that you will be able to answer the questions contained in this survey.'); return false; } else { return true; } });
} }); <*/script*>

[Video Check Questions]

Please answer the four questions below to assess how much information you have retained from the video clip. When you are done click “Next”, and you will be presented with questions that ask about your opinion regarding online PHRs.

According to the video clip you just watched, which of the following statements is true about an online PHR? *

- ○ It helps you create and maintain a consolidated record of your lifelong health information.
- ○ It is owned and controlled by you or a designee of your choice.
- ○ It helps you securely share your health information with whom you choose.
- ○ All of the above are true about an online PHR.
- ○ I am not sure.

Which of the following statements is true about the video clip you just watched? *

- ○ A man narrated the entire video clip.
- ○ A lady narrated the entire video clip.
- ○ A man and a lady each narrated a part of the video clip.
- ○ I am not sure.

Based on what was presented in the video clip, is the following statement true or false?
"There are three ways of entering information into an online PHR: Manual entry, entering information using a health measurement device and automatic transfer of information from health care facilities you have visited." *

- ○ True
- ○ False
- ○ I am not sure.

Is the following statement true or false?
"In one of the three scenarios presented in the video clip, there was a man who was using an online PHR to help with his sports training." *

- ○ True
- ○ False
- ○ I am not sure.

[Intention to Use]

Now that you have seen a typical online PHR and you have become familiar with it, please indicate to what extent you agree with each of the following statements. *

7-point "strongly disagree" to "strongly agree"

BI1[29]**:** If available to me, I intend to use an online PHR in the near future to help manage my health.

BI2**:** If available to me, I predict I would use an online PHR in the near future to help manage my health.

BI3**:** If available to me, I plan to use an online PHR in the near future to help manage my health.

[Perceived Usefulness]

For each statement below, select the option that best describes your opinion about an online PHR similar to the one in the video clip. *

7-point "strongly disagree" to "strongly agree"

PU1**:** Overall, I find an online PHR would be useful for managing my health.

PU2**:** I think an online PHR would be valuable to me in terms of managing my health.

PU3**:** The information contained in an online PHR would be useful for managing my health.

PU4**:** The functionalities provided by an online PHR would be useful for managing my health.

[Complexity]

For each statement below, select the option that best describes your opinion about an online PHR similar to the one in the video clip. *

7-point "strongly disagree" to "strongly agree"

CPLX1**:** Using an online PHR would take too much time from my normal duties.

CPLX2**:** Working with an online PHR seems so complicated; it would be difficult to understand what is going on.

CPLX3**:** Using an online PHR involves too much time doing mechanical operations (e.g., data input).

CPLX4**:** It would take too long to learn how to use an online PHR to make it worth the effort.

[PHR Self-Efficacy]

[29] Item codes were not provided on the actual survey which was seen by participants of the study.

For each statement below, select the option that best describes your opinion about an online PHR similar to the one in the video clip. *

7-point "strongly disagree" to "strongly agree"

SE1[30]**:** I am confident that I can use an online PHR if I was only provided with the online instructions for reference.

SE2**:** I am confident that I can use an online PHR even if there is no one around to show me how to do it.

SE3**:** I am confident that I can use an online PHR even if I have never used such a system before.

SE4**:** I am confident that I can use an online PHR if I have just seen someone using it before trying it myself.

SE5**:** I am confident that I can use an online PHR if I just have the online "help" function for assistance.

[Open-ended questions]

For the following questions, type your answer to each question in the corresponding blank box. Your answer could be as short as a single word or as long as several sentences.

OEQ1: What are the primary reasons, if any, that would motivate/encourage you to use an online PHR?

OEQ2: What are the primary reasons, if any, that would prevent/discourage you from using an online PHR?

[Demographics and Control Variables]

Please answer the following questions about yourself:

What is your age in years? *

Approximately, how many years have you been using the Internet? *
On average, how many hours per day do you spend on the internet? *
What is the highest educational level you have attained? *

- ○ Secondary School or Less
- ○ Some University or College

[30] Item codes were not provided on the actual survey which was seen by participants of the study.

- ○ University or College Degree
- ○ Some Graduate Work
- ○ Graduate Degree
- ○ Prefer Not To Say

Do you have any food allergies?

- ○ Yes
- ○ No
- ○ No Answer

Do you currently collect or have you previously collected your health records in a paper-based form? *

- ○ Yes
- ○ No

Are you retired? *

- ○ Yes
- ○ No
- ○ Prefer Not To Say

Are you responsible for managing the health of anybody other than yourself? Examples: Parents, children, other family members. *

- ○ Yes
- ○ No

What is your household income? *

- ○ Less than $40,000
- ○ $40,000 - $79,999
- ○ $80,000 - $119,999
- ○ $120,000 - $159,999
- ○ More than $160,000
- ○ Prefer Not to Say

For each question below, select the option that best describes your opinion using the provided scale: *

7-point "bad" to "excellent"

PHS1**:** How would you evaluate your health in general?

PHS2**:** Compared to women/men your age how would you evaluate your health?

Do you currently live with any chronic condition/disease?

- ○ Yes
- ○ No
- ○ Prefer not to say

Thank you for participating in this research. Your responses are now saved.
Please click on the link below to be redirected to Research Now website for your compensation.

APPENDIX B: Snapshots of the HTML Prototype Used in the PHR Introduction Video Clip

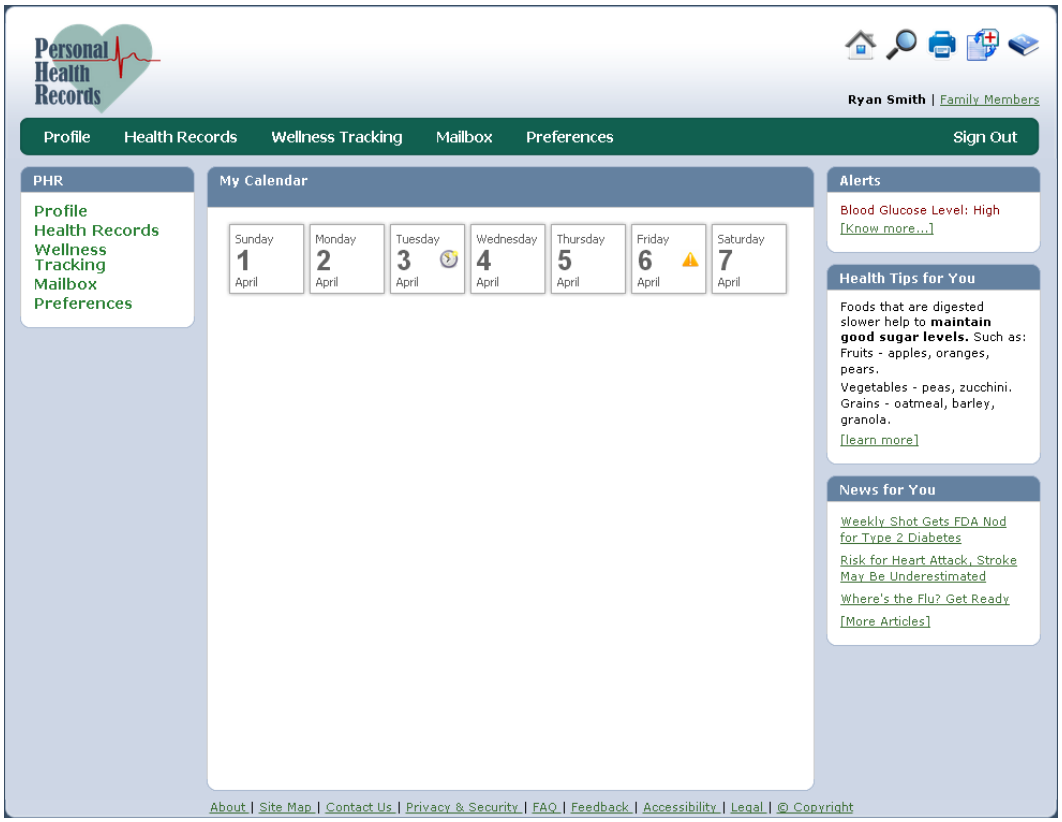

Figure B.1: A snapshot of the HTML prototype – home page

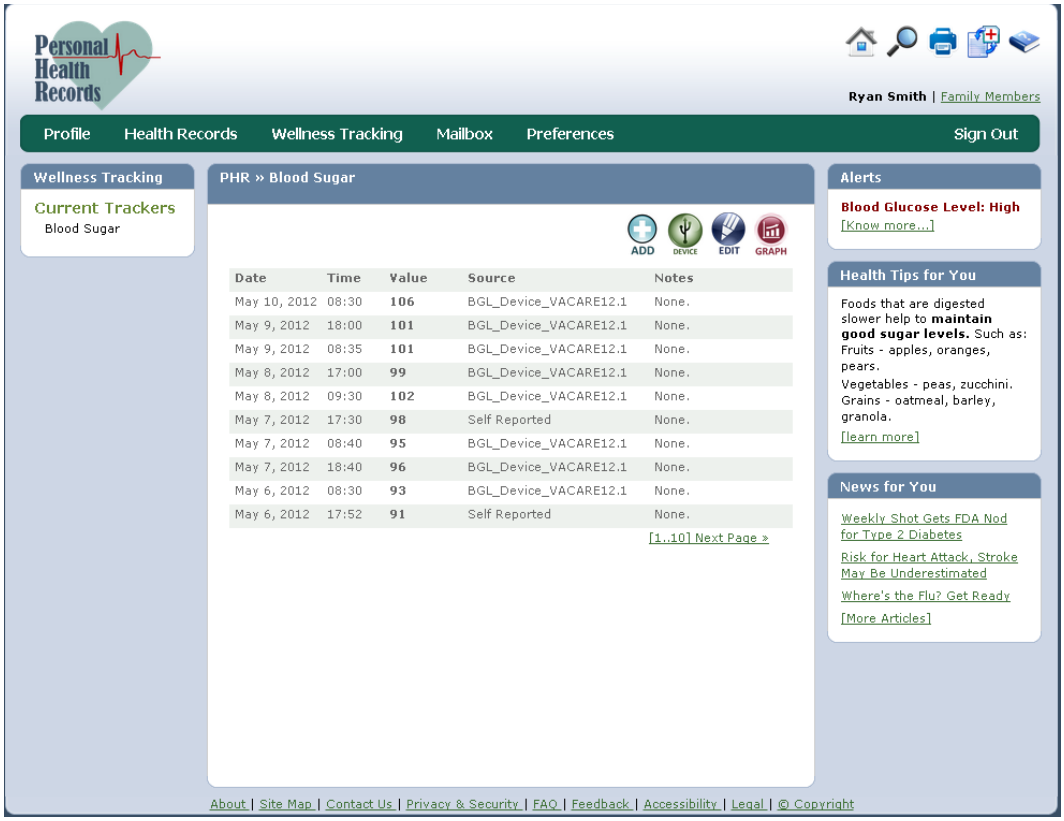

Figure B.2: A snapshot of the HTML prototype – blood sugar level tracking

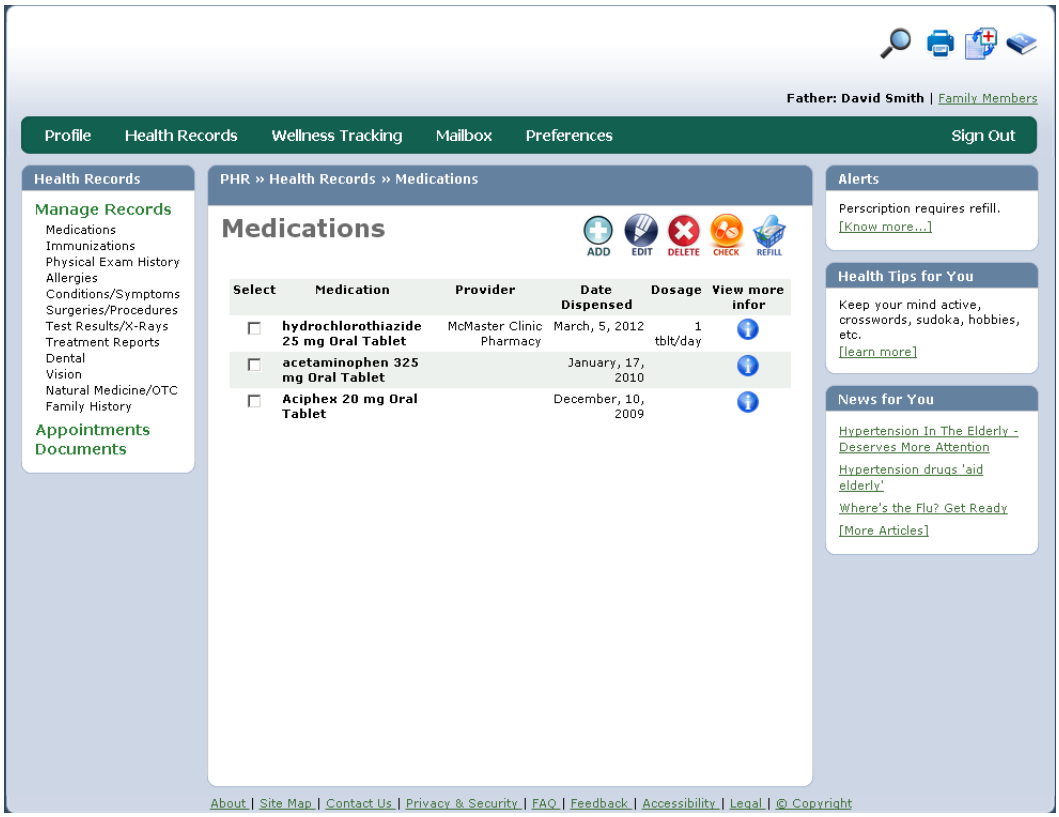

Figure B.3: A snapshot of the HTML prototype – medication history

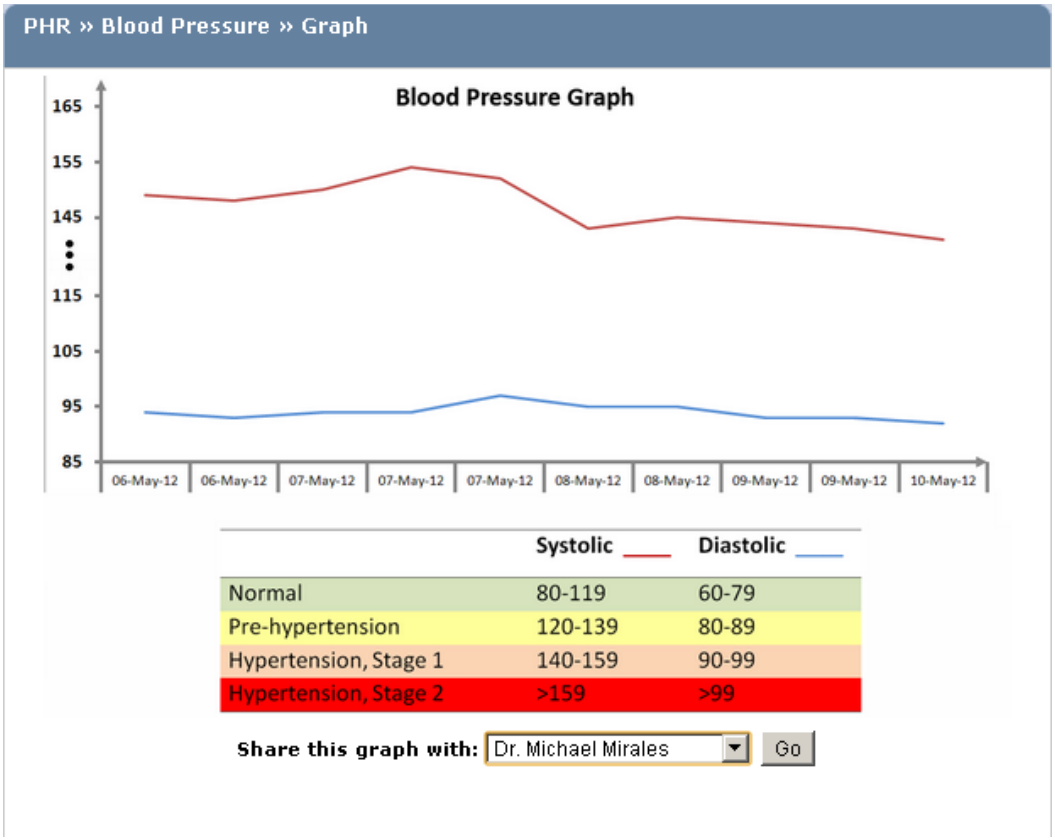

Figure B.4: A snapshot of the HTML prototype – blood pressure tracking graph