2010

Intention To Use A Personal Health Record (phr) A Cross Sectional View Of The Characteristics And Opinions Of Patients Of One Internal Medicine Practice

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INTENTION TO USE A PERSONAL HEALTH RECORD (PHR): A CROSS SECTIONAL VIEW OF THE CHARACTERISTICS AND OPINIONS OF PATIENTS OF ONE INTERNAL MEDICINE PRACTICE

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Public Affairs
in the College of Health and Public Affairs
at the University of Central Florida
Orlando, Florida

Spring Term
2010

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ABSTRACT

A personal health record (PHR) allows a patient to exert control over his/her healthcare by enhancing communication with healthcare providers. According to research, patients find value in having access to information contained in their medical records. Often a glossary is required to aid in interpreting the information and understanding the content. However, giving patients the ability to speak with providers about their medical conditions empowers them to participate as informed healthcare consumers.

The majority of patients (75%) at Medical Specialists expressed their intention to adopt the PHR if it is made available to them. Although the perceived usefulness of a PHR was a significant determining factor, comfort level with technology, health literacy, and socioeconomic status were indirectly related to intention to adopt as well. Perceived health status was not found to be a significant factor in this population for determining intention to adopt a PHR. The majority of patients in each category of gender, age, marital status, and race/ethnicity (except American Indian/Alaska Native) expressed interest in adopting a PHR, with most categories being above 70%.

Findings indicate a broad acceptance of this new technology by the patients of Medical Specialists. Improvement of adoption and use rates may depend on availability of office staff for hands-on training as well as assistance with interpretation of medical information. Hopefully, over time technology barriers will disappear, and usefulness of the information will promote increased demand.

ACKNOWLEDGMENTS

Dr. Thomas Wan has been a pillar of strength for me to lean on throughout the prospectus, research, and dissertation process. His undying patience with me from student to candidate has given me the confidence to proceed through the research and analysis phases. My committee has been also extremely supportive with valuable advice and guidance. Dr. Myron Fottler, who is also a colleague in the Department of Health Management and Informatics, has shown genuine interest in personal health records and unending willingness to provide suggestions to improve my writing. Dr. Christopher Blackwell has been extremely supportive and positive about this project and my abilities to see it through to the end. His attention to detail has contributed greatly to the quality of the final product.

Dr. Shriram Marathe provided me with wonderful insight, support, and a location to perform this research. The entire staff of Medical Specialists was friendly and helpful throughout the weeks that I invaded their territory to accomplish an initially seemingly unrealistic task of obtaining 560 questionnaires. The support of the staff, physicians, and patients of Medical Specialists enabled me to reach the goal and complete the research project.

Ultimately I owe my success to my father Richard Brunet, and my late mother, Jane Brunet, who always encouraged me to pursue higher education and reach for excellence. They continue to provide the guiding force to see me through to the end of this journey. As I have immersed myself in assignments and projects for the past three to four years, my husband, Frank, has also been an unending source of support. I look forward to finding a better balance in life and spending more quality time with my spouse of 25 years.

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LIST OF ACRONYMS/ABBREVIATIONS

AA	Associate in Arts
AGFI	Adjusted Goodness of Fit Index
AHCA	Agency for Healthcare Administration
AS	Associate in Science
BP	Blood Pressure
BS	Bachelor of Science
CCHIT	Certification Commission on Health Information Technology
CDC	Centers for Disease Control
CFA	Confirmatory Factor Analysis
CITL	Center for Information Technology Leadership
CMIN	Chi-Square Minimum
DF	Degrees of Freedom
DM	Diabetes Mellitus
eHEALS	eHealth Literacy Scale
EHR	Electronic Health Record
FAQ	Frequently Asked Questions
GED	General Equivalency Diploma or General Education Diploma
GFI	Goodness of Fit Index
GOF	Goodness of Fit
HIPAA	Health Insurance Portability and Accountability Act
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

IBD	Inflammatory Bowel Disease
IRB	Institutional Review Board
IVF	In Vitro Fertilization
LPN	Licensed Practical Nurse
MCAR	Missing Completely at Random
MMS	Multimedia Message Services
PC	Palm Coast
PDA	Personal Digital Assistant
PHR	Personal Health Record
REALM	Rapid Estimate of Adult Literacy in Medicine
RMSEA	Root Mean Square Error of Approximation
SA	St. Augustine
SEM	Structural Equation Model
SES	Socioeconomic Status
SF-8™	Short Form – 8
SF-36®	Short Form – 36
S-TOFHLA	Short Test of Functional Health Literacy in Adults
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
USB	Universal Serial Bus

CHAPTER 1: INTRODUCTION

Chronic diseases by their very nature last a long time, meaning months or years. As the population age increases along with the prevalence of chronic diseases, the costs of treatment will continue to rise. Chronic disease self-management is a process that requires participation by the patient as well as the provider. In addition to patient-provider interactions, self-management promotes health through monitoring physical and mental status and managing the effects of illness (Clark & Gong, 2000). Communication between the patient and physician is important in this process. The ability to monitor specific components of diseases and adjust medications or provide other early intervention prior to significant worsening of a condition allows the potential of saving significant healthcare dollars. These savings are seen primarily through the avoidance of inpatient hospital stays (Lorig et al., 1999) as well as emergency room encounters (Windham, Bennett, & Gottlieb, 2003).

In 2005, 133 million Americans were living with at least one chronic illness and 70% of all deaths in the U.S. were caused by chronic diseases (CDC, 2009). Taking responsibility for chronic disease(s) includes a commitment from the patient to practice day-to-day disease management (Lorig et al., 1999). Physician-patient communication and increased decision-making involvement by the patient are vital components of a successful self-management program and improved patient outcomes (Heisler, Bouknight, Hayward, Smith, & Kerr, 2002). Maly, Bourque, and Engelhardt (1999) concur, stating that communication, specifically information exchange, improves the health of the patient as well as the patient's satisfaction with care.

Personal Health Records

Physicians who have adopted an electronic health record (EHR) in their practice may have the ability to offer a personal health record (PHR) to their patients. A personal health record (PHR) is defined as "an electronic, lifelong resource of health information needed by individuals to make health decisions" (Burrington-Brown et al., 2005, p. 24). As implied by its name, the PHR is maintained by the patient and is not considered to be a part of the legal medical record. However, the PHR can provide improved communication between the patient and physician and will allow the patient to be more engaged in the healthcare process (Wolter & Friedman, 2005). Winkelman and Leonard (2004) stress the importance of location-*independence* as a characteristic of a PHR. Patients are quite mobile in today's society, and their PHR should be mobile as well.

Patients have some choices as to the format of the PHR. For example, PHRs can be hard copy/ paper records, documents on a disk or USB drive, or an online record possibly connected (tethered) to a physician or other provider(s). Waegemann (2005) lists five types of PHRs:

- Hard copy, paper records, which offer the most control but the least access in times of emergency. Some people may also have records scanned and keep them on a USB drive.
- Web-based PHRs may be free or may require a maintenance fee.
- Functional PHRs are web based and often used by people who travel frequently and may be in need of emergency assistance overseas.
- Provider-based PHRs may be provided by an insurance company or a healthcare facility. Typical information available through these patient portals is appointments, medications, allergies, and test results.
- Partial PHRs are usually web based and are disease specific, such as for diabetes.

According to a survey performed for the Markle Foundation in November 2006, the public sees several advantages to adopting a PHR (Connecting for Health, 2006). These include improving communication with physicians, avoiding medical errors, and reducing/eliminating

repetition of medical tests. Denton (2001) states that some reasons patients are more interested in keeping a PHR may be the availability of inexpensive computers, HIPAA regulations that allow patients access to their information, and chronic or unexpected illnesses that motivate patients to keep records of treatments and changes in their condition.

President Bush mandated that medical records be available in an electronic format by 2014 (2004). Waegemann (2005) argues that this mandate will increase the need for the PHR and also agrees with Denton (2001) that one of the reasons PHRs will gain traction with consumers is the Internet. The Internet has made medical information readily available through websites such as *Web*MD®. This availability enables patients to investigate treatment options for a new diagnosis. Other websites allow consumers to compare quality of care provided by physicians and healthcare facilities. As noted above, the Internet can also be a storage venue for personal health information through websites such as those provided by insurers.

In addition to the improved patient–physician communication benefits, the PHR offers the opportunity for patients to take control of their healthcare and be active participants in decision making (Tang & Lansky, 2005). However, to be helpful, the PHR must be updated regularly with accurate data required for ongoing disease management. Patients or their caretakers who are willing to actively and routinely provide this information are able to be a part of their healthcare management. Many people find that the ability to participate in the formation and ongoing supervision of their own care improves their satisfaction and actually motivates them to follow instructions and treatment plans. Ongoing research at the Cleveland Clinic confirms that patients like the flexibility of reporting blood pressure measurements when it is convenient to their schedule and based on their availability and need (Moore, 2009).

Cost Savings Associated with the PHR

The Center for Information Technology Leadership (CITL) has estimated that total annual cost savings with PHRs could be as high as $21 billion (Kaelber, Shah, et al., 2008). This saving is based on interoperability, which allows multiple users to have access to data but does not include $3.7 billion to acquire or the estimated $1.9 billion required annually to maintain such a system. The net savings are therefore projected at approximately $19 billion annually after the initial acquisition costs. The benefit of cost containment is realized through lowering of medical errors and duplication of services. Efficiency is also accomplished through lowered administrative costs and clinical practice savings (in large part through chronic disease management).

As healthcare costs continue to rise, individual patients do have an option to directly impact their outcomes through self-management and communication with providers (Windham et al., 2003). A recent survey found that 79% of adult Americans believe that a PHR would provide major benefits in healthcare management (Connecting for Health, 2008). A distinct advantage of the PHR is the ability it affords the patient to be an active member of the medical team and not just a passive consumer of healthcare services. An active team member will seek the ability to understand the content of the PHR, including diseases and medications. This understanding is known as health literacy and is important in that it allows patients to recognize the benefits of access to their health information (Lober et al., 2006). Giving the patient the ability to refer (back) to treatment plans can result in improved care and, more importantly, prevent an untoward event (The Joint Commission, 2007).

Physicians must also be willing to utilize the information provided and open the lines of communication for their patients to benefit. It is currently difficult for physicians to obtain reimbursement for encounters that are not face-to-face. This limitation may require policy adjustments, particularly for Medicare, to provide incentives for physician participation (Tang & Lansky, 2005). However, in the long run, the potential benefits in terms of improved disease outcomes and cost savings will provide the incentive necessary to promote adoption of the PHR on a widespread basis.

Motivation of Patients to Use a PHR

According to Ball, Smith, and Bakalar (2007), providing patients with a "dashboard" to manage chronic health conditions allows the patient to have more control and the physician to provide an early intervention. The dashboard can alert the patient to the need for a test, and it can also alert the physician when a blood level (such as glucose) is abnormal. Norris et al. (2002) confirmed that a disease management program can improve glycemic control, including screenings for foot lesions and peripheral neuropathy, in diabetic patients.

An adjustment in medication can prevent future complications and even obviate the need for hospitalization. In addition, it is possible that if patients know they are being observed and monitored by their provider(s) they will be more motivated to adhere to the guidelines provided to them for health maintenance (Green, 1987). Patients may even see their providers as "guardian angels" who are looking over their shoulder (Ralston, Revere, Robins, & Goldberg, 2004). At the very least, the patients can provide data which the provider(s) will use to track and trend various health markers, such as weight and blood pressure.

Heisler et al. (2002) focused on a common chronic condition, diabetes mellitus, and found that the most significant predictor of patient adherence to treatment recommendations (self-management) was provider communication. Their survey asked the participants about the information provided by their physician such as test results, treatment alternatives, and medication side effects. In another investigation of information exchange, Maly et al. (1999) went a step further and included medical record sharing between the physician and patient. Patients were provided a copy of the most recent progress note (a typed document summarizing the office visit) along with a glossary of terms to aid in their interpretation. Medical record sharing did not significantly increase office visit lengths, but did improve the quality of the visit. This was felt to be due to improved patient interest in their medical records and overall patient satisfaction.

Tang and Lansky (2005) agree with the use of a glossary, stating that in addition to access to the health record, patients need tools to aid them in interpreting and understanding the contents of the record. This will improve "health literacy," identified by Lober et al. (2006) as understanding the content of the PHR, including diseases, medications, and terminology. The Joint Commission on National Health Education Standards expands on the need to understand by including competency to use the information to improve health (Nielsen-Bohlman, Panzer, & Kindig, 2004).

Tang and Newcomb (1998) also found improved satisfaction when patients are provided an after-visit summary of an encounter with a physician. This computer generated summary included vital signs, medication allergies, current medications, laboratory tests ordered, instructions, and educational materials. Ralston et al. (2007) caution against sharing too much

information, stating that patients may not find access to a full medical record as helpful as some basic information (test results, medication refills, and care plans). Patients appreciate a summary in printed format and feel it shows that the physicians are organized and professional. Graphs of blood pressure levels over several visits for hypertensive patients can be considered a "motivator" by some of the patients to continue following therapeutic regimens. Tailoring information to a patient's condition not only personalizes and improves communication but also allows the patient to see the value of the numbers in relation to his or her own health status. Using "plain language" at a level the patient can understand enhances understanding and communication (The Joint Commission, 2007). Providers are encouraged to take time to tell patients the action steps that are needed and use multiple forms of communication to improve understanding (Oates & Paasche-Orlow, 2009).

Motivation of Clinicians to Use a PHR

Clinical practices can benefit from the enhanced communication with patients. Casalino et al. (2009) found the failure rate of physicians (or their offices) to inform patients of test results that were considered to be clinically significant to be 7.1%. The overall rate was noted to be highest in those practices with a partial electronic health record which may or may not have included access to electronic laboratory results. Some offices use a "no news is good news" policy which is felt to attribute to the error rate. A PHR which includes laboratory results could improve this communication gap and therefore improve patient safety and quality of care.

In addition to improved patient health, PHRs can be used to improve early reporting of diseases which has the potential to improve community health. Bourgeois et al. (2007) developed a Self-Report Tool to screen emergency room patients for disease surveillance. The

information obtained from the patients resulted in better accuracy of disease identification than the use of chief complaints given upon admission to the emergency room or diagnostic coding provided by the physician. They concluded that it is viable to adapt the Self-Report Tool to an electronic version and that more data can be collected through this tool than through routine methods in the emergency room. These additional data lend themselves to more precise disease reporting. Aggregation of PHR data for similar disease reporting can assist in early identification of diseases and trends.

Conclusion

According to Denton (2001), some reasons patients are interested in keeping a PHR may be the availability of inexpensive computers, federal regulations allowing patients access to their information (Health Insurance Portability and Accountability Act [HIPAA]), and chronic or unexpected illnesses motivating patients to keep records of treatments and changes in their condition. However, in spite of the advantages and apparent high levels of interest in using PHRs, adoption rates have been low with only 2.7% of adult Americans currently using an electronic PHR (Connecting for Health, 2008).

Wolter and Friedman (2005) believe that the patient must serve as the link between the provider and his or her health information. This requires moving the healthcare focus from the doctor's office to the patient's daily routine at home. Adoption and ongoing usage of a personal health record (PHR) can facilitate this link. Leonard (2004) validated that patients believe if they are given access to their medical record, they will be able to manage their condition(s) at home. The PHR can provide direct and timely communication with the physician and empower the patient to be involved and participate in the decision making process about his or her health (Ball

et al., 2007). According to Tang and Lansky (2005), this type of healthcare delivery and shift in patient behavior represents a fundamental change in our traditional system.

Research Questions

These low PHR adoption rates comingled with the documented importance of the PHR to manage chronic diseases raise concerns about the patient population(s) to target for improved usage of the technology. Characteristics of the patients who *are* willing to adopt the PHR may provide some answers to the dilemma of how to proceed with programs to educate and convert the many patients who are unaware of the availability and uses of this technology. The research questions address the five major areas presented throughout this dissertation: Perceived Usefulness, Technology Barriers (Perceived Ease of Use), Health Literacy, Patient Health Status, and Socioeconomic Status.

Perceived Usefulness

1. Is a patient's perceived usefulness of the personal health record (PHR) a factor in the patient's intention to adopt a PHR?

Technology Barriers (Perceived Ease of Use)

2. Is a patient's comfort level with technology (technology barriers) a determinant for intention to adopt the PHR?
3. Is a patient's perceived usefulness of the PHR impacted by the patient's comfort level with technology (technology barriers)?

Health Literacy

4. Is a patient's level of comfort and skill for using information technology for health, i.e., health literacy, a determinant for intention to adopt the PHR?
5. Is a patient's health literacy a determinant for the patient's comfort level with technology?

Patient Health Status

6. Will patients who do not consider themselves to be healthy intend to adopt the PHR at the same rate as those patients who do consider themselves to be healthy?
7. Will patients who do not consider themselves to be healthy perceive a higher usefulness to the PHR than patients who do consider themselves to be healthy?

Socioeconomic Status

8. Does a patient's socioeconomic status impact the level of perceived technology barriers?
9. Is a patient's socioeconomic status a factor in intention to adopt a PHR?
10. Does a patient's socioeconomic status impact the level of health literacy?

CHAPTER 2: THEORETICAL CONTEXT AND LITERATURE REVIEW

This research aims to predict behavioral intention to adopt a PHR. As such, the technology acceptance model (TAM) (Figure 1) will be employed to determine a patient's attitude toward using the PHR. The usefulness portion attempts to measure a patient's perceived advantages of PHR adoption and usage. The technology barriers portion considers ease of use or how comfortable the patient is with computers and the Internet.

Technology Acceptance Model

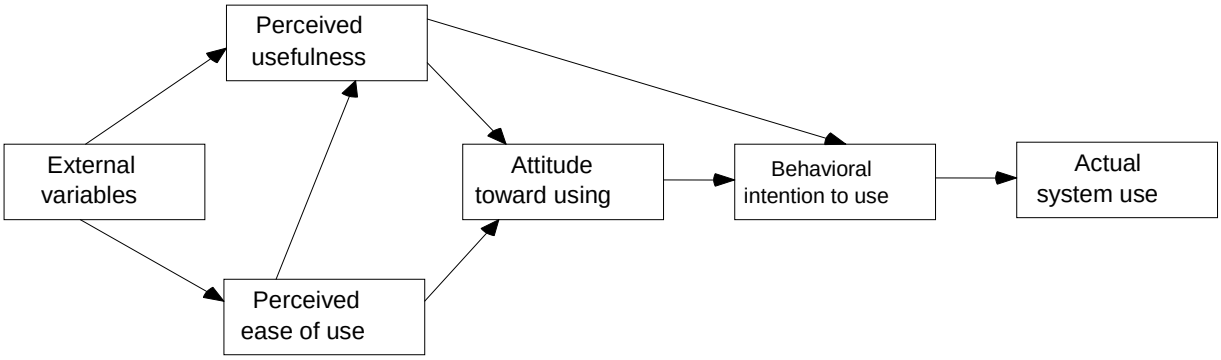

Figure 1. Technology Acceptance Model (from Davis, Bagozzi, and Warshaw, 1989)

The TAM was developed by Fred Davis in 1989. TAM is an adaptation of the theory of reasoned action (TRA) developed by Ajzen and Fishbein. The TRA is based on behavioral intention as the main predictor of actual behavior (Ajzen & Fishbein, 1980). An individual will develop a positive or negative attitude toward a behavior and will also respond to social pressures about the behavior. The general feelings that make up attitudes are composed of salient beliefs, which include the consequences resulting from the behavior (Huang, Davison, &

Gu, 2008). The social pressures are called "subjective norms," and these are taken together with an individual's attitude to determine intention and ultimately behavior change.

Subjective norms were used in marketing research of mobile phone users in China conducted by Zhang and Mao (2008). Short message services (SMS) advertising is a type of mobile marketing that allows texting between mobile devices. Technology acceptance model (TAM) as well as the subjective norms portion of the TRA were two of the theories considered in the research. Subjective norms were found to determine users' intentions to use SMS advertising. The mobile phone users did consider the opinions of their significant others important in their decision to adopt the technology. Trust was also found to influence intention to use, and the authors encouraged marketers to take their findings into account in designing campaigns for these services.

TAM is specifically aimed at computer usage behavior. Thus, the goal of TAM is to provide general determinants of technology acceptance (Davis et al., 1989). This may in turn lead to explanations for non-adoption which allows for corrective steps to change intentions to use. According to TAM, there are two major beliefs relevant to technology acceptance: perceived usefulness and perceived ease-of-use.

Perceived usefulness is defined by Fred Davis (1989) as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). Davis states that if the user sees a positive relationship with the new system, in that it helps the user perform his/her job, he/she is more likely to develop a positive attitude. Davis also contends that "users are driven to adopt an application primarily because of the functions it performs for them, and secondarily for how easy or hard it is to get the system to perform those functions"

(p. 333). In addition to improving job effectiveness, a technology is seen as useful if it improves productivity or time savings. Usefulness is further enhanced if the new technology is important to a person's job.

Davis (1989) defines perceived ease-of-use as "the degree to which a person believes that using a particular system would be free from effort" (p. 320). Davis contends that if an application is perceived to be easy to use it will be more likely to be accepted. A person may determine ease of use by the amount of physical or mental effort required to use the new technology and how easy it is to learn the new technology. Therefore, according to Davis, ease of use and ease of learning are strongly related. People are motivated to "learn by doing" rather than through manuals or online tutorials.

In his own research, Davis (1989) found that usefulness is more related to intention to use than is perceived ease of use. He found that people may be willing to accept some difficulty with a technology if they see the usefulness. Therefore, perceived ease of use is not seen as parallel in importance to perceived usefulness, but rather is an indicator of perceived usefulness. Also, in longitudinal studies, perceived ease of use may be important in the initial study but not important in follow-up (due to improved understanding and ability to use the new technology).

Because the TAM is the central theory/model to be used in this dissertation research, several studies looking at its use in technology are considered. See Appendix B for details of the literature review.

All of the TAM studies looked at technology adoption or intention to use a technology as the endogenous variable. All have implications for PHR adoption studies and patterns. The use of motivation theory by Lee, Cheung, and Chen (2007) was especially applicable. With the

PHR, the extrinsic motivators are the perceived ease of use and perceived usefulness, and the intrinsic motivators are theorized to be perceived health status and health literacy. Motivation theory asserts that the intrinsic motivators are internal and are usually stronger indicators of behavior change than extrinsic motivators (Vansteenkiste, Soenens, & Vandereycken, 2005). Venkatesh (2000) found intrinsic motivation to be an important part of a person's perceived ease of use determination of a new system.

Wilson and Lankton (2004) combined the TAM with intrinsic and extrinsic motivation to provide an integrated model. They found a strong association between perceived usefulness and intention to use an E-health application which included general health information, e-mail, and requests for prescription refills and appointments. Intrinsic motivation was noted to be significant for both perceived usefulness and perceived ease of use.

Perceived ease of use was the strongest determinant for intention to use the technology in several of the studies. Davis (1989) argues that while perceived ease of use may be a factor in the initial decision to adopt a new technology, over time this will usually become less important as the person becomes more comfortable and familiar with the technology. Venkatesh (2000) agrees stating that perceived ease of use does adjust to usability.

Diffusion of Innovation

According to Rogers' diffusion of innovation theory, one of the basic influences on the rate of spread of a change is the characteristics of the people who adopt an innovation or fail to do so (Berwick, 2003). Innovation theory will help to determine the characteristics of patients who are willing to adopt a PHR. Knowing these typical characteristics will improve chances of

targeting the correct population in the future to increase the use of the PHR and therefore diffuse the technology further.

Rogers (2003) characterizes innovations with five attributes, and he believes these attributes provide some explanation for the rates of adoption. *Relative advantage* is how the individual views the innovation in comparison to the previous idea. The individual's perception of the advantage is important in determining the rate of adoption. *Compatibility* is how the individual perceives the idea in relation to his or her current values or past experiences. Higher perceived compatibility translates into more rapid adoption. Likelihood of diffusion is improved because little behavior change in required (Cain & Mittman, 2002). *Complexity* is the individual's perception of how difficult the innovation will be to use. Highly complex ideas will be adopted at a slower rate. This is similar to Davis' (1989) TAM component of ease of use, in that if an application is perceived to be easy to use it will be more likely to be accepted.

Trialability is the idea that the individual might get a "free trial" and have the opportunity to experiment with the innovation prior to committing to its use permanently. This ability to try out the innovation provides a comfort level to users as they are able to see the risks and benefits (Cain & Mittman, 2002). This personal experience can even overcome evidence against the innovation. Davis (1989) agrees with this concept noting that people are more interested in learning by doing rather than reading through manuals.

The last characteristic noted by Rogers (2003) is *observability* which is the visibility of the results. If the results are readily visible, the innovation is more likely to be adopted. The ability to watch someone else using the innovation and seeing the advantages accounts for the higher likelihood of adoption (Cain & Mittman, 2002).

Lee (2004) conducted in depth interviews with 12 nurses using a computerized nursing care plan. Upon admission to the unit, the nurse prints a specific care plan for each patient's condition. Lee found that the nurses' acceptance of the technology is influenced by relative advantage, compatibility, complexity, trialability, and observability. For example, the nurses commented that the new care plan had the advantages of saving paper and easy readability. In addition, the system was viewed as easy to use and user friendly. Some problems were noted with the hardware (printer and ink cartridge issues), but the overall format of the care plans was felt to be useful.

As a person moves toward adoption, there are categories of adopters as follows (Berwick, 2003):

- Innovators: fastest adopting group (2.5%), characterized by venturesomeness, tolerance of risk, fascination with novelty, willingness to leave the village to learn (cosmopolite)
- Early adopters: next group (13%), opinion leaders, locally well-connected socially, do not tend to search quite so widely as the innovators, but they do speak with innovators and with each other
- Early majority: (34%), watch the early adopters, learn mainly from people they know well, more risk averse than early adopters
- Late majority: (34%), watch the early majority, adopt the innovation when it appears to be the status quo
- Laggards: final group (16%)

McDonald and Alpert (2007) investigated the importance of identifying early adopters in marketing strategies through a meta-analysis. This group is significant in their ability to spread

the word and influence others in their network. These early adopters can contribute to both trialability and observability with their example of use. In addition, they can help suggest improvements and help to refine the innovation.

Most people do consider one or more of the five attributes of innovations (Rogers, 2003) into account when weighing the options of change. The proposed PHR research model includes "perceived usefulness" which hopes to measure, at least in part, the relative advantage(s) a patient would see in considering adoption of the innovation. Another portion of the PHR model is "technology barriers," and this takes the complexity attribute into account. The categories of adopters (innovators, early adopters, early majority, late majority, and laggards) are also important in this research to identify characteristics of patients who are likely to adopt a PHR.

The findings of Zhang and Mao (2008) illustrate the impact of significant others on an individual's decision to adopt a technology. Golan and Banning (2008) confirmed that people do prefer to participate in behaviors considered to be socially desirable. As PHRs become more well-known, it is hoped that patients will seek physicians who offer the technology and will value the influence and opinion of the physician. In the meantime, using research to target the early adopters may help diffuse the technology to the significant others.

Intention to Use

Behavioral intention is considered to be the main predictor of actual behavior (Ajzen & Fishbein, 1980). Appendix B contains the Literature Review for Intention to Use a PHR. Winkelman and Leonard (2004) performed a meta-analysis on 46 research articles which included terms such as "electronic patient records" and "utilization" in the content. They identified four important characteristics that impact patient utilization of the electronic patient

record: environmental pressures, physician centeredness, collaborative organizational culture, and patient centeredness.

Environmental pressures include the longitudinal lifelong nature of the health record as well as the format and content of the record. Due to the long-term characteristics implied by the PHR in addition to the collection of information from many sources, policymakers anticipate the ability to determine service utilization patterns over time (Winkelman & Leonard, 2004). An important component of this will be how many of the physicians who obtain the electronic record systems are actually using them and to what extent, as well as the characteristics of the users, such as demographics, the organization type and size, etc. (Davidson & Heineke, 2007).

Physician centeredness refers to the usability of information by physicians. Most electronic patient record systems are designed for physician use, especially in hospitals. Conversely, in community use, the relationship between the patient and physician lends itself to greater patient participation. Brenner (2003) sees benefits to both parties for providing laboratory results in a secure website for patients to retrieve. The physician may require fewer staff for telephone calls, with only the patients who do not retrieve their results requiring a follow-up call. Kim, Wang, Lau, and Kim (2004) add that physicians appreciate avoiding telephone tagging through asynchronous messaging in an online system.

Berner and Moss (2005) stress the importance of "information filtering" when too much information is presented to physicians and too little time is available to thoroughly review it. The use of summaries with clinical alerts may be helpful when data have been collected over many years from people of varying medical expertise. Filtering is especially applicable to

monitoring systems which track daily activities of, for example, elders living alone (Beaudin, Intille, & Morris, 2006).

Collaborative organizational culture refers to the input that is required from multiple sources when an electronic patient record system is selected and implemented. Integrating dental and medical records into a PHR is especially useful for dentists with 87% agreeing to the usefulness of the PHR (Jones et al., 1999). Additionally, 68% of physicians see the usefulness of including dental records in a PHR. Caregivers, such as therapists, see improved communications among team members as an advantage to the PHR. Social workers agree with the team approach and can be influential in PHR adoption decisions by patients (Lober et al., 2006). Lee, Delaney, and Moorhead (2007) add that nursing considerations also need to be incorporated into the PHR to allow for continuity of care between hospital and home care.

From a cost effectiveness standpoint, giving patients access to their electronic records may not be justified (Winkelman & Leonard, 2004). In addition to hardware and software expenses, procedural changes must also be considered. Davidson and Heinke (2007) remind us that physicians are not paid any differently for providing the PHR to their patients, but the payers and the patients are most likely to benefit.

Patient-centeredness is the final characteristic found in the meta-analysis completed by Winkelman and Leonard (2004). Although there are some benefits for patients to access their medical records, such as improved communication with healthcare providers and improved compliance with treatment programs, access to the patient records is often not utilized when it is available. For example, Grant et al. (2008) and Denton (2001) found disappointing involvement with only 37% and 15% of their patients participating respectively.

Perceived Usefulness

Beaudin et al. (2006) note that what people want to track in their health changes over time in response to their age, health status, social status, and other factors. Indeed, Lober et al. (2006) found that elderly patients in low income housing will adopt a PHR if it is available and they perceive the need, which is often determined by the presence of a chronic illness. Data produced by PHRs need to be of interest and value to the patient for adoption and long term usage. Lee, Delaney, et al. (2007) add that nursing elements such as psychological and social dimensions aid the patient in assessing their overall health status. See Appendix B for further literature review of perceived usefulness.

Halamka, Mandl, and Tang (2008) provided follow-up information on three PHR systems in use for 8-9 years. At the Palo Alto Medical Foundation, 90,000 patients have used the system since 2000. It allows the patients to view their diagnoses, medications, allergies, immunizations, laboratory and radiology results, appointments, and demographics. The most popular features are the ability to view lab results and the ability to communicate with physicians.

Beth Israel Deaconess Medical Center initiated a PHR in 2000. Patients can view medications, allergies, laboratory (including microbiology) results, and diagnostic test results. They can also add home glucometer readings and over-the-counter medications. The most popular feature is the clinical messaging system, followed by prescription renewing and appointment making, with over 35,000 patients using the system monthly.

Children's Hospital Boston implemented an electronic record system in 1999 in which the patients maintain copies of their records in a storage site they choose. The system is known

as Indivo, and it allows the patient to control the information. Laboratory results are included in the information shared with the patient.

Several challenges have been realized by these PHRs, including which lab tests should be made available to patients and when. A problem the clinicians foresaw was that patients would interpret insignificant negative results incorrectly, resulting in numerous phone calls. This was resolved in some cases by holding certain types of lab test values (pathology) so the clinician can contact the patient personally with the results. Another area of confusion can result from progress note misinterpretation by the patient. Therefore, this portion of the record is usually not made available to the patient.

Although patient-physician messaging is a popular feature, the Beth Israel physicians worried that they would be inundated by messages. In reality, the number averages 20 messages per month per 100 patients, which has replaced about the same number of phone calls. American adults do prefer communication by e-mail with their physician and have stated that this availability would influence their choice in physicians (HarrisInteractive, 2007). Specifically, 74% state they would like to communicate with their physicians by e-mail.

An additional concern has been raised by the clinicians about the difficulty obtaining reimbursement for this type of service. According to Halamka et al. (2008), some payers, including Medicare and Medicaid, do understand the need to update reimbursement policies for this service. In the meantime, the lack of compensation acts as a disincentive for physicians to provide a PHR, even if they have the capability (Kaelber, Jha, Johnston, Middleton, & Bates, 2008).

Technology Barriers (Perceived Ease of Use)

Design of PHR systems should include patient input in the development process. Basic computer skills are required for these systems, including opening a web browser and using a mouse to navigate and make selections. Some (elderly) patients may lack motor skills necessary to enter and move through a web-based PHR. See Appendix B for literature review of technology barriers.

In addition to Internet usage, patients must also be able to use the specific PHR program offered by their physician. As reported by Dr. Denton (2001), patients can find difficulty with learning to use new software as well as hardware. However, as noted by Davis (1989), once the new technology is learned, continued usage is not likely determined by the perceived ease of use of the software being used.

Health Literacy

Misunderstanding of medical terminology can cause fear in patients who are unfamiliar with the language. Overcoming this barrier will give patients a sense of ownership and allow them to contribute to their own healthcare. Web-based PHRs require patients to enter their information to include demographics, history, medications, lab test results, diagnostic studies, and immunizations. See Appendix B for a literature review of Health Literacy.

DeClercq, Hasman, and Wolffenbuttel (2003) express concern over the accuracy of patient-entered medical information, stating that the patient's inability to interpret information may decrease the validity of the medical data. Lober et al. (2006) confirm this possibility stating that 29% of the patients in their study had problems with "health literacy." This included

questions about diseases, medications, and terminology in general. Therefore, populating the records initially from pharmacy records may improve accuracy. Indeed, the American Pharmaceutical Association encourages pharmacists to improve communications, including cultural awareness, with patients (Andrulis & Brach, 2007).

People who speak English as a second language are also less confident in their ability to obtain needed health information (Moen & Brennan, 2005). In their meta-analysis examining the prevalence of limited health literacy, Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, and Rudd (2005) found low education levels and race were significant predictors of low literacy. However, an association between low health literacy and gender was not identified.

To offset literacy challenges, Baorto and Cimino (2000) reported on the development of an "infobutton" for use by women to access Pap smear results online. This is part of the Patient Clinical Information System (PatCIS) provided by New York Presbyterian Hospital. Definitions for frequently encountered diagnostic terms are made available to aid patients in reading and understanding their reports. Providing patients with such a tool is an important step in allowing patients to take ownership of their healthcare outcomes.

Patient Health Status

Management of a chronic illness is aided by a patient's willingness to participate in the process. DeClercq et al. (2003) investigated consumer health records as a form of this participation as noted in Appendix B. They received feedback that patients were encouraged to work with their physician to solve health issues. In addition, the requirement that the patient enter some of the data actually improves insight into the health condition. See Appendix B for additional literature review pertaining to Patient Health Status.

Ralston et al. (2007) found that their patients showed an increased interest in their conditions and treatment plans when they were provided with an after-visit summary. In addition, Fowles et al. (2004) found that 36% of their sample were "very interested" in reading their medical record, with an average age of 46.2 years. Taking an active role in their healthcare was the most common reason for their interest. Of those patients who stated their general health status was fair or poor, 42.5% were "very interested" in reading their medical record. These results along with others in this section of Appendix B appear to indicate that some patients are interested in improving their health and that access to medical information (through a PHR) is an avenue to accomplish this goal.

Socioeconomic Status

Dillon, Blankenship, and Crews (2005) investigated nursing personnel attitudes prior to implementation of an electronic medical record system. Overall, the attitudes were positive. Age groups showed significant differences in attitudes, especially between the 30s group (which was more positive) and the next two older groups, 40s and 50s. Average and more experienced computer users had more positive attitudes than beginners or novices. Level of education showed similar attitudes in LPN, AS, BS, and masters level nurses, but slightly more negative in diploma nurses.

Dickerson and Gentry (1983) attempted to define the characteristics of adopters of home computers with a survey of 639 computer club members and *Psychology Today* (magazine) subscribers. They found that approximately 52% of the adopters were 30-45 years of age, and 72% were married. In addition, 73.2% held professional and technical jobs, and 31% lived in

large cities. The income levels were fairly even in the $20,000-$29,000 range, $30,000-$39,000 range, and the $40,000-$59,999 range at about 22-23% of the adopters in each range.

The Pew Research data in Table 1 indicate that the majority of both males and females are currently using the Internet, but that whites report higher usage rates than black and Hispanics. Also, people with some college or a college degree report higher Internet usage than people with high school education or less. As income increases, Internet usage increases as well.

Table 1. Pew Research Center Results of Internet Users, December, 2009

Demographic	**Detail**	**% reporting Internet usage**
Gender	Male	74
	Female	74
Race	White	76
	Black	70
	Hispanic	64
Age	18–29	93
	30–49	81
	50–64	70
	65+	38
Education	Less than high school	39
	High school graduates	63
	Some college	87
	College degree (s)	94
Income	Less than $30,000	60
	$30,000–$49,999	76
	$50,000–$74,999	83
	$75,000 and above	94

Kalichman et al. (2003) found that a group of people living with HIV/AIDS had similar Internet usage characteristics to those reported by Pew Research. They reported those patients who use the Internet for health information searches are better informed about the disease and

also use the Internet for social support. Improving Internet usage among this population is felt to be important for both education and coping strategies.

Demographics

When looking at PHR adoption likelihood, it is important to consider the various characteristics of likely adopters of an innovation. See Appendix B for a literature review of demographics.

E-mail messaging has been found to be a popular feature in patient Internet portals (Weingart, Rind, Tofias, & Sands, 2006). The typical user was noted to be younger, more affluent, and healthier than those who did not use the portal. Females have been found to use Internet portal users more than men and also more frequently use web-based communication systems (Hassol et al., 2004; Weingart et al., 2006). Benaroia, Elinson, and Zarnke (2007) also commented on age as a factor that might impact usability of a system. They found that younger patients who used a computer on a regular basis were more likely to rate their system as easy to use. The IVF patient study reported by Tuil, Hoopen, Braat, Vries Robbe, and Kremer (2006) also included relatively young, well motivated women who were frequent Internet users. The majority of these patients reported they were so pleased with the PHR provided that they were willing to pay for the service if necessary. Brenner (2003) provided online lab results in a gynecology practice, and 60% of the study group used the Internet to access their lab results online. The majority of the users were in their 30s and 40s, and 87% stated they would use the system again to access lab data. Hassol et al. (2004) found that the majority of their study participants were middle aged, between the ages of 46 and 64. Kim, Mayani, Modi, Soh, and

Kim (2005) noted that with assistance, age barriers could be transcended (their study population average age was 65 years).

Hypotheses

The hypotheses address the five major areas presented throughout this dissertation: Perceived Usefulness, Technology Barriers (Perceived Ease of Use), Health Literacy, Patient Health Status, and Socioeconomic Status.

Perceived Usefulness

H_1 Patients who perceive the PHR to be useful will agree to adopt the technology at a higher rate than those who do not perceive it to be useful

Technology Barriers (Perceived Ease of Use)

H_2 Patients who perceive technology positively will be more likely to adopt a PHR than those patients who are uncomfortable with technology

H_3 Patients who perceive technology positively will also view perceived usefulness of the PHR more positively than those patients who are uncomfortable with technology

Health Literacy

H_4 Patients who have high levels of comfort and skill in using information technology for health (health literacy) are more likely to adopt the PHR than those with low levels

H_5 Patients who have high levels of comfort and skill in using information technology for health (health literacy) are more likely to perceive technology positively than those patients with low levels of health literacy

Patient Health Status

H_6 Patients who perceive themselves as "unhealthy" are more likely to adopt a PHR than those patients who consider themselves to be "healthy"

H_7 Patients who perceive themselves as "unhealthy" are more likely to perceive the PHR as useful than those patients who consider themselves to be "healthy"

Socioeconomic Status

H_8 Patients with a higher socioeconomic status level will have a lower level of perceived technology barriers than those patients with a lower socioeconomic status level

H_9 Patients with a higher socioeconomic status level will agree to adopt the PHR at a higher rate than those with a lower socioeconomic status level

H_{10} Patients with a higher socioeconomic status level will have a higher level of health literacy than those with a lower socioeconomic status level

Conclusion

Personal health records provide patients with a way to consolidate information about acute and chronic medical problems. The PHR gives the consumer control over this information.

According to Burrington-Brown et al. (2005), "The PHR will play a key role in the move to a safer, more efficient, consumer-driven U.S. healthcare system" (p. 24).

Confirmation of the technology acceptance model may provide a useful model to predict a patient's willingness to adopt a PHR. However, to take this a step further, identification of characteristics common in patients who have adopted a PHR may allow providers to target this population for further diffusion of the technology. An important component of PHR adoption is the patient's willingness to use the PHR. While it may appear an obvious beneficial technology for everyone, very few people have adopted a PHR. The answer to "why" may lie in perceived need.

Perceived ease of use has been shown to be important in the behavioral intention to use a new technology initially. Pew Research (2009) indicates that the majority of Americans are active Internet users in all categories except those people over 65 years of age and those with less than a high school education. However, according to Kalichman et al., (2003) it may be worthwhile to reduce the technology barriers for those people not using the Internet to improve their access to health information.

Access to medical information, such as through a PHR, has been shown to provide numerous benefits, such as improved communication with providers, improved understanding of treatment regimens, and ultimately improved compliance with healthcare plans (Green et al., 2008; Hassol et al., 2004; Winkelman, Leonard, & Rossos, 2005). Physicians must play an active role as the change agents for adoption, but ultimately the patient can control his/her destiny through adoption and continued active use of the PHR. In addition to the estimated $19

billion in annual savings in healthcare spending, the importance of PHRs for improved patient safety and quality of care should be highlighted as distinct advantages to adoption.

Confirmation of the hypotheses will provide some characteristics of patients who intend to adopt a PHR. In addition to the components of the TAM (perceived usefulness and perceived ease of use [technology barriers]), the research will add components describing health status as well as literacy to ultimately produce a robust model to describe a patient's intention to adopt a PHR. The resulting profile combined with patient demographics and socioeconomic status information will provide profile information for diffusion of the innovation to additional adopters. The characteristics defined by Rogers (2003) of typical innovations (relative advantage, compatibility, complexity, trialability, and observability) which promote adoption will also be useful in moving the PHR past the innovators to the early adopters and ultimately to the early majority and beyond.

CHAPTER 3: METHODOLOGY

In an effort to promote adoption of personal health records by individual patients, this research will attempt to define the characteristics of the most likely early adopters. It is hoped that this definition will lead to targeted marketing toward those populations most likely to adopt. Over time, according to Rogers' (2003) diffusion of innovation theory, the early adopters will grow in numbers and will influence the next group of adopters, the early majority.

This study differs from other studies included in the literature review in its basic design. Most studies regarding the PHR have been longitudinal studies in medical practices which have a PHR in use. Patients are recruited to participate in the PHR system and are followed for improvements in various health markers or to gauge their reaction to the PHR. In contrast, this PHR study will focus on determining a patient's likelihood of PHR adoption prior to the availability of the technology. The additional foci of patient health status and patient literacy will provide unique insights into the characteristics of patients who view PHRs positively and intend to adopt the technology. In addition, it is hoped by identifying specific characteristics of those patients most likely to adopt the PHR, that future efforts can be more efficiently targeted to the correct population.

Study Characteristics

The unit of analysis will be the individual patients in a general medical practice who present for an office visit on or after a specific start date. The study will discontinue enrollment when 560 patients have completed the survey, based on the number of parameters in the

structural equation model. Note that according to Wan (2002), 10 cases per measured variable (there were originally 56 in the proposed survey) is a reasonable sample size (560).

Further validation of the sample size determination can be done with Tchebysheff's theorem which is applicable to a 5-point Likert scale. $n=N\sigma^2/(N-1)(B^2/4)+\sigma^2$. Assuming a population size of N=5000 and accepting a margin of error of B=.1. Estimated population standard deviation is calculated by taking the lowest value from the highest value on the Likert scale, 5-1 = 4 and dividing that by 4 = 1. Therefore, 5000/12.4975 = 400. This figure is lower than the amount recommended by Wan, and the higher figure is preferred to ensure adequate sample size.

The survey will be conducted in the office via a hard copy (paper) instrument. Patients will be given information about the PHR and instructions on how to complete the questionnaire. They will be asked to complete the questionnaire prior to their appointment in the waiting room. The researcher will be available to answer questions and assist patients as needed.

Research Design

The research is correlational, attempting to determine the strength of the relationships between a patient's perceived health status, health literacy, SES, comfort level with computers, perceived usefulness of the PHR and his/her intention to adopt a PHR. The study is convenience (non-random) since patients must be in the selected practice to be included. To improve validity, a letter which describes the research along with an information sheet about PHRs was mailed to all patients seen at one of the Medical Specialists' offices within the past one and a half years (active patients). This letter invited those patients who did not have appointments to participate

by coming to the office to complete a questionnaire during a specified time frame (November 5th to December 23rd). The physician and his associates are internal medicine and family practice physicians, and this should allow for generalizability to patients of family practitioners and other internal medicine physicians in nearby counties, the state of Florida, and possibly elsewhere. It is also noted that there will be no charge for the use of the PHR that is proposed to be used by the patients of Medical Specialists (this information was included in the Frequently Asked Questions sheet provided to the patients).

Setting

The setting is a general medical practice that has instituted an electronic health record. Therefore, the capability of an electronic PHR is a reality and the physicians would like to know the interest level of the patients prior to pursuing institution of a PHR. There are two office locations: St. Augustine in St. Johns County and Palm Coast in Flagler County.

Participant Selection

Patients who are seen in the office during the time period the research is conducted (within November and December, 2009) will be included in the survey, if they are willing to participate. All patients were mailed information prior to their visit to allow them to read about PHRs and the proposed questionnaire. Their questions were answered when they presented for the office visit. Even if a patient had more than one visit during the data collection period, the questionnaire was only to be completed one time. Patients must be at least 18 years of age, able to read and understand English (or have an interpreter with them for assistance) and be able to hear the instructions (or read lips). New patients were invited to participate during their initial

office visit once they had completed the required paperwork for Medical Specialists. The PHR was then briefly described as well as the purpose of the research. Those who were willing to participate were then provided with the letter and frequently asked question sheet previously mailed to practice active patients.

Study Instrument

Intention to Adopt

The endogenous (dependent) variable at the center of the structural equation model is Intention (to adopt a PHR). It attempts to measure behavioral intention. According to Ajzen and Fishbein (1980), "the more a person perceives that others who are important to him think he should perform a behavior the more he will intend to do so" (p. 57). Therefore, if a physician is a strong advocate for the PHR and the patient also sees the value and importance of the PHR, the intention to change behavior will be positively affected. Table 2 includes the indicator (variable in structural equation model), actual question on the survey instrument, possible answer selections and how they were coded for data analysis (see Chapter 4 for further details about re-coding of not applicable answers), and the source from the literature review (including how the question/statement was worded in the original research). Intention is defined as the patient's behavioral willingness to adopt and use a PHR in the future.

Table 2. Operational Definitions for Intention to Adopt a PHR

Indicator	Question	(Coded→Re-coded) Answers	Literature review
Intention_agree	I intend to use a personal health record (PHR) in the future.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Sun and Zhang (2008): I intend to use search engines in the future.

Perceived Usefulness

This endogenous latent construct consists of 4 questions attempting to determine if the patient feels the PHR will be useful to him/her. Although Fred Davis (1989) defines perceived usefulness as it relates to job performance, research has expanded to include a variety of new and innovative technologies. How the person perceives the new technology in terms of its ability to improve his/her life determines the strength of the perception or attitude toward the innovation. One attribute of an innovation characterized by Rogers (2003) which is similar to perceived usefulness is compatibility. This is how a person views a technology in relation to current or past experiences.

Table 3 includes the indicators used in the structural equation model, the questions on the survey instrument which are adapted from the literature review, possible answer selections and how they were coded for data analysis, and the source from the literature review with the original wording of the question/statement. One question was developed by the researcher specifically for this PHR study. It was based on research of Tang and Newcomb (1998) in which patients

were provided an after-visit summary by their physicians, resulting in reflections by patients that the physicians were viewed as more organized and professional (not related to the TAM). Usefulness is defined as how the patient feels the PHR will be beneficial in his/her life, including for personal health or the health of family members (i.e., spouse, children, parents).

Table 3. Operational Definitions for Perceived Usefulness

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Improvehlth	I think using the PHR would improve my overall health.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Wang, Lin and Luarn (2006): Using mobile services would improve my performance in conducting transactions.
Lifestyle	I think I would find the PHR useful in maintaining a healthy lifestyle.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Wang, Lin and Luarn (2006): I would find mobile services useful in conducting my transactions.
Communicate	I think the PHR will be useful for me to communicate with my doctor(s).	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Lee, Cheung and Chen (2007): I think multimedia message services (MMS) will be useful for me to communicate with others.

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Organize	I think the PHR will improve my ability to keep my medical information organized.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Developed specifically for PHR research, based on Tang and Newcomb (1998).

Technology Barriers

This endogenous latent construct attempts to measure perceived ease of use by determining how the patient feels about computer technology (comfort level with technology). To reiterate the feelings of Davis (1989), if a technology application is perceived to be easy to use it will be more likely to be accepted. However, once adopted, over time as the person becomes accustomed to the features of the system and how to use them, the importance of usability diminishes. Rogers (2003) refers to this characteristic as complexity, stating that highly complex innovations are adopted at a slower rate.

Table 4 includes the indicators used in the structural equation model, the questions on the survey instrument which were adapted from the literature review, possible answer selections and how they were coded/re-coded for data analysis (see Chapter 4 for further details on the rationale), and the source from the literature review with the original wording of the question/statement. All of the questions are worded such that the patient would agree with the statements if he/she is uncomfortable with using computers, including new software packages and the Internet. Technology barrier is defined as the patient's comfort level with computers, computer (software) programs, and the Internet.

Table 4. Operational Definitions for Technology Barriers

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Destroy	I am scared that hitting the wrong key could cause the computer to destroy a large amount of my information.	(1)→(5) Strongly disagree (2) →(4) Disagree (3) Neither agree nor disagree (4) →(2) Agree (5) →(1) Strongly agree (6) →(3) Not applicable	Wang and Wang (2008): It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
Mistakes	I hesitate to use a computer for fear of making mistakes I cannot correct.	(1)→(5) Strongly disagree (2) →(4) Disagree (3) Neither agree nor disagree (4) →(2) Agree (5) →(1) Strongly agree (6) →(3) Not applicable	Wang and Wang (2008): I hesitate to use a computer for fear of making mistakes I cannot correct.
Intimidate	I am somewhat intimidated by the Internet.	(1)→(5) Strongly disagree (2) →(4) Disagree (3) Neither agree nor disagree (4) →(2) Agree (5) →(1) Strongly agree (6) →(3) Not applicable	Wang and Wang (2008): Computers are somewhat intimidating to me.
Explanation	I will need expert help to use a computer.	(1)→(5) Strongly disagree (2) →(4) Disagree (3) Neither agree nor disagree (4) →(2) Agree (5) →(1) Strongly agree (6) →(3) Not applicable	Lee, Cheung and Chen (2007): It will be impossible to use MMS without expert help.

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Confusion	I find learning to operate a new type of computer software to be difficult.	(1)→(5) Strongly disagree (2) →(4) Disagree (3) Neither agree nor disagree (4) →(2) Agree (5) →(1) Strongly agree (6) →(3) Not applicable	Lee, Cheung and Chen (2007): Learning to operate MMS will be easy for me.

Health Literacy

This endogenous latent construct attempts to determine the patient's capacity to engage in and use the PHR. The questions are taken from the eHealth Literacy Scale (eHEALS). The instrument is a measure of a patient's knowledge, comfort, and perceived skill level to find, evaluate, and apply electronic health information to health problems (Norman & Skinner, 2006). To clarify, skills are not assessed directly, but rather the patient is asked to answer based on his/her perceived skills. Table 5 includes the indicators used in the structural equation model, the questions on the survey instrument which were taken directly from eHEALS, possible answer selections and how they were coded for data analysis, and the source from the literature review (Norman & Skinner, 2006). It should be noted that "not applicable" was not a choice given by Norman and Skinner in their research validating the eHEALS.

Table 5. Operational Definitions for Health Literacy

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Whatresources	I know what health resources are available on the Internet.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Norman and Skinner (2006)
Wheretofind	I know where to find health resources are available on the Internet.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Norman and Skinner (2006)
Howtofind	I know how to find health resources are available on the Internet.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Norman and Skinner (2006)
UseInternet	I know how to use the Internet to answer my questions about health.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6) →(3) Not applicable	Norman and Skinner (2006)

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Howtouse	I know how to use the health information I find on the Internet to help me.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6)→(3) Not applicable	Norman and Skinner (2006)
Skillstoeval	I have the skills I need to evaluate the health resources I find on the Internet.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6)→(3) Not applicable	Norman and Skinner (2006)
Highvslow	I can tell high quality health resources from low quality health resources on the Internet.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6)→(3) Not applicable	Norman and Skinner (2006)
Confidentdec	I feel confident in using information from the Internet to make health decisions.	(1) Strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) Strongly agree (6)→(3) Not applicable	Norman and Skinner (2006)

Patient Health Status

This exogenous latent construct portion of the survey used the QualityMetric's SF-8™ Health Survey. This represents an adaptation of the Short-Form 36 (SF-36®) which was developed to measure functional health from the patient's point of view (www.qualitymetric.com). The full SF-36 was felt to be too long to use in this research. The SF-8 questions represent physical and emotional health. The patient is asked to recall information about his/her level of physical and mental health from the past four weeks. As noted by Turner-Bowker, Bayliss, Ware, and Kosinski (2003), the SF-8 and SF-36 produced consistent scores in the migraine suffers they surveyed. Construct validity of the SF-8 was confirmed in their research. Table 6 includes the indicators used in the structural equation model, the questions on the survey instrument which were taken directly from SF-8, possible answer selections (which vary in wording and quantity from question to question), and the source of the survey, QualityMetric, Incorporated.

Table 6. Operational Definitions for Patient Health Status

Indicator	Questions	(Coded) Answers	Literature review
Ratehealth	Overall, how would you rate your health during the past 4 weeks.	(1) Excellent (2) Very good (3) Good (4) Fair (5) Poor (6) Very poor	QualityMetric SF-8™ Health Survey
Limitactivities	During the past 4 weeks, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?	(1) Not at all (2) Very little (3) Somewhat (4) Quite a lot (5) Could not do physical activities	QualityMetric SF-8™ Health Survey
Dailydifficult	During the past 4 weeks, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?	(1) Not at all (2) Very little (3) Some (4) Quite a lot (5) Could not do daily work	QualityMetric SF-8™ Health Survey
Bodilypain	How much bodily pain have you had during the past 4 weeks?	(1) None (2) Very mild (3) Mild (4) Moderate (5) Severe (6) Very severe	QualityMetric SF-8™ Health Survey

Indicator	Questions	(Coded) Answers	Literature review
Energy	During the past 4 weeks, how much energy did you have?	(1) Very much (2) Quite a lot (3) Some (4) A little (5) None	QualityMetric SF-8™ Health Survey
Limitsocial	During the past 4 weeks, how much did your physical health or emotional problems limit your usual social activities with family or friends?	(1) Not at all (2) Very little (3) Somewhat (4) Quite a lot (5) Could not do social activities	QualityMetric SF-8™ Health Survey
Emotional	During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?	(1) Not at all (2) Slightly (3) Moderately (4) Quite a lot (5) Extremely	QualityMetric SF-8™ Health Survey
Keepfromact	During the past 4 weeks, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?	(1 Not at all (2) Very little (3) Somewhat (4) Quite a lot (5) Could not do daily work	QualityMetric SF-8™ Health Survey

Socioeconomic Status (SES)

This exogenous latent construct will be measured based on level of income, level of education, and occupational category. Mueller and Parcel (1981) caution against using either education or income as a single indicator of SES, stating that there can be wide variations in income within occupational categories. Also, income can be affected by layoffs or other types of organization down-sizing. In addition, within education levels, both income and occupation can vary greatly. Because the occupational categories contain a wide variety of jobs, considerable differences are possible in both education and income levels. The goal of a socioeconomic status scale is to look at individuals relative to others in the same "community" as a method of predicting health behaviors (Green, 1970). Because the current research aims to make predictions based on individual intentions, the attributes of the individual for education and occupation as well as the household for income are considered.

Table 7 includes the indicators used in the structural equation model, the questions on the survey instrument, possible answer selections and how they were coded (and re-coded) for data analysis, and the source from the literature review for the occupational category. To improve response rate, broad income levels were provided for patients to choose from.

Table 7. Operational Definitions for Socioeconomic Status

Indicator	Questions	(Coded→Re-coded) Answers	Literature review
Education	What is the highest level of education you have completed?	(1) Less than high school (2) High school/GED (3) Some college (4) Associate's degree (AS and/or AA) (5) Bachelor's degree (6) Master's degree or above	
Income	Which of the following broad categories best describes your household income from all sources in 2008?	(1) $20,000 or less (2) $20,001 - $35,000 (3) $35,001 - $50,000 (4) $50,001 - $100,000 (5) $100,001 or more	
Occupcateg	Which ONE of the following occupational categories best describes your longest held job:	(1) →(6) Service worker (2) →(9) Sales worker (3) →(2) Laborer (4) →(5) Clerical worker (5) →(10) Manager or proprietor (6) →(7) Operative (7) →(8) Craftsperson, foremen (8) →(11) Professional or technical (9) →(4) Farm worker (10) →(3) Private household workers (11) →(1) I have never worked outside the home	Reiss, A. J. (1977). *Occupations and social status*

Procedure

Prior to conducting this research, approval of the University of Central Florida Institutional Review Board (IRB) was obtained on October 9, 2009 (see Appendix A). Informed consent was implied by completion of the questionnaire (as noted in the letter sent to patients), and a separate note requested by the IRB was attached to each survey as follows:

> Thank you for agreeing to participate in this survey research! We appreciate you volunteering to help us determine if Dr. Marathe's patients would be willing to adopt a personal health record. We will report the findings to Dr. Marathe in the coming months. By answering the questions and completing the survey, you are agreeing to participate in this important research. However, you may discontinue the survey at any time, for any reason.
>
> Thank you for your time!

Patients could choose to discontinue the survey and not complete it. In addition, no names, social security numbers, birth dates or other identifying data were collected on the survey. The physicians in Medical Specialists were not aware of who participated and who did not.

The instrument was pilot tested on Friday, October 23rd at the Medical Specialists' offices in St. Augustine (six questionnaires completed) and Palm Coast (four questionnaires completed). The purpose of the research and a brief description of a PHR were given to each patient. Cronbach's Alpha showed high reliability within each portion of the questionnaire (perceived usefulness, technology barriers, health literacy, patient health status, and socioeconomic status). Other statistical measures were reasonable, given the small sample size. Minor adjustments were made to the occupational category portion, to include a choice of "never worked outside the home," and also an area was added for patients to write in the occupation if the patient was

unsure of how to categorize it. No addendum was presented to the IRB based on this minor adjustment. Upon finalization of the survey instrument, the researcher obtained mailing labels with the names and addresses of patients seen at Medical Specialists (by all physicians) within the past one and a half years.

A letter about the PHR in addition to information about the proposed research was mailed to all active patients in the practice, inviting those without appointments to come to one of the Medical Specialists' locations to complete a questionnaire during the anticipated dates if they wished to do so. The letter was on Medical Specialists' letterhead and signed by Dr. Marathe. Approximately 4800 mailing labels were provided by Medical Specialists. Duplicates for the same household were discarded, as were incomplete addresses, addresses out of state, and addresses out of the local area (e.g., Miami, Orlando, etc.). A total of 4020 letters and frequently asked question sheets were mailed out during the week of October 26-30, 2009. Approximately 362 were returned due to address issues, deaths, patient relocations, etc. No attempt was made to follow-up on these returned letters. (See Appendix C for a copy of the letter and Appendix D for a copy of the frequently asked question sheet.)

Beginning Wednesday, November 4th, at the St. Augustine office location, the researcher approached those patients who presented for office visits by first asking if they had received the letter that was mailed out the previous week. The research was briefly described to the patient as follows:

"The physicians here at Medical Specialists are considering providing a personal health record for the patients. This would allow you, the patient, to go on a computer and see parts of

your medical record, specifically your medications and recent laboratory results. In addition, you could make appointments and e-mail the office through the secure portal provided to you."

An analogy of online banking was offered for those wondering how they would access it and how secure it would be. They were told that they would set up their own password and only those who they shared the password with would have access to their information (in addition to Medical Specialists staff and physicians). Patients who agreed to complete the questionnaire were given a clipboard containing the questionnaire, as well as a copy of the letter and frequently asked question sheet that was mailed out in October. They were encouraged to keep the letter and question sheet for future reference if they so desired. This procedure was repeated for all qualified patients seen during office hours. To reach the desired 560 questionnaires, 16 days were spent collecting questionnaires in November and 8 days in December. In addition, the front-office staff assisted with distributing surveys in the researcher's absence. Each survey was marked with either SA or PC to denote the location of the office where the survey was completed, but no other identifying information was added (See Appendix E for the questionnaire used in the research).

Data Analysis

Descriptive analysis will be performed with SPSS (PASW® Statistics 17). Pearson correlation coefficients will be used to determine relatedness of questions within each construct. Cronbach's Alpha will also obtained as part of factor analysis to confirm that questions in the constructs to belong together. In addition, frequency distributions will be used to determine data

characteristics and also to see outliers (possible input errors). Finally, means and standard deviations will be obtained to further investigate data characteristics.

Structural equation modeling (SEM) in AMOS ™ 17.0 will be used with graphics and output results. SEM will analyze the data in an attempt to determine causal relationships between the latent constructs and to explain the relationships between the latent variables and the observed variables (indicators) they contain. Four latent endogenous constructs are included in the survey: patient's perceived usefulness of the PHR, patient's comfort level with technology (AKA technology barriers), patient's health literacy, and patient's intention to adopt the PHR. In addition, there are two latent exogenous constructs: patient's perceived health status and patient's SES. Each latent construct consists of indicators that, when combined, make measurement of the construct possible. Care has been taken to ensure the validity of the constructs by using two proven constructs and questions from prior research to build additional constructs.

According to Byrne (2001), we cannot explain changes in the exogenous (latent) variables by the SEM model. Therefore, we include demographic control variables in the research that are external to the model and yet influential to the endogenous variables. The exogenous (latent) variables do influence the endogenous or dependent variables, and some of the endogenous variables influence each other. In this study, the endogenous variable that we are ultimately attempting to predict is the Patient intention to adopt the PHR. According to Byrne, changes in values of the endogenous variable are explained by the model because the model contains all the latent variables that influence Patient intention.

Residual (R1-R4) represents the difference between the observed data and the hypothesized model (Byrne, 2001). The residual is necessary because it is improbable that the data will prove to be a perfect fit to the model. Alternatively speaking, the residual represents the error that results in the prediction of the endogenous variables based on the latent exogenous variables.

Each observed exogenous variable (indicator) also has an error term, which is represented by d1-11 in Figure 2. These deltas are measurement errors that reflect the capability of the indicators (observed variables) to measure the exogenous variables (Byrne, 2001). These deltas are associated with a specific indicator, but not correlated to the latent variable or the endogenous variable. The deltas can be correlated with each other, which denotes that the measurement error for one indicator can be correlated with the measurement error of another indicator. Endogenous variable indicators also have associated error terms, represented by e1-17 in Figure 2. These etas are comparable to the deltas associated with exogenous variables and can also be correlated with each other or (theoretically) with deltas.

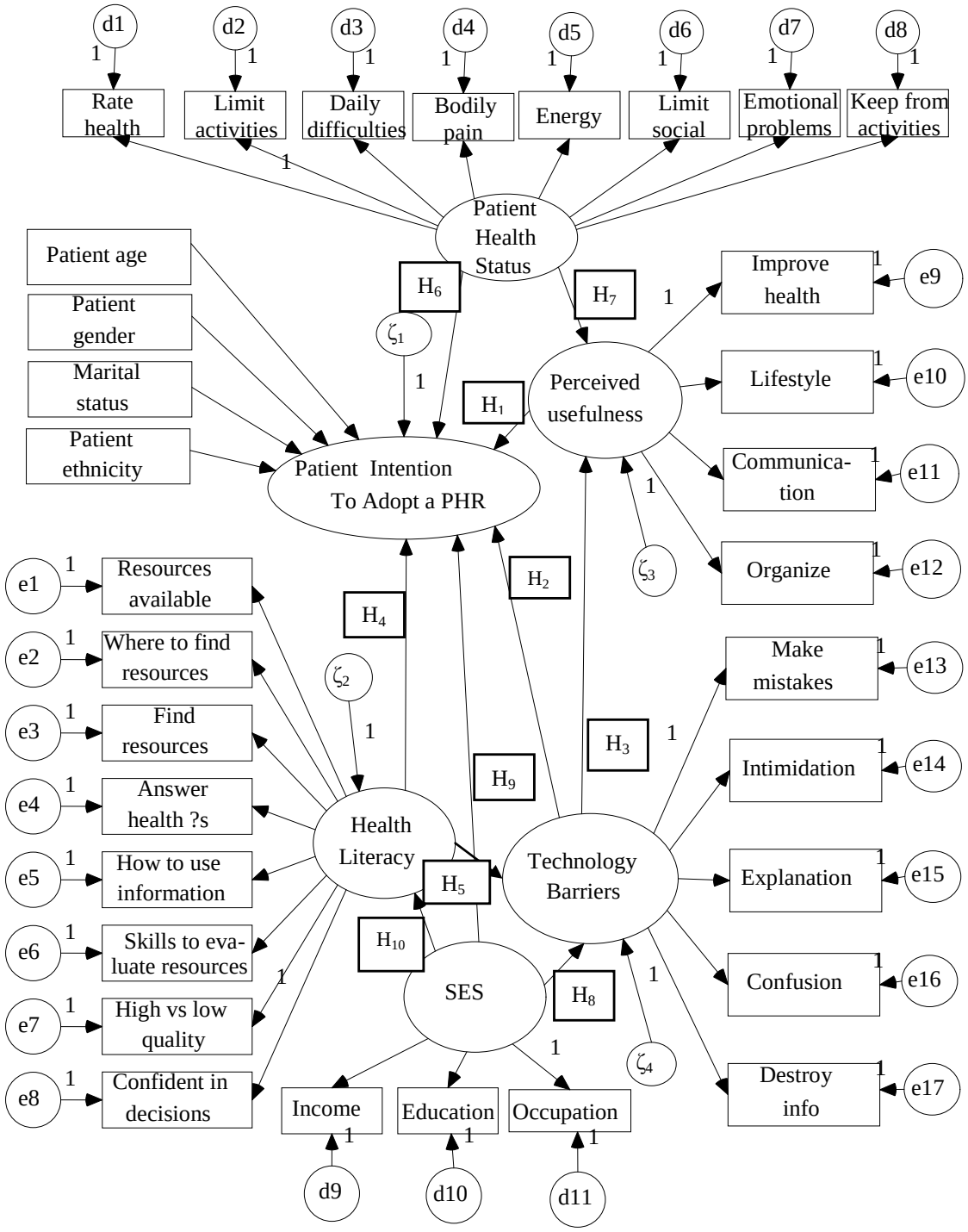

Figure 2. Model for Patient Intention to Adopt a PHR

The initial model (Figure 2) uses unidirectional arrows to show that one exogenous or endogenous variable "causes" another (Byrne, 2001) and assumes:

Perceived usefulness "causes" Patient *Intention* to adopt a PHR

Technology barriers "causes" Patient *Intention* to adopt a PHR

Technology barriers "causes" *Perceived usefulness*

Health literacy "causes" Patient *Intention* to adopt a PHR

Health literacy "causes" *Technology barriers*

Perceived health status "causes" Patient *Intention* to adopt a PHR

Perceived health status "causes" *Perceived usefulness*

SES "causes" *Technology barriers*

SES "causes" Patient *Intention* to adopt a PHR

SES "causes" *Health literacy*

Therefore, Perceived health status, Perceived usefulness, Technology barriers, Socioeconomic status, and Health literacy may all have direct causal effects on patient Intention to adopt a PHR. In addition, Perceived health status and Technology barriers may also have an indirect causal effect (Perceived usefulness acting as a mediator) on patient Intention to adopt a PHR, and Socioeconomic status may also have an indirect causal effect (Health literacy and Technology barriers acting as mediators) on patient Intention to adopt a PHR. According to Wan (2002), the causal link between two variables is more strongly supported by a strong association between the variables. The unidirectional arrows which lead from the indicators to the endogenous and exogenous variables show the influence of the indicators on the variable.

When data were entered into SPSS, exploratory analysis was conducted to look at means and correlations to determine relationships of factors within the latent constructs as well as the demographic characteristics of the sample. Following this analysis, goodness of fit statistics were evaluated to determine the model fit to the data collected for this research (Wan, 2002). Table 8 shows the specific ranges desired for each measure as well as definitions provided by Wan (p. 82).

Table 8. Goodness of Fit Statistics

Index	Range	Definition (Wan, 2002, p.82)
CMIN/DF (Chi-square divided by the degrees of freedom)	<5	Tests the null hypothesis that the sample covariance matrix is drawn from a population with characteristics of the covariance matrix
GFI (goodness-of-fit index)	0–1 (the larger the better)	Measures the amount of variances and covariances accounted for by the model
AGFI (adjusted goodness of fit index)	0–1 (the larger the better)	Measures GFI while taking into account the degrees of freedom available
RMSEA (root mean square of approximation)	<.05 (or .08)	Measures the degree of model adequacy based on population discrepancy
p-close	= or > .05	Tests the null hypothesis that RMSEA is = or < .05
Hoelter's critical N	= or > 200	Indicates the largest sample size which indicates that a model is correct

CHAPTER 4: RESULTS

As described in chapter 3, the parameters on the SEM model required a maximum of 560 questionnaire responses. Although 562 patients did participate in the research, analysis of the questionnaires at the time of data input revealed that 90 were incomplete. Therefore, information is presented describing and comparing the demographic characteristics of the 562 patients of Medical Specialists who participated in the research and the 472 patients whose questionnaires were complete and included in the final analysis.

Data Cleaning

The researcher performed all data entry. Initial descriptive statistics with frequency distributions revealed a few keying errors which were corrected (33 instead of 3 and 6 in a question with choices of 1-5). Occasionally patients would choose two answers for one question. To be consistent, the first (top or left) answer was keyed in. For occupational category, if no answer was chosen but the occupation was provided by the patient, the researcher categorized the occupation based on information provided by Albert Reiss (1977). Examples are occupations that would be categorized as service, including waitress, bartender, hairdresser, nail technician, and dietary aid.

Quality control was accomplished by double checking a sampling of 25 additional questionnaires to ensure accurate keying. Each questionnaire was numbered prior to data input, and the number was included as part of the input to allow for follow-up of specific problems with the data.

It is difficult to achieve good model fit in SEM with missing data. To run a data set with incomplete data, the maximum likelihood estimation is used and modification indices cannot be determined. Modification indices allow us to identify improvements in model fit through addition of constraints between variables (Wan, 2002).

Missing data are present in 16% of the questionnaires (90 of 562). Both mean imputation and listwise deletion assume the data to be missing completely at random (MCAR). MCAR implies that the missing data are independent of both the complete data and the incomplete data (Byrne, 2001). Imputation with the mean reduces variance (Byrne) and is therefore not recommended for SEM. In this data set, imputation with the mean increases the number of centrally located responses, which moves more responses toward agree and strongly agree. Therefore, listwise deletion was used to remove the cases with missing data. This was accomplished manually, placing each column of data in numerical order (lowest to highest) and deleting cases with missing data. Appendix F lists the number of cases deleted per variable in this manner.

A visual scan of the data set appeared to indicate the missing cases were randomly distributed. Additionally, the demographic information provided in Table 9 illustrates that the percentages of the various categories are similar before and after deletion of missing cases. Finally, in looking at the central endogenous variable of the research, intention to adopt, 75% of patients agree or strongly agree prior to the deletion, and 76% agree or strongly agree after the deletion. Income level was the question most often not answered (26 cases). After listwise deletion, the lowest category ($20,000 or less) increased the most with patients reporting intention to adopt being 57% before deletion and 59% afterwards.

One St. Augustine patient wrote the following comment in the box provided at the end of the questionnaire: "Questions I did not answer are because I choose not to share this info or I was not sure how to answer, example #6 1st page. Other questions I choose not to answer for private reasons. From what I have read it seems as if this program can be quite helpful." Therefore, the patient seems positive about the PHR, but because he/she did not complete the questionnaire (including income data) the responses were not used in the analysis.

For comparison, Table 9 includes the demographic data of the total (562) participants as well as the percentages of the total for each category, and the data for only the complete cases, again with the percentages of the total for each category. These figures appear to indicate that the sample characteristics were not altered significantly by the listwise deletion procedure used to manage the cases with missing data.

Table 9. Demographic Data, Comparison of Total Sample and Cases with Complete Data

Variable	Description/Choices	Total (n=562) Number	%	Complete data (n=472) Number	%
Location	St. Augustine	389	69	325	69
	Palm Coast	173	31	147	31
Gender	Male	148	26	126	27
	Female	405	72	346	73
	No answer	9	2	0	0
Age	25 years of age or younger	55	10	50	11
	26–40 years of age	158	28	144	30
	41–55 years of age	163	29	135	29
	56–70 years of age	142	25	113	24
	71 years or older	41	7	30	6
	No answer	3	1	0	0
Marital status	Single, never married	114	20	97	20
	Partnered	22	4	19	4
	Married	220	39	194	41
	Separated	36	6.5	27	6
	Divorced	128	23	108	23
	Widowed	41	7	27	6
	No answer	1	.5	0	0

Variable	Description/Choices	Total (n=562) Number	%	Complete data (n=472) Number	%
Race/ethnicity	American Indian or Alaska Native	5	1	4	1
	Asian	5	1	5	1
	Black or African American	104	18.5	87	18.5
	Native Hawaiian or other Pacific Islander	0	0	0	0
	Hispanic or Latino	25	4	21	4.5
	White	415	74	355	76
	No answer	8	1.5	0	0

Not applicable was a choice on the questionnaire for questions 1-18 (page one), which included questions pertaining to Intention to use, Perceived usefulness, Technology barriers and Health literacy. Patients who chose this option were usually those who would not use a PHR, did not have knowledge of computers, and/or did not have access to a computer currently. Some of these patients verbalized to the researcher that they believe the PHR is a good idea, but they simply would not use an electronic form for their record keeping. The researcher personally administered about 90% of the surveys and often found it difficult to convince these patients to complete the questionnaire due to their lack of interest in the PHR. Therefore, to exclude all the "not applicable" cases as missing would likely result in skewing of the data further to the positive side (everyone intends to use the PHR). Based on this, it was decided to recode the "not applicable" answers to "neither agree nor disagree" to retain this population in the results.

Initial Model Results

The final data set was analyzed both within each construct and with the initial model (Figure 2). Exploratory analysis of the data as well as confirmatory factor analysis (CFA) results are presented within each of the five major areas, with original and final model results provided in the tables for Standardized and Unstandardized Parameter Estimates.

Demographics

Data provided by Medical Specialists indicate that approximately 39% of the practice patients are seen in the Palm Coast office and 61% are seen in the St. Augustine office. There are 44% males and 56% females in the practice. Age categories were slightly different from

those used in the research: 21 years of age or younger = 23%; 22-40 = 25%; 41-64 = 33%; and 65 years or older = 19%.

Exploratory analysis was done with SPSS with descriptive statistics for the location, gender, age, marital status, and race/ethnicity (see Table 9). Although the percentages of the whole for the sample do not equal those of the actual practice estimates, this is believed to be a representative sample of the patients of Medical Specialists. The inflated number of females who participated in the research is accounted for by at least two factors: if both the husband and wife were present for the appointment, the wife completed the form, and women accompanied children to appointments more frequently than men did. The researcher observed males deferring (questionnaire completion) to their female partner on numerous occasions. Scott, Gazmararian, Williams, and Baker (2002) also found females more willing to participate in research regarding use of preventive healthcare services.

For age data, the practice reports that 48% of patients are 40 years of age and younger. The research included 41% of patients in this age category for the completed questionnaires. It is possible that this difference in percentages is accounted for by the pediatric patients in the practice, which were not included in the research.

Intention to Adopt

Table 10 shows Intention to Adopt by demographic characteristics. The majority of patients do intend to adopt the PHR in all categories except the Race/Ethnic category of American Indian or Alaska Native, where 50% intend to adopt and 50% do not intend to adopt the PHR. Only gender was significant in the final model at -.08, indicating that 8% of the variation in the model is explained by gender.

Table 10. Intention to Adopt by Demographic Characteristics

Demographic	Category	Total for category	Intend to adopt Number	Intend to adopt %	Do not intend to adopt Number	Do not intend to adopt %
Gender	Male	126	99	79	27	21
	Female	346	258	75	88	25
Age	25 years of age or younger	50	35	70	15	30
	26-40 years of age	144	115	80	29	20
	41-55 years of age	135	104	77	31	23
	56-70 years of age	113	83	73	30	27
	71 years or older	30	20	67	10	33
Marital status	Single, never married	97	64	66	33	34
	Partnered	19	15	79	4	21
	Married	194	160	82	34	18
	Separated	27	20	74	7	26
	Divorced	108	80	74	28	26
	Widowed	27	18	67	9	33
Race/ethnicity	American Indian or Alaska Native	4	2	50	2	50
	Asian	5	4	80	1	20
	Black or African American	87	65	75	22	25
	Native Hawaiian or other Pacific Islander	0	0	0	0	0
	Hispanic or Latino	21	15	71	6	29
	White	355	271	76	84	24

Although six choices were available on the questionnaire, the answers were transformed and re-coded to dichotomize the choices to agree (strongly agree and agree) and disagree (strongly disagree, disagree, and neither agree nor disagree). Not applicable answers were previously re-coded to neither agree nor disagree. Dichotomizing the Intention variable allowed for a cleaner delineation of the respondents between two choices, rather than spreading responses among the original five choices (after re-coding neither agree nor disagree).

To more precisely determine the relative importance of each predictor variable on Intention, logistic regression analysis was conducted. This procedure is preferred for a dichotomized endogenous variable with exogenous variables that are either continuous or discrete (Wan, 2002). The exogenous variables were also re-categorized into dichotomous variables to improve the results. Three categorical exogenous variables were used: gender (male = 0, female = 1); marital status (not married [includes single, partnered, separated, divorced, widowed] = 0, married = 1); and race (nonwhite [includes American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino] = 0, white = 1), as well as one continuous variable, age.

The logistic analysis will look at the probability that Intention equals 1 (strongly agree or agree to adopt the PHR) and will assess the goodness-of-fit of the predictor variables as well as the relative importance of each one (Pallant, 2007). Chi-square in the Hosmer and Lemeshow Goodness of Fit test is 3.760 with 8 degrees of freedom and a p value of .878. This indicates that this (logistic regression) model is significant, but not that it explains a great deal of variance. It should be noted that according to Pallant (2007), significance of the Hosmer-Lemeshow Goodness of Fit Test result is interpreted by $p > .05$. Cox & Snell R Square (.023) and

Nagelkerke R Square (.034) reveal the amount of variation in Intention_Adopt that is explained by the model (Pallant, 2007). This means that 2.3% and 3.4% of the variability is explained by these variables collectively. Classification tables yield the same predicted percentages for adopters (in block 0 and block 1), indicating that those intending to adopt a PHR cannot be differentiated by age, race, marital status, or gender.

The Wald statistics for the four exogenous variables shows a significance level <.05 for marital status (.004). The other variables are not statistically significant and do not contribute to the predictive ability of the model. So, only marital status influences a person's Intention to adopt a PHR. According to Pallant (2007), if direction of the relationships for B values is negative, this means an increase in the exogenous variable will result in a decrease in the endogenous variable. For marital status, the B value is -.686, indicating that people who are married do not intend to adopt a PHR. The closer the odds ratio (Exp(B)) is to 1, the less effect a unit change in that exogenous variable exerts on the endogenous variable. Marital status displays the greatest difference at .504, which is difficult to interpret because it indicates that for every person who agrees to adopt a PHR, there is a .504 chance he/she is married. In the measurement model, only gender is statistically significant at -.087 and the remaining demographic variables are removed from the model (see Table 11).

Table 11. Standardized and Unstandardized Parameter Estimates for Intention

Model (1=original, 2=final)	Unstandardized coefficients	Standardized coefficients	Critical ratio	*p* (sig.)
1. Intention_agree<Perceived_usefulness	.311	.648	15.361	***
1. Intention_agree<Technology_Barriers	.043	.093	2.070	.038
1. Intention_agree<Patient_Health_Status	.004	.008	.228	.819
1. Intention_agree<Age	.006	.016	.461	.645
1. Intention_agree<Gender	-.087	-.090	-2.632	.008
1. Intention_agree<Maritalstatus	.009	.033	.965	.334
1. Intention_agree<Race	-.012	-.036	-1.047	.295
2. Intention_agree<Perceived_usefulness	.309	.674	15.425	***
2. Intention_agree<Technology_Barriers	.038	.077	2.002	.045
2. Intention_agree<Gender	-.082	-.085	-2.444	.015

***Indicates statistical significance at $p <$. 05 level

Table 11 reveals the statistics on the original model (1) in addition to those for the final SEM model (2). *p* values greater than .05 reveal that the unstandardized factor loading (unstandardized coefficient) relationship is not significant and should be excluded from further analysis. Critical ratios confirm these findings, as only those greater than or equal to 1.96 are significant at the .05 level. According to Byrne (2001), nonsignificant parameters should be deleted "in the interest of scientific parsimony" (p.76). Therefore, the following relationships were removed from the original model: Intention_agree<Patient_Health_Status, Intention_agree<Age, Intention_agree<Maritalstatus, and Intention_agree<Race.

The R^2 is .496, or 49.6%, representing the amount of variance in Intention that is explained by Perceived usefulness, Technology barriers and Gender. In the final model, these three variables are all statistically significant predictors of Intention, and the strongest predictor is Perceived usefulness at .674. When Perceived usefulness increases by one standard deviation, Intention increases by .674 standard deviations. This standardized coefficient is arrived at by

multiplying the unstandardized coefficient by the product of the standard deviations (of Intention and Perceived usefulness).

Perceived Usefulness

Descriptive statistics show means near 4 (agree) and standard deviations of similar value to each other (1.06-1.08), all less than the corresponding means (see Appendix G for descriptive statistics). High correlation between "organize" and "communicate" of .852 revealed that these two indicators are likely measuring the same concept. Because the factor loadings (regression weights) are higher for "communicate" than for "organize," this indicator is retained in the model. There is also high correlation (.837) present between "improve health" and "lifestyle." Removing either "lifestyle" or "improve health" results in an unidentified model and therefore at this point both of these indicators are retained (see Appendix G for the model of Perceived usefulness). However, in the final proposed SEM model with all significant endogenous and exogenous variables included, "improve health" is removed due to lower factor loadings than "lifestyle."

Exploratory factor analysis was conducted to determine internal consistency reliability with SPSS reliability analysis. The Cronbach's Alpha was .869 for the two items to be retained in the latent construct (>.80 is considered very good and indicates the set of questions are measuring the same construct and are unidimensional). Therefore, the items within the Perceived usefulness construct are judged to be highly reliable. Item-scale correlations between the items was .769. This represents the relationship between the total score and each item (indicator) individually and indicates that deleting further items is not warranted.

Confirmatory factor analysis (see Table 12) reveals the statistics for the original model in addition to those for the final SEM model ("organize" and "improve health" are removed). All *p* values are significant for unstandardized coefficients (factor loadings), and the remaining two indicators are strong predictors of Perceived usefulness.

Table 12. Standardized and Unstandardized Parameter Estimates for Perceived Usefulness

Model (1=original, 2=final)	Unstandardized coefficients	Standardized coefficients	*p* (sig.)
1. Lifestyle<Perceived _usefulness	1.000	.891	
1. Communicate<Perceived _usefulness	1.004	.898	***
1. Organize<Perceived _usefulness	.974	.878	***
1. Improvehlth<Perceived _usefulness	.935	.825	***
2. Lifestyle<Perceived _usefulness	.995	.873	***
2. Communicate<Perceived_usefulness	1.000	.881	

***Indicates statistical significance at $p < .05$ level

Data analysis was performed in AMOS without correlated measurement errors. No correlations of the measurement errors are indicated by the modification indices, indicating the data fit the model quite well. The goodness of fit statistics for the revised model show the regression weights are statistically significant for this latent construct with a goodness of fit index (GFI) equal to one, indicating a perfect fit (see Appendix G for GOF statistics for Perceived usefulness).

Technology Barriers (Perceived Ease of Use)

The responses for the Technology barriers construct were transformed (re-coded) so that 1=5, 2=4, 3=3, 4=2 and 5=1 because the questions were worded such that strongly agree responses meant more difficulty with technology. Because these questions were taken from prior

studies per the literature review, it is felt meaning would be lost in changing these questions to "fit" the remaining questions on page one of the questionnaire. However, in contrast, strongly agree responses for the Perceived usefulness construct indicated a more positive impression of the PHR.

Exploratory analysis was done with SPSS with descriptive statistics showing that some of the indicators used in the analysis were correlated. But none were above .80, and therefore none were removed. Descriptive statistics show means near 4 (agree) and standard deviations of similar value to each other, all less than the corresponding means (see Appendix H for descriptive statistics).

Exploratory factor analysis was conducted to determine internal consistency reliability with SPSS reliability analysis. The Cronbach's Alpha was .898 for the five items (>.80 is considered very good). Item-scale correlations between items ranged from .610 to .802 at this point indicating strong relationships between each indicator and the total. Deleting "destroy" would improve the Cronbach's Alpha to .906 but this was not enough of a gain to consider worthwhile.

Table 13 reveals the statistics on the original model for Technology barriers (1) in addition to those for the final SEM model (2). The unstandardized regression weights indicate that all indicators are statistically significant and are therefore retained in the model. However, the model fit statistics show that the model does not fit well with the data. Therefore, the measurement errors were allowed to be correlated in order to improve the model fit based on modification index data as well as theoretical justification (see Appendix H for model with measurement errors correlated).

Table 13. Standardized and Unstandardized Parameter Estimates for Technology Barriers

Model (1=original, 2=final)	Unstandardized coefficients	Standardized coefficients	*p* (sig.)
1. Destroy<Technology_barriers	.722	.601	***
1. Confusion<Technology_barriers	1.045	.875	***
1. Explanation<Technology_barriers	1.000	.866	
1. Intimidate<Technology_barriers	1.005	.872	***
1. Mistakes<Technology_barriers	.858	.763	***
2. Destroy<Technology_barriers	.600	.513	***
2. Confusion<Technology_barriers	1.041	.896	***
2. Explanation<Technology_barriers	1.000	.890	
2. Intimidate<Technology_barriers	.951	.848	***
2. Mistakes< Technology_barriers	.762	.696	***

***Indicates statistical significance at $p < .05$ level

The goodness of fit statistics for the original and the revised model reveal that after the measurement errors had been allowed to be correlated, the model shows improved fit with 3.102 Chi-square ratio and *p*-value larger than .05 (p=0.245). Additionally, the GFI and AGFI are quite close to 1.0 (GFI = 0.995; AGFI = 0.961) while RMSEA is smaller than 0.08 (0.67) and Hoelter's critical N is larger than 200 (455), indicating that the model fits the data quite well (see Appendix H for GOF statistics for Technology barriers).

Health Literacy

This latent construct was previously validated by Norman and Skinner (2006) as the components of the eHealth Literacy Scale (eHEALS). The data for the population used in this research revealed high correlations between "how to find" and "where to find" as well as between "use Internet" and "how to use." Based on higher factor loadings, "how to find" and "how to use" were retained, and "where to find" and "use Internet" were removed from the latent construct (see Appendix I for descriptive statistics). Descriptive statistics show most means

above 3.5, which is between neither agree nor disagree (3) and agree (4). Standard deviations of similar value to each other (1.06-1.12) are noted as well, all less than the corresponding means.

Exploratory factor analysis was conducted to determine internal consistency reliability of the trimmed construct with SPSS reliability analysis. The Cronbach's Alpha was .895 for the six items retained in the latent construct (>.80 is considered very good). This Cronbach's Alpha is slightly better than the .880 found by Norman and Skinner (2006) in their original research on the eHealth Literacy Scale (including eight indicators). Item-scale correlations between items ranged from .600 to .808 at this point indicating strong relationships between each indicator and the total. No improvement could be made in Cronbach's Alpha by item deletion.

Table 14 reveals the statistics on the original Health literacy construct in addition to those for the construct with "use Internet" and "where to find" removed (due to multicollinearity as described above). All *p* values reveal significant relationships of the regression weights.

Table 14. Standardized and Unstandardized Parameter Estimates for Health Literacy

Model (1=original, 2=final)	Unstandardized coefficients	Standardized coefficients	*p*(sig.)
1. Whatresources<Health Literacy	.831	.714	***
1. Howtofind<Health Literacy	1.001	.869	***
1. UseInternet<Health Literacy	1.000	.873	
1. Howtouse<Health Literacy	.986	.892	***
1. Skillstoeval<Health Literacy	.916	.829	***
1. Highvslow<Health Literacy	.772	.674	***
1. Confidentdec<Health Literacy	.672	.580	***
1. Wheretofind<Health Literacy	.995	.851	***
2. Howtouse<Health Literacy	1.000	.917	
2. Skillstoeval<Health Literacy	.945	.867	***
2. Whatresources<Health Literacy	.719	.625	***
2. Howtofind<Health Literacy	.866	.763	***
2. Confidentdec<Health Literacy	.697	.610	***
2. Highvslow<Health Literacy	.845	.748	***

***Indicates statistical significance at $p < .05$ level

The goodness of fit statistics for the original and the revised model reveal that after the measurement errors had been allowed to be correlated, the model shows improved fit with 3.441 Chi-square ratio, with *p*-value larger than .05 (p=0.156). Additionally, the GFI (.991) and AGFI (.951) are quite close to 1.0. RMSEA is smaller than 0.08 (0.72) and Hoelter's critical N is larger than 200 (325), indicating that the model fits the data quite well (see Appendix I for the revised model for health literacy as well as the GOF statistics for health literacy).

Patient Health Status

QualityMetric's SF-8™ is an abbreviated version of the well-validated SF-36®. Patients are asked to recall various measures of health for the previous four weeks. The data collected for this research found high correlation between "daily difficult" and "limit activities." Due to

smaller factor loading, “limit activities” was removed from the latent construct (see Appendix J for descriptive statistics).

Exploratory factor analysis was conducted to determine internal consistency reliability with SPSS reliability analysis. The Cronbach’s Alpha was .904 for the seven items remaining Patient health status (>.80 is considered very good). Item-scale correlations between items ranged from .641 to .806 at this point indicating strong relationships between each indicator and the total. No improvement could be made with deletion of any items in the latent construct.

Table 15 reveals the statistics for the original Patient health status construct as well as the final version of the construct, with correlated measurement errors (see Appendix J for the revised model for patient health status with correlated measurement errors). All *p* values are greater than .05 and reveal that the relationships are significant.

Table 15. Standardized and Unstandardized Parameter Estimates for Patient Health Status

Model (1=original, 2=final)	Unstandardized coefficients	Standardized coefficients	*p* (sig.)
1. Ratehealth<Patient health status	1.000	.692	
1. Limitactivities< Patient health status	1.179	.813	***
1. Dailydifficult< Patient health status	1.296	.867	***
1. Bodilypain< Patient health status	1.334	.769	***
1. Energy< Patient health status	.836	.726	***
1. Limitsocial< Patient health status	1.173	.840	***
1. Emotional< Patient health status	.977	.641	***
1. Keepfromact< Patient health status	1.104	.773	***
2. Bodilypain< Patient health status	1.349	.786	***
2. Energy< Patient health status	.820	.720	***
2. Limitsocial<Patient health status	1.121	.811	***
2. Ratehealth<Patient health status	1.000	.699	
2. Dailydifficult<Patient health status	1.292	.873	***
2. Keepfromact<Patient health status	1.006	.712	***
2. Emotional<Patient health status	.935	.619	***

***Indicates statistical significance at $p < .05$ level

The goodness of fit statistics for the original and the revised model for Patient health status reveal that after the measurement errors had been allowed to be correlated, the model shows improved fit with Chi-square ratio of 1.220 and *p* value greater than .05 at .879. In addition, the GFI and AGFI are close to 1 at .993 and .979. RMSEA is smaller than 0.05 at .022 and Hoelter's critical N is greater than 200 at 726. Overall these figures indicate the model fits the data very well (see Appendix J for patient health status GOF statistics).

Socioeconomic Status

The study population was characterized by a majority with high school education or less. The majority of patients were in the lowest income category (less than $20,000 annually) for 2008. Data for occupational categories were re-coded to reflect a hierarchy of occupational

prestige from lowest to highest, see Table 16. This aligned the categories of occupation with the lowest to highest nature of the education and income variables. The median and mode for occupational category was operatives, which includes machine operators, such as manufacturing equipment. All categories of the three SES variables indicate a majority of the patients intending to adopt a PHR, except laborers.

Table 16. Socioeconomic Status Variables/Indicators by Intention to Adopt the PHR

Variable	Category	Total for category	Intend to adopt		Do not intend to adopt	
			Number	%	Number	%
Education	Less than high school	65	41	63	24	37
	High school/GED	178	138	78	40	22
	Some college	136	109	80	27	20
	Associate's degree (AS and/or AA)	49	37	76	12	24
	Bachelor's degree	30	22	73	8	27
	Master's degree or above	14	10	71	4	29
Income	$20,000 or less	277	207	75	70	25
	$20,001 to $35,000	84	67	80	17	20
	$35,001 to $50,000	56	42	75	14	25
	$50,001 to $100,000	39	31	79	8	21
	$100,001 or more	16	10	62.5	6	37.5
Occupation	1. I have never worked outside the home	78	59	76	19	24
	2. Laborer	11	5	45	6	55
	3. Private household workers	52	44	85	8	15
	4. Farm worker	57	44	77	13	23
	5. Clerical worker	7	4	57	3	43
	6. Service worker	28	22	79	6	21
	7. Operative	87	65	75	22	25
	8. Craftsperson, foremen	13	13	100	0	0
	9. Sales worker	45	30	67	15	33
	10. Manager or proprietor	68	53	78	15	22
	11. Professional or technical	26	18	69	8	31

Exploratory factor analysis was conducted to determine internal consistency reliability with SPSS reliability analysis. The Cronbach's Alpha was .535 for the three items (<.65 is considered poor). No improvement can be made in the reliability calculation. According to Pallant (2007), this low value for Cronbach's Alpha may be due to the low number of items in the construct. Therefore, using the mean inter-item correlation is an alternative way to ensure internal consistency, and for this data it is .381. The optimal range for this correlation is .2 to .4 (Briggs & Cheek, 1986).

Table 17 reveals the statistics on the original/final model for Socioeconomic status. No changes were made in the original model. Data analysis was performed in AMOS without correlated measurement errors. The goodness of fit statistics for the model show GFI is 1.00 which indicates a perfect fit. Regression weights are statistically significant for this latent construct (see Appendix K for correlations, model and GOF statistics for SES indicators).

Table 17. Standardized and Unstandardized Parameter Estimates for Socioeconomic Status

Model (1=original/final)	Unstandardized coefficients	Standardized coefficients	*p* (sig.)
1. Education<Socioeconomic_status	.406	.703	***
1. Income<Socioeconomic_status	.274	.498	***
1. Occupcateg<Socioeconomic_status	1.000	.659	

***Indicates statistical significance at $p < .05$ level

Final Model

Statistics for the proposed model are given in Table 18. The unstandardized regression weights indicate that all remaining indicators are statistically significant. Critical ratios confirm

these findings, as only those greater than or equal to 1.96 are significant at the .05 level. It should be noted that several relationships were removed based on the original measurement model statistics. The most significant was removal of the Patient health status portion of the original model. In this patient population, the relationships between the following constructs were not significant: Patient health status and Perceived usefulness; Patient health status and Intention; Health literacy and Intention; and Socioeconomic status and Intention.

Wan (2002) also reminds us that increasing the number of correlations between the measurement errors may improve the model fit slightly but do not contribute to the model theoretically. Therefore, a more parsimonious (efficient) model is preferred. No additional measurement error correlations are added after a careful review of the modification indices for the final model. Small improvements can be made in the model fit with additional correlations, but theoretically the correlations are not easily explained. Figure 3 shows the proposed model for Patient Intention to Adopt a PHR.

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Table 18. Standardized and Unstandardized Parameter Estimates for Model for Patient Intention to Adopt a PHR

Model components with corresponding hypothesis [H]	Unstandardized coefficients	Standardized coefficients	Critical ratio	*p* (sig)
Health Literacy<SES [H_{10}]	.070	.198	3.279	.001
Technology Barriers<SES [H_8]	.081	.182	3.289	.001
Technology Barriers<Health Literacy [H_5]	.555	.441	7.816	***
Perceived Usefulness<Technology Barriers [H_3]	.295	.274	5.267	***
Lifestyle<Perceived Usefulness	.995	.873	19.685	***
Mistakes<Technology Barriers	1.000	.725		
Intimidate<Technology Barriers	1.225	.864		***
Explanation<Technology Barriers	1.251	.882	19.228	***
Confusion<Technology Barriers	1.299	.885	18.500	***
Destroy<Technology Barriers	.813	.550	16.501	***
Highvslow<Health Literacy	1.169	.737	14.146	***
Communicate<Perceived Usefulness	1.000	.881		
Occupcateg<SES	1.000	.624		
Income<SES	.278	.479	7.459	***
Education<SES	.459	.751	7.455	***
Intention Agree<Technology Barriers [H_2]	.038	.077	2.002	.045
Intention Agree<Gender	-.082	-.085	-2.444	.015
Intention Agree<Perceived Usefulness [H_1]	.309	.674	15.425	***
Confidentdec<Health Literacy	.982	.612	11.389	***
Whatresources<Health Literacy	1.000	.621		
Howtofind<Health Literacy	1.219	.766	16.853	***
Howtouse<Health Literacy	1.386	.906	14.804	***
Skillstoeval<Health Literacy	1.343	.879	14.870	***

***Indicates statistical significance at $p < .05$ level

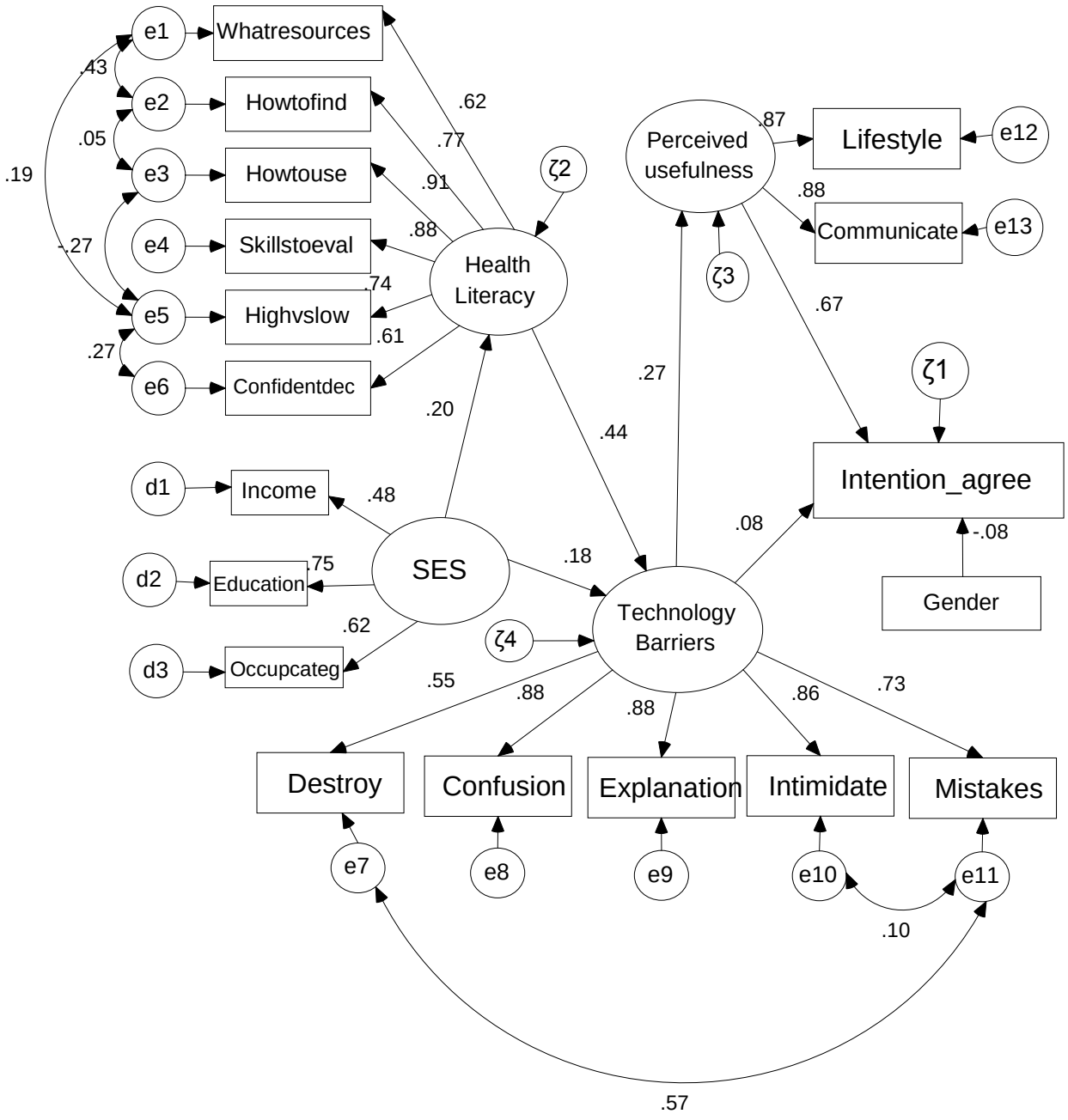


Figure 3. Proposed Model for Patient Intention to Adopt a PHR

R2 values indicate the amount of variance from the proposed model that is explained by each endogenous variable, with Health literacy explaining 3.9%, Perceived usefulness explaining 7.5%, Technology barriers explaining 25.9%, and Intention explaining 49.6%.

Overall, the data did prove to be a good fit for the proposed model for Patient Intention to Adopt a PHR, based on the GOF data in Table 19. The Chi-square is between 2 and 3 which does indicate good fit of the data to the model. Goodness of fit indices are .935 (GFI) and .910 (AGFI) are both quite close to 1 and RMSEA is less than .08 at .053. Hoelter's critical is above 200 at 247, with all the statistics indicating that the data fit the model quite well. Improvements in the GOF statistics from the initial model confirm that the changes have enhanced the overall fit of the data to the model. No further improvements of significance can be accomplished in the GOF figures with additional measurement error correlations.

Table 19. Goodness of Fit Statistics for Patient Intention to Adopt a PHR

Index	Range	Initial model	Proposed model
CMIN/DF	<5	4.609	2.330
GFI (Goodness-of-fit)	0–1 (the larger the better)	.759	.935
AGFI	0–1 (the larger the better)	.723	.910
RMSEA	<.05 (or .08)	.088	.053
p-close	= or > .05	.000	.251
Hoelter's critical N	= or > 200	114	247

Hypothesis Testing

Perceived Usefulness

Hypothesis 1: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who perceives the PHR to be useful and intends to adopt the PHR.

The unstandardized regression weight shows a positive association between Perceived usefulness and Intention (gamma = .309) with the level of significance less than .05 and a critical ratio greater than 1.96 at 15.425, indicating that the patients who perceived the PHR to be useful are more likely to report the Intention to adopt the technology (see Table 18).

Technology Barriers (Perceived Ease of Use)

Hypothesis 2: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who perceives technology positively and intends to adopt the PHR.

The unstandardized regression weight shows a positive association between Technology barriers and Intention (gamma = .038) with the level of significance less than .05 (*p*-value = .045, C.R. = 2.002), indicating that the patients who perceived technology positively are more likely to report the Intention to adopt the PHR (see Table 18).

Hypothesis 3: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who perceives technology positively and perceives the PHR to be useful.

The unstandardized regression weight shows a positive association between Technology barriers and Perceived usefulness (gamma = .295) with the level of significance less than .05 and

critical ratio greater than 1.96 at 5.267, indicating that the patients who perceive technology positively are more likely to report that they perceive the PHR to be useful (see Table 18).

Health Literacy

Hypothesis 4: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who has a high level of health literacy and intends to adopt a PHR.

The unstandardized regression weight shows no association between Health literacy and Intention, gamma = .021 with the level of significance greater than .05 and critical ratio less than 1.96 (*p*-value = .359, C.R. = .918). This indicates that the patients who have high levels of Health literacy are NOT more likely to report the Intention to adopt the PHR than those patients with low Health literacy.

Hypothesis 5: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who has a high level of health literacy and perceives technology positively.

The unstandardized regression weight shows a positive association between Health literacy and Technology barriers (gamma = .555) with the level of significance less than .05 and a critical ratio above 1.96 at 7.816, indicating that the patients who have high levels of Health literacy are more likely to report that they perceive technology positively (see Table 18).

Patient Health Status

Hypothesis 6: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who is unhealthy and intends to adopt a PHR.

The unstandardized regression weight shows no association between Patient health status and Intention (gamma = .004) with the level of significance greater than .05 and a critical ratio less than 1.96 (*p*-value = .819, C.R. = .228). This indicates that the patients who perceived themselves to be "unhealthy" are NOT more likely to report the intention to adopt the PHR than those people who consider themselves to be healthy.

Hypothesis 7: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who is unhealthy and perceives the PHR to be useful.

The unstandardized regression weight shows no association between Patient health status and Perceived usefulness (gamma = .058) with the level of significance greater than .05 and a critical ratio less than 1.96 (*p*-value = .232, C.R. = 1.194). This indicates that the patients who perceive themselves to be unhealthy do NOT perceive the PHR to be useful.

Socioeconomic Status

Hypothesis 8: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who has a high socioeconomic status and a low level of perceived technology barriers.

The unstandardized regression weight shows a positive association between Socioeconomic status and Technology barriers (gamma = .081) with the level of significance less than .05 and critical ratio greater than 1.96 (*p*-value = .001, C.R. = 3.289), indicating that the patients with a higher Socioeconomic status are more likely to report lower levels of perceived Technology barriers (see Table 18).

Hypothesis 9: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who has a high socioeconomic status and is willing to adopt the PHR.

The unstandardized regression weight shows no association between Socioeconomic status and Intention (gamma = -.008) with the level of significance greater than .05 and a critical ratio less than 1.96 (*p*-value = .379, C.R. = -.879). This indicates that the patients with a higher Socioeconomic status are NOT more likely to report the Intention to adopt the PHR (than people with lower SES).

Hypothesis 10: The alternative hypothesis was that there would be a positive association in the factor loadings for a patient who has a high socioeconomic status and a high level of health literacy.

The unstandardized regression weight shows a positive association between Socioeconomic status and Health literacy (gamma = .070) with the level of significance less than .05 and critical ratio greater than 1.96 (*p*-value = .001, C.R. = 3.279), indicating that the patients who have higher Socioeconomic status levels are more likely to have higher levels of Health literacy (see Table 18).

CHAPTER 5: DISCUSSION

The TAM was employed in a structural equation model to predict behavioral intention to adopt a PHR by the patients at Medical Specialists. Findings showed that both technology barriers (perceived ease of use) and perceived usefulness are significant in a patient's decision to adopt a PHR. Perceived ease of use was also a factor in a patient's perceived usefulness of the PHR. Davis noted that perceived ease of use is not seen as parallel in importance to perceived usefulness, but rather is an indicator of perceived usefulness. Two of the variable constructs utilized in this research directly impacted perceived ease of use and indirectly impacted perceived usefulness (health literacy and socioeconomic status).

Technology Acceptance Model

The TAM portion of the SEM used in this research was statistically significant and can be used to predict a patient's intention to accept the technology (PHR). According to Davis (1989), the patients of Medical Specialists would adopt the PHR for their own benefit first, and secondarily due to the ease of using the system. The current research did bear this portion of the theory out, in that the strongest association with intention to adopt is perceived usefulness. Also, as noted by Davis in his own research, once a patient adopts the PHR and becomes accustomed to using the various features, the perceived ease of use portion of the model will become unimportant.

Davis (1989) contends that ease of use and ease of learning are strongly related. The health literacy portion of the model measures a patient's knowledge, comfort and perceived skill level to find, evaluate and apply electronic health information to health problems. The current

model noted a strong association between health literacy and technology barriers, which may indicate that ease of learning and ease of use are strongly related in the current research.

Because the original TAM was based on the workplace, Davis (1989) has noted that usefulness is further enhanced if the new technology is important to a person's job. Parlaying this thought to the PHR, an exogenous construct was added to the original structural equation model seeking to determine if the patients felt the PHR would be important to their health. The Quality Metrics SF-8^{TM} was therefore added to the questionnaire. The surprising result was that this portion of the model, patient health status, showed no statistical significance, even after the intention to adopt variable was dichotomized to improve the chances of significance. Therefore, in this patient population, patient health status is not a factor in a patient's intention to adopt a PHR.

Wang, Lin, and Luarn (2006) suggest performing a comparison of the base TAM model goodness of fit statistics with one construct (literacy and SES) added at a time. Using the PHR data collected for this research, small improvements can be made in model fit for some of the indices for goodness of fit. With a *p* value greater than .05, the literacy portion becomes statistically insignificant. Although SES does produce slightly improved figures to the proposed model, most of them are less than the TAM only model. Therefore, overall the proposed model shows good fit to the data and verification of the TAM for explaining the intention to use a PHR (see Table 20).

Table 20. Comparison of GOF Statistics for TAM, Literacy and SES Model Components

Index	Range	TAM only model	TAM + literacy	TAM + SES	Proposed model
CMIN/DF	<5	2.408	2.713	2.212	2.330
GFI (Goodness-of-fit)	0–1 (the larger the better)	.975	.941	.963	.935
AGFI	0–1 (the larger the better)	.950	.911	.941	.910
RMSEA	<.05 (or .08)	.055	.06	.051	.053
p-close	= or > .05	.314	.039	.443	.251
Hoelter's critical N	= or > 200	300	222	289	247

Perceived Usefulness

The significant association of 0.674 demonstrated in Figure 3 supports the TAM assumption that perceived usefulness is a strong indicator of a patient's eventual intention to adopt a PHR. As seen in Appendix B, the majority of TAM research has upheld this association for the technology investigated. For example, Yi, Jackson, Park, and Probst (2006) and Wang et al. (2006) both reported a significant association between perceived usefulness and behavioral intention in their research of 0.55 and 0.41 respectively.

Many of the patients of Medical Specialists verbalized their intention to use a PHR if it is made available to them in the future. Tables 29 and 30 contain some of these comments, negative and positive respectively. Sometimes patients would verbalize to the researcher that they realize it would be useful, but they did not intend to use the PHR. The physicians at Medical Specialists do currently provide the patients with copies of laboratory results when they come for office visits, and some patients admitted that they preferred it that way (hard copies).

Perceived usefulness may depend on several factors, such as how often a patient visits Medical Specialists. Research has indicated that patients do feel more organized when they are able to view lab results and other information prior to a visit so they can formulate questions ahead of time and focus on their specific concerns (Ayana, Pound, & Ebrahim, 1998). The office visit is then perceived as higher quality and more productive (Maly et al., 1999; Tang & Newcomb, 1998).

Technology Barriers (Perceived Ease of Use)

The patients of Medical Specialists who are comfortable with computers and technology expressed willingness to use a PHR and felt it would be helpful. Literature review pointed out the importance of including patients in the design of a PHR system (DeClercq et al., 2003). The physicians at Medical Specialists are considering Microsoft® HealthVault™ as their PHR. This web-based PHR has been available (to anyone) for several years. If Medical Specialists chooses HealthVault™, patients will be required to create an account in HealthVault™ which will then be linked to portions of their electronic health record at Medical Specialists. For those patients with concerns about security of their information, not creating the PHR in HealthVault™ will exclude them from the information exchange that the PHR would provide. However, Medical Specialists should realize that the patients may not perceive HealthVault™ as favorably as they would perceive a portal within the Medical Specialists website. Alternatively stated, patients may feel more secure going through the Medical Specialists' website to access their information than going through a generic website such as HealthVault™.

As noted above, the ability to create an account on HealthVault™ will be required for patients to participate in the PHR system being considered by Medical Specialists. To offset the

technology barriers that some patients may perceive, it would be helpful if a computer could be available to help the patients sign up for the PHR in the office. In addition, a demonstration site with a mock patient file could be used to aid with adoption, thereby providing the trialability characteristic recommended by Rogers (2003) which promotes diffusion of an innovation. Also, Davis reminds us that people are motivated to learn by doing rather than by reading manuals and that personal experience with an innovation can overcome evidence against it. In the early phases, having an office staff member available to assist patients with questions as they enter diagnostic information will likely improve the quality of the data that is entered by patients (Kim et al., 2005).

Van der Meijden, Tange, Troost, and Hasman (2001) studied the role of users in electronic health record development and design. They were aware that change agents promote the innovation, and are especially important in acceptance of an electronic patient record. In addition, Kim et al. (2005) theorized that "champion residents" were influential in improving PHR adoption in their community of primarily disabled and elderly residents. These experiences indicate that improved diffusion of the innovation may occur if a few patients will act as change agents to promote the PHR to other patients. One patient wrote the following in the comments area provided on the questionnaire during the pilot study portion of the research: "I can teach software use." This patient was in the 71 years and older age category and would make an excellent champion for other senior citizens. We are also reminded by McDonald and Alpert (2007) that these early adopters can suggest improvements and help to refine the innovation.

Health Literacy

Although an indirect causal link was found between health literacy and intention, health literacy surprisingly did not have a strong (direct) association with intention. However, eHEALS assesses the ability to find and use health resources found on the Internet. Some of the questions were very similar to each other, and patients commented to the researcher that they felt the questions were the same and were confusing. Examples are: "I know *where* to find helpful health resources on the Internet" and "I know *how* to find helpful health resources on the Internet." The researcher often used *Web*MD® as an example of a health resource which many of the patients were usually familiar with.

A strong causal link was found between health literacy and technology barriers, which indicated that, in this population, high levels of health literacy are associated with a patient's comfort level with technology (ease of use). This contributed to the indirect causal link between health literacy and intention. Intuitively it makes sense that patients who are comfortable using the Internet for health resources are also comfortable with technology in general.

Health literacy is considered an important aspect of patient safety by the Joint Commission (2007). Skills such as the ability to read a prescription bottle and the associated instructions contribute to a patient's compliance with health plans. Overall, supplying patients with education and other tools, such as access to their medical records, has the potential to decrease healthcare encounters and costs.

Patient Health Status

The lack of association between patient health status and usefulness of the PHR *or* patient health status and intention to adopt a PHR was an unexpected finding based on the literature

review. It is difficult to determine what might motivate patients to follow their health and become involved in the care they receive. Interestingly, relatively healthy patients, such as those undergoing in vitro fertilization have found the features of a PHR to be valuable for ongoing care as well as social support (Tuil et al., 2006). HIV/AIDS patients also find social support important and Kalichman et al. (2003) assert that promoting Internet use will improve the lives of this patient population. However, research has shown mixed results of adoption when a PHR is made available to chronically ill patients, including diabetics (Grant et al., 2008).

Socioeconomic Status

The association between socioeconomic status level and technology barriers indicates that patients with a higher level of education, income and occupational prestige are likely more comfortable with using technology than those patients of lower levels. The latest Pew Research (2009) results as shown in Appendix B bear this point out. Internet users report higher levels of education and income than people not using the Internet. In addition, those patients with higher levels of education, income and occupational prestige also have higher levels of health literacy. In spite of a higher level of health literacy, these patients did not intend to adopt a PHR at a higher rate than those patients with lower levels of SES. Therefore, in this population, the early adopters will likely be those in the lower SES level.

Socioeconomic status was statistically significant and indirectly impacts a patient's intention to adopt, with both health literacy and technology barriers being mediators. Therefore, for example, targeting females who are educated with at least high school may prove fruitful in diffusing PHR technology.

Diffusion of Innovation

In addition to the TAM, portions of Rogers' diffusion of innovation theory were considered in this research in an attempt to identify characteristics of early adopters. Of the control (demographic) variables considered, only gender was significant, explaining 8% of the variance in the model. Both Marital Status and Race/Ethnicity were dichotomized (i.e., married, not married, etc.) to improve chances of statistical significance. Logistic regression did reveal that marital status is significant but to a very small degree and it was not retained in the proposed SEM model (it was not significant in SEM).

Hypothesis Result Discussion

Table 21 summarizes the results of the hypothesis testing. Since the main focus of the research was to predict which factors are related to a patient's intention to adopt a PHR, several of the hypotheses looked at this association.

Table 21. Results of Hypothesis Testing

Alternate hypothesis	Significant?	Comment
H_1 Patients who perceive the PHR to be useful will agree to adopt the technology at a higher rate than those who do not perceive it to be useful	Yes	Many patients equated usefulness with convenience. This relationship is a central theme to the TAM. The standardized regression weight was strong at .674.
H_2 Patients who perceive technology positively will be more likely to adopt a PHR than those patients who are uncomfortable with technology	Yes	Comfort level with technology was often (verbally) expressed as a reason patients would or would not adopt a PHR. The relationship between technology barriers and intention to adopt was statistically significant although not particularly strong at .077.
H_3 Patients who perceive technology positively will also view perceived usefulness of the PHR more positively than those patients who are uncomfortable with technology	Yes	The relationship between technology barriers and perceived usefulness of the PHR was statistically significant at .274.
H_4 Patients who have high levels of comfort and skill in using information technology for health (health literacy) are more likely to adopt the PHR than those with low levels	No	The relationship between health literacy and intention to adopt a PHR was not statistically significant. Therefore, a person's health literacy level does not impact the decision to use a PHR.
H_5 Patients who have high levels of comfort and skill in using information technology for health (health literacy) are more likely to perceive technology positively than those patients with low levels of health literacy	Yes	The relationship between health literacy and comfort level with technology was statistically significant and quite strong at .441.

Alternate hypothesis	Significant?	Comment
H_6 Patients who perceive themselves as "unhealthy" are more likely to adopt a PHR than those patients who consider themselves to be "healthy"	No	Denton (2001) did conclude that patients with chronic illnesses are more likely to adopt and use a PHR. However, patients participating in this research who are not healthy are not more likely to adopt a PHR. This relationship was not statistically significant.
H_7 Patients who perceive themselves as "unhealthy" are more likely to perceive the PHR as useful than those patients who consider themselves to be "healthy"	No	Patients who are not healthy are more likely to perceive the PHR as useful. The relationship was not statistically significant.
H_8 Patients with a higher socioeconomic status level will have a lower level of perceived technology barriers than those patients with a lower socioeconomic status level	Yes	Literature review, particularly Pew Research (2009) supports higher Internet usage amongst higher SES population. This research population supports the Pew Research, with the majority of patients with higher SES having low technology barriers. The relationship was statistically significant, although not particularly strong at .182.
H_9 Patients with a higher socioeconomic status level will agree to adopt the PHR at a higher rate than those with a lower socioeconomic status level	No	The majority of patients participating in the research were high school educated with income less than $20,000, yet 75% of the patients overall agreed to an intention to adopt the PHR. The relationship between higher SES and intention to adopt a PHR was not statistically significant.

Alternate hypothesis	Significant?	Comment
H_{10} Patients with a higher socioeconomic status level will have a higher level of health literacy than those with a lower socioeconomic status level	Yes	There was a statistically significant relationship between SES and health literacy, although not particularly strong at .198. This could be related to the above mentioned average participant education level of high school or less.

Patient Comments

Although qualitative research was not the primary aim of this research, it is worthwhile to include some of the comments patients provided on the questionnaire. The comments provide insight into concerns the patients of Medical Specialists about this technology which may be viewed as additional barriers to eventual adoption and usage. Table 22 represents some of the negative comments. Privacy and security concerns were often mentioned by patients who were not willing to use a PHR in the future.

Table 22. Patient (Negative) Comments About the PHR

Office	Comment
Palm Coast	I would not feel comfortable having my health records on the Internet, as there is always a chance that someone may have access.
Palm Coast	Use of the PHR will be determined by if the program is user friendly to seniors.
Palm Coast	Will not participate in PHR!
St. Augustine	Perhaps if I was a lot younger would do this, but no interest at this time. Also, let's not lose the personal touch.
St. Augustine	I'm not sure how safe it would be to have this info online. Not to mention a lot of people are not medically knowledgeable. There would have to be a 24 hour hotline to answer questions. It could create more work with people calling in with questions if there is no hotline. I still think it's best if it stays between doc and patient. It's more personal and creates a closer relationship between doc and patient. Info is always better when it comes straight from the doc.
Palm Coast	Would not use a computer system. Would not feel safe that it would be secure enough for someone to gain access to my medical file.
Palm Coast	Health records being sold to companies who use the information for potential profit, i.e., mailing list, potential customers for products. Concerned about making this available online and the potential risk.

Table 23 represents some of the positive feedback about PHRs. Many patients expressed gratitude for the potential time savings and convenience. The ability to request medication refills on line and view test results seem to be most important. This is consistent with the findings of Halamka et al. (2008).

Table 23. Patient (Positive) Comments About the PHR

Office	Comment
Palm Coast	I think it will be great and will have less calls into the office to get test results, etc.
Palm Coast	PHR should be downloadable and I can put it on a thumb drive and carry it with me around my neck. With standardized formats, hospitals all over could use algorithms to pull info into their system from the thumb drive.
Palm Coast	I feel like the Internet is the way the world connects with resources useful to everyday life and it is a great way for busy people who are healthy to not have to come to the office where there are ill people, opening ourselves to illness.
Palm Coast	I would love to be able to access my records online! It would not only be convenient but helpful.
St. Augustine	I think that the system would help some people who are able to use the net and understand it!
St. Augustine	The PHR will also free up a lot of time from the doctor and the staff so they don't have to deal with patients calling about refills, med trans, or info on pt rec. Computers are the future and very helpful as well as useful.
St. Augustine	Thank you! I really need this! It would make life so much easier! No calling and waiting for results…
St. Augustine	I think your idea for a PHR is an excellent idea and many would benefit from it. I have an 8-year-old special needs son with so many specialists and I'm constantly trying to obtain his medical records due to my recent relocation and transfer of doctors.
St. Augustine	I believe this could help in a number of ways: 1. If I lose an appointment card I can find out when my next appointment is without tying up not only the phones but also the staff. 2. If it has a refill alert on the meds I take, it would remind me that I need to see or contact the office. 3. Sometimes we tend to forget instructions given to us because of the limited time of an appointment or forget something we need to speak with the doctor or staff about.
St. Augustine	I think this is a great idea. Tell us more on how and when.

Threats and Limitations

Instrumentation threat was addressed with a pilot test on ten patients prior to beginning the study. A threat to validity was the consistency of the office staff in explaining the purpose and importance of adopting the PHR to the patient, including their attitude (positive or negative). This was helped with the use of written information in addition to the oral instructions. In addition, the office staff may have been influential in the patients' willingness to participate in the survey. To offset this threat, the researcher was present during the majority of the research. It is estimated that the researcher was present for about 90% of the questionnaire completion time, and that the front office staff in St. Augustine was able to assist getting about 9-10% of the questionnaires completed in the researcher's absence. The Palm Coast staff was able to assist getting about 0.5% to 1% of the questionnaires completed.

An interesting phenomenon occurred occasionally in the Palm Coast office, where the waiting room is significantly smaller than in the St. Augustine office. Upon entering the waiting room and describing the research to a group of patients, the researcher found that if the first patient declined to participate, the majority of the other patients would also say no. If the first one said yes, most of the others would say yes. This method (approaching patients in the waiting room) was preferred to approaching the patients in a treatment room which would have helped to minimize the influence of other patients. In St. Augustine, the researcher sat at a table in the waiting room throughout the office hours. Typically patients in St. Augustine were not influenced by others in the waiting room probably due to the extra space available.

An external threat to validity would occur if the government or another major third party payer requires the use of a PHR and/or provides incentives to those who adopt the PHR from

another source. One patient did in fact say that her employer, Wal-Mart, made a PHR available to her and that she was actively using it (she refused to complete a questionnaire). Another patient mentioned that he had already begun entering information into his own account at Microsoft® HealthVault™, which is the PHR Medical Specialists will likely use (he did complete a questionnaire). Other examples that exist are Medicare PHR Choice (not currently available in Florida) and other third party payers that provide access to a PHR. In addition, the Agency for Healthcare Administration (AHCA) began piloting a PHR for Florida Medicaid recipients in December, 2009 (Sullivan, 2009). Although a high percentage of Medical Specialists' patients are Medicaid beneficiaries, none of them mentioned knowledge of this PHR during the research.

Additional limitations may include sample size and incomplete surveys. To offset this limitation, a large sample was obtained, based on the number of parameters in the hypothesized SEM model, with a maximum of 560 responses. In fact, the research terminated when 562 questionnaires were completed. This high return was a result of the directly administered questionnaires (Gliner & Morgan, 2000). The availability of the researcher did improve the completion rate (when returned to the researcher, questionnaires were scanned for completeness). However, the proximity of the researcher may have contributed to the patients' honesty in answering the questions. Some patients mentioned they were so pleased with the care they receive that they would do anything Dr. Marathe requested of them. Therefore, these patients may want to please the physician by providing what they perceive as "good" answers rather than truthful answers. Sample size was cut down to 472 with all questionnaires having

one or more missing answers being deleted. The proposed (final) SEM model, with numerous parameters trimmed, required a maximum sample size of 171.

A possible selection bias in data collection resulted when patients who were interested in using a PHR eagerly agreed to complete a questionnaire. Some patients said immediately that they would not use it or that they did not have a computer or know how to use a computer. These patients were then coaxed to complete a questionnaire with the researcher mentioning that "if only patients who want the PHR complete the questionnaire, the doctors will assume everybody wants it." Some of these patients agreed to complete the survey and some did not. This may have resulted in nonrespondent bias. In fact, one patient wrote a letter as follows:

"Dear Dr. Marathe: I am not willing to participate and do not consent to my personal health records being available on your website as suggested. Thus, I will not be filling out the questionnaire. I feel very strongly about this."

Therefore, it is not surprising that the results show that 75% of the practice patients intend to adopt a PHR. It is likely that those not intending to use a PHR are underrepresented in the findings. Listwise deletion of cases with missing data may have contributed to this bias, although not intentionally.

The generalizability of one medical practice is a possible limitation. In the sample used for this research, homogeneity (majority white, majority women, majority with only high school education, etc.) detracts from generalizability to minorities and better educated patients. It should be noted that every effort was made to include all patients who presented for appointments at Medical Specialists in an effort to improve generalizability. However, the

questionnaire was only available in English, so those patients who could not read English were excluded from participating.

To further consider generalizability of the findings, census data were used to compare demographic characteristics of the sample used for this research to the state as well as the two counties involved. Table 24 compares demographic percentages available from U.S. Census Bureau estimations for 2008 population data (U.S. Census Bureau, 2008). Data are compared for the state of Florida, St. Johns County (St. Augustine), Flagler County (Palm Coast), and finally the sample of data obtained from Medical Specialists. Because age categories differed from those used in this research, the medians are used for comparison. That category is similar across all entities and improves generalizability of the findings based on age. However, data for other categories give indications that generalizability statewide may be difficult. Gender representation is especially skewed, with the sample data including 73% females, compared to about a 50-50 split between the genders in the counties and the state. However, as mentioned previously, females were either present more often (accompanying children) or were more willing to participate in the research. This phenomenon may be consistent in other medical practices as well.

In addition, the marital status shows that the patient sample at Medical Specialists included 41% married people, which is well below those married in either county (59.9%, 67.2%) represented by the practice, or the state of Florida (54.3%). There were more divorced patients at Medical Specialists than the other categories, but other marital status category figures were similar across the board.

When compared to the county and state information, the Medical Specialists' data under-represent Hispanics (4.5%) and over-represent Black or African Americans (18.5%) based on the county data but not for the state. Alternatively, the white population in the study sample was closer to the numbers in the counties than the state.

The sample population has a higher percentage of people with high school education or less (51.5%) than either the counties (most remarkably St. Johns County) or the state. Also, there are fewer people with bachelor's degrees and above in the study sample than in the counties or the state. Generalizability may be improved by finding other counties in Florida or in other states with similar demographic data to that of Medical Specialists (likely excluding gender).

Table 24. Comparison of Demographic Data and Educational Information for Medical Specialists, St. Johns County, Flagler County, and the State of Florida

Variable	Description/Choices	State of Florida	St. Johns County	Flagler County	Medical Specialists data
Gender (%)	Male	49.1	49.1	48.6	27
	Female	50.9	50.9	51.4	73
Age (yrs)	Median	40.2	40.5	42.9	41–55
Marital status (%)	Single, never married	23.8	20.2	13.8	24
	Married	54.3	59.9	67.2	41
	Separated	2.4	1.6	1.3	6
	Divorced	11.6	11.7	8.7	23
	Widowed	7.9	6.6	8.9	6
Race/ ethnicity (%)	American Indian or Alaska Native	0.5	0.2	0.2	1
	Asian	2.3	2	2	1
	Black or African American	15.9	6.4	10.8	18.5
	Native Hawaiian or other Pacific Islander	0.15	0.05	0.01	0
	Hispanic or Latino	21	5	8.3	4.5
	White	60.3	85.7	77.9	76

Variable	Description/Choices	State of Florida	St. Johns County	Flagler County	Medical Specialists data
Education (%)	Less than high school	20.1	12.8	14.2	13.8
	High school/GED	28.7	24.5	31.9	37.7
	Total of above two categories	**48.8**	**37.3**	**46.1**	**51.5**
	Some college	21.8	22.3	25.6	28.8
	Associate's degree (AS and/or AA)	7.0	7.2	7.1	10.4
	Bachelor's degree	14.3	21.8	13.4	6.4
	Master's degree or above	8.1	11.3	7.8	3

Future Research

Due to the fact that PHRs are a relatively new technology, further research in potential methods to improve diffusion of the innovation is worthwhile. This research used a questionnaire to determine if patients of Medical Specialists intend to adopt a PHR. If Medical Specialists move forward with offering the technology, future research can include longitudinal data looking for positive correlation between the maintenance of a PHR (with clinical review and follow-up) and the patient's health status. Evaluation of longitudinal data that results in improved patient outcomes (such as blood glucose, blood pressure, etc.) will enhance the perception and reputation of the technology through an evidence-based approach. The construction of the questionnaire specifically excluding the "not applicable" option would force patients into a different choice, such as disagree or neither agree nor disagree. It is hoped that the re-coding performed for this research did not significantly distort the intended responses of those patients who choose not applicable. However, future research should be conducted without this as an option.

Klein (2007) included trust in his research of patients' willingness to adopt an Internet based physician patient communication system and Zhang and Mao (2008) found trust influenced intention to use mobile marketing devices. Some patients at Medical Specialists were concerned about the security measures which would be taken to keep their medical information safe from "hackers" on the Internet. Therefore, a construct such as trust or security in PHR research is warranted.

Focusing on the ability of patients to read and understand written health related materials, including prescription bottles, is an important first step for improving health literacy. Lower

education levels are well known to be correlated with lower levels of health literacy (Scott et al., 2002; The Joint Commission, 2007). However, as discovered by Powell, Hill, and Clancy (2007), diabetics with low literacy levels are still willing to take action to improve the management of their disease. Therefore, a closer look at the patients' understanding and ability to use information supplied by providers is a worthwhile endeavor.

Conclusion

This research was undertaken to determine the opinions of patients at Medical Specialists in regard to their willingness to adopt a PHR. After obtaining IRB permission, a letter and frequently asked question sheet about PHRs was mailed to 4,050 patients of Medical Specialists. This represents "active" patients seen within the past one and a half years. The letter informed the patients of the intended research which was to be conducted in the office. The PHR was briefly introduced, and the FAQ sheet attempted to provide answers to potential questions that patients would have about the PHR. To improve generalizability, all patients were invited to present to the office to complete the survey (whether or not an appointment was scheduled). New patients who presented to the office during the research time period were also invited to participate and were provided a copy of the letter and FAQ sheet.

A total of 562 patients participated in the research which was conducted between November 4th and December 21st in the St. Augustine and Palm Coast offices of Medical Specialists. Results indicated that 75% of the Medical Specialists' patients do intend to adopt a PHR if it is made available to them. These findings are encouraging in this population of socioeconomically unlikely candidates (low income, high school education). However, follow-

up longitudinal research will be required to determine if the patients (and providers) indeed access the data and use it to improve health status and outcomes. The research surprisingly indicated that how the patients feel about their health status does not impact their intention to use a PHR at least initially, but perhaps health status would play a role in the decision to maintain and use the data provided in the PHR.

Perceptions of (high) health literacy were found to be important in terms of comfort levels with technology. This indicates that patients who are comfortable with using the Internet to look for health resources are comfortable with technology. Literacy includes the ability of the patient to use the information found on sites such as *Web*MD® to improve health status. Measurements of health literacy can also take the form of a spelling test such as the Rapid Estimate of Adult Literacy in Medicine (REALM) and a test asking the patient to interpret a prescription bottle label as well as nutritional information (S-TOFHLA). Neither of these measures were considered appropriate for the research about PHRs, but both tests have been used in research extensively.

Healthcare policy is often aimed at improved patient safety and quality of care, in addition to cost containment. Kaelber, Shah, et al. (2008) have reported that 70 million Americans have access to a PHR through payers such as the Department of Veterans Affairs which provides a PHR to 25 million military veterans. Chronic disease management is costly and adds financial pressures to government programs such as Medicare and Medicaid. Encouragement of patients to participate in preventive practices through PHR participation may ease the financial hardships faced by these programs. For example, the Florida Medicaid Personal Health Record Demonstration Project, which started in December, 2009, hopes to

improve clinical decision making and improve coordination of care among providers (Sullivan, 2009). Outcomes research for Medicaid patients participating in this PHR will likely provide indication of the value of the technology.

Change in reimbursement for Medicare and Medicaid must include the clinical reviews necessary for physicians to participate in PHR systems. Currently patient education is reimbursable for diabetes teaching. However, patient teaching reimbursement for more than diabetes mellitus is also important to improve health literacy. Oates and Paasche-Orlow (2009) note that many patients are too embarrassed to admit they do not understand the instructions that are given to them. In many instances, providers are rushed and do not take the time to ensure that patients heard and understood the treatment plan. The Joint Commission (2007) encourages techniques such as "repeat back" to close the gap between instruction and understanding.

Policies which promote widespread adoption of electronic health records in physician office settings should require provision for a tethered PHR for patients (online record connected to the physician's office record). Standards organizations such as the Certification Commission on Health Information Technology (CCHIT) should include PHRs in certified electronic health record products available for physician offices. PHR research can contribute to validation for the reform necessary to promote these policy changes.

As the population ages and technology provides enhancements for healthcare, personal health records will become a more common option offered by providers. Neither player (patient or provider) can exist in a vacuum, and the ability to communicate in this manner may bridge the gap of information needed for improved care management. With improved continuity of care and increased cost savings as the incentives, all third party payers should see the benefit in

improved reimbursements for providers who offer a PHR. The key to ultimate success will be the patients who are willing to adopt and use the PHR as they participate in their own healthcare and well being.

APPENDIX A
INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Alice M. Noblin**

Date: **October 09, 2009**

Dear Researcher:

On 10/9/2009, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Personal Health Record (PHR) Adoption and Intention to Use: What are the influences in a patient's decision to adopt a PHR? A cross sectional view of the characteristics and opinions of the patients of one internal medicine practice
Investigator:	Alice M. Noblin
IRB Number:	SBE-09-06466
Funding Agency:	American Health Information Management Association
Grant Title:	Not a grant. Dissertation Research Assistance Award.
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 10/09/2009 09:56:59 AM EDT

IRB Coordinator

APPENDIX B
LITERATURE REVIEW TABLES

Literature Review of the Determinants of the Intention or Actual Use of Technology (TAM)

Year	Author	Sample	Dependent var	Findings
2008	Wang & Wang	N: 281 online gamers in Taiwan Gender: 54.8% male Age range (years) < 20 46.6% 21–30 10.7% 31–40 16.4% 41–50 22.4% > 50 3.9%	Behavioral intention	Gender differences in perceptions of online gaming experiences were investigated with perceived playfulness being used to measure behavioral intention. It was based on system characteristics of challenge, feedback, and speed, as well as individual differences of computer self-efficacy and computer anxiety. The authors found no difference between the genders on how they viewed the speed, feedback and challenge of online games. Men's ratings of computer self-efficacy, perceived playfulness and behavioral intention were higher than those for women. Men with high computer self-efficacy were found to have higher intentions to play online games than those men with lower computer self-efficacy, but women with high computer self-efficacy do not have stronger intentions to play than those women with lower computer self-efficacy. Also, women with high computer anxiety have lower intentions to play than women with low computer anxiety, but men with high computer anxiety do not have lower intentions to play than those men with lower computer anxiety.

Year	Author	Sample	Dependent var	Findings
2008	Sun & Zhang	N: 161 internet users Gender: 43% male Age range (years) 19–24 15.6% 25-34 42.5% 35-44 20% > 45 21.9%	Behavioral intention	Participants completed search tasks and answered questions related to playfulness and enjoyment. The authors found that perceived enjoyment is a causal factor of perceived ease of use and suggested that targeting perceived enjoyment will enhance the perceived ease of use and this may be a useful way to introduce technology in the work place.
2007	Hwang & Kim	N: 325 business undergrads in northern region of U.S. Gender: 44% males Avg age = 22.36	e-Commerce adoption	Trust was measured to determine e-commerce adoption. Trust is a combination of integrity, benevolence and ability, which were measured through enjoyment and anxiety of the website. Web quality is also included as an independent variable and was found to be very significant in self-service. This affects a customer's perceived enjoyment and reduces system anxiety thereby improving trust.

Year	Author	Sample	Dependent var	Findings
2007	Lee, Cheung, & Chen	Online survey N: 207 business undergrads in Hong Kong Gender: 46.9% male Age range (years) <18 0.5% 19–24 95.2% 25–34 4.3%	Intention to use multimedia message services	Motivation theory combined with the TAM, identifying perceived usefulness and perceived ease of use as extrinsic motivators. Perceived enjoyment is an intrinsic motivator also included in the model. These three factors in addition to perceived media richness are used to measure behavioral intention to use MMS. The research indicated that both the intrinsic and extrinsic motivators are important to explaining acceptance of new technologies but perceived ease of use had a stronger effect than perceived usefulness on the intention to adopt MMS. However, this may be explained by the more pleasure based nature of the technology (as opposed to a technology required for a job).

Year	Author	Sample	Dependent var	Findings
2006	Wang, Lin, & Luarn	N: 258 users of mobile devices in Taiwan, attending an e-commerce exposition and symposium Gender: 63% males Age range 18-45 years (mean = 32 years) Education: 35% had completed a college degree.	Use behavior	Research was conducted to determine consumer (behavioral) intention to use mobile services. The following constructs were investigated: self-efficacy, perceived financial resource, perceived usefulness, perceived ease of use, and perceived credibility. All of the constructs were found to have positive influences on behavioral intentions. Perceived credibility and perceived financial resources had stronger effects on behavioral intention than perceived ease of use.
2005	Liu & Ma	N: 79 undergrads in allied health programs Gender: "almost all female" Average age = 20–25	Willingness to use application service oriented medical records	TAM was extended to include perceived service level along with perceived usefulness and perceived ease of use to predict behavior intention. Perceived service level includes attributes such as system accessibility, flexibility, reliability and response time. Participants were asked to perform specific tasks and then complete a questionnaire. Findings showed perceived service level to be causally linked to perceived ease of use but not perceived usefulness. Perceived service level was found to be a strong determinant of willingness to use the new medical record system.

Year	Author	Sample	Dependent var	Findings
2005	Yi, Jackson, Park, & Probst	N: 222 resident and faculty physicians in an eastern US state Gender: 65% male Average age = 35.6	Behavioral intention to use PDA	Perceived usefulness was found to be the most significant determinant of a physician's decision to use the PDA and perceived ease of use was not considered to be a significant factor. However, there was a significant effect of perceived ease of use on perceived usefulness. The subjective norm (taken from TRA) influenced perceived usefulness directly. Davis (1989) reported similar findings that ease of use declined in importance over time.

Literature Review of the Determinants of Intention to Use a PHR

Year	Author	Sample	Dependent var	Findings
2007	Klein	N: 143 respondents to a vendor website in the U.S. Gender: 43% male Age range 18–74 mean 41.2	Use behavior	The author investigated attitudes toward technology of first-time users' intentions for use of a patient-physician communication application on the Internet. The e-mail application is provided to various medical practices of all sizes. This type of communication is not typical e-mail, but rather is based on secure accounts within proprietary systems (similar to a PHR). A relationship was found between perceived ease of use and perceived usefulness, but not between perceived ease of use and intention to use. Trust and vendor reputation were also part of the model used to predict use behavior. It was noted that perceived ease of use and vendor reputation played a key role in the formation of trust beliefs. The research found that intentions were predicted through the perceptions of utility of the technology.
2006	Weingart, Rind, Tofias & Sands	Patients enrolled in PatientSite Avg age: 42.9, (7% were at least 65) Gender: 33% males Race/ethnicity: 80% whites	Willingness to use a patient portal	The authors reported on an Internet portal offered by physicians that includes laboratory test results, radiology reports, prescription renewals, appointment requests, managed care referrals, and e-mail messaging. Patients typically log into the site most frequently at the beginning of their access period and the percentage of patients who continued to use the portal at least monthly went from 77% in April 2003 to 30% in March 2004.

Literature Review of the Impact of Perceived Usefulness on Intention to Adopt a PHR

Year	Author	Sample	Dependent var	Findings
2006	Tuil, ten Hoopen, Braat, de Vries Robbe & Kremer	Reproductive specialists in the Netherlands allowed 54 couples access to website. Avg age = 34.4 Nationality: 97% Dutch Employed: 94% Education: 48% "higher" education	Patient usage of a website	A population-tailored PHR used by couples undergoing in vitro fertilization (IVF) was investigated with a web site including general information about infertility, personal information about the patient (medical history, test results, etc.) and a communication area including e-mail, discussion boards, and chat rooms. This allowed patients to e-mail directly to clinicians or to communicate with other patients. The discussion boards and chat rooms are monitored by clinical staff to clarify any erroneous information that is posted.
2005	Winkelman, Leonard & Rossos	N: 12 patients with inflammatory bowel disease (IBD) in Canada Gender: 42% males Ages: 21–40: 75% 41–60: 25%	Value of PHR to patients with IBD	Four overriding themes were identified: illness ownership, communication, support and trust. Ability to access history information and test results as well as explanations of laboratory results improves ownership and a sense of power over the illness. Communication with physicians allows IBD patients to assume more responsibility for health status with physicians acting in supportive role with shared problem solving. Support becomes personalized and patients trust the physician to communicate significant results to ensure understanding.

Year	Author	Sample	Dependent var	Findings
1998	Ayana, Pound & Ebrahim	Interviews with 25 therapists in London, England. 12 physiotherapists; 11 occupational therapists; 2 dieticians.	Therapist and patient use of patient-held record	The therapists who participated in focus groups felt that in stroke patients it is helpful for the patient to have access to medical information even if there is a chance of misinterpretation by the patient. Healthcare encounters are often rushed and the patient may not recall the details of a treatment plan. The lines of communication are enhanced when the patient is given time to think about the information prior to the next office visit.

Literature Review of the Impact of Technology Barriers on Intention to Adopt a PHR (Perceived Ease of Use)

Year	Author	Sample	Dependent var	Findings
2007	Benaroia, Elinson & Zarnke	N: 67 patients presenting to an emergency room in Canada Avg age 34 years Gender: 43% males; Income: majority between $20,001 and $60,000 Computer use: 78.5% used a computer with some frequency	Complete historical data (computer versus physician versions)	The authors evaluated the use of medical history-taking software in a hospital emergency room. Patients completed the questionnaire (based on their chief complaint) in the waiting room. It is hoped that a system such as this can help with the triage process and cut down on time spent in the emergency room. The results showed that 90% of the important history information was obtained through this software versus 55% by the physician. From the patient's perspective, 83.6% of the patients felt the system was easy to use and 86% felt the system can improve patient care.
2004	Hassol, Walker, Kidder, Rokita, Young, Pierdon, Deitz, Kuck, & Ortiz	N: 1421 users of an EHR in a large Pennsylvania Health System	Use of web-based communication system	The ease of system use for registering, logging in, renewing prescriptions and using e-mail were all considered very high. Other areas rated highly included the ability to understand medical information and test results, completeness of information, and accuracy of medical history. Patients preferred use of e-mail for several items, including having general medical questions answered, getting routine follow-up of minor problems, having prescriptions refilled, and obtaining instructions for self-monitoring.

Year	Author	Sample	Dependent var	Findings
2001	Denton	N: 330 patients with spinal conditions in a neurosurgery practice in Alabama Age range: 35–85	Patient usage of the PHR	Denton offered a PHR to 1,000 of his patients, with 330 accepting the offer. After ten months, only 50 of the patients continued to use the PHR although 46 planned to use it when they needed it. The system was rated as "easy to use" by 49 of the patients, but four found the software too difficult to use. The author indicated that patients with chronic illnesses are more likely to adopt and use the PHR, with about 30% of patients with spinal conditions showing an interest in the PHR.

Literature Review of the Impact of Health Literacy on Intention to Adopt a PHR

Year	Author	Sample	Dependent var	Findings
2006	Lober, Zierler, Herbaugh, Shinstrom, Stolyar, Kim & Kim	N: 41 residents of a low-income housing project, many with chronic diseases Avg age = 69 Gender: 18% male;	Use of a Personal Health Information Management System	Nine of the residents were able to enter and maintain their information in the PHR. Health literacy was identified as a barrier to using the PHR in 29% of the patients.
2005	Kim, Mayani, Modi, Soh, & Kim	Open to all residents of Broadway Plaza, a low-income housing project in Washington. Avg age: 65.07	Use of a Personal Health Information Management System	To improve participation, graduate nursing students aided elderly residents of a housing project in data entry of their information. An area of particular confusion by these patients was the rationale for taking specific medications. The days of highest usage were Thursdays, which was the day the nurses were available to assist the residents.
2003	DeClercq, Hasman & Wolffenbuttel	Two groups of patients who rely on frequent monitoring of blood glucose	Use of a consumer health record by diabetic patients	Patients are able to view and enter data in the record. The authors found that patients were unable to interpret medical terms in their PHR. To overcome such issues, they frequently included input from the patients in the design phase of the PHR. The feedback was incorporated to make the system more user-friendly. The system was set up so only providers could enter certain information such as medical history. The patient could enter information such as weight and glucose readings.

Year	Author	Sample	Dependent var	Findings
2002	Scott, Gazmararian, Williams, & Baker	N: 2722 Medicare patients in 4 U.S. cities. Age Range: 65–79 Mean: 71. Males were more likely to be nonresponders; those with higher SES were more likely to be nonresponders, based on zip code of home.	Use of preventive services	The authors used the Short Test of Functional Health Literacy in Adults (S-TOFHLA) to assess levels of health literacy which are categorized as inadequate, marginal or adequate. Preventive services included flu vaccines and pneumonia vaccines (asking patient if he/she had ever had one) and, for women, Pap smears and mammograms. The majority of patients with an inadequate health literacy level also reported the lowest levels of preventive service usage. The patients with inadequate health literacy had less than a high school education and income level less than $15,000 annually.
2002	Kim & Johnson	N: 11 online PHR systems	Completeness of online PHRs	The authors found little in the way of guidance when entering the diagnostic information. This led to concerns about a patient's ability to categorize and prioritize his/her information. Often drop down lists were provided and the patient was asked to pick the diagnosis. In addition, only one of the 11 PHRs in the study included all the elements determined to provide a complete history. The authors feel that patients should receive guidance on how to complete the records so they can determine which elements need to be included in the PHR.

Literature Review of the Impact of Patient Health Status on Intention to Adopt a PHR

Year	Author	Sample	Dependent var	Findings
2009	Ralston, Hirsch, Hoath, Mullen, Cheadle & Goldberg	N: 83 patients with diabetes mellitus (DM) type 2 in Washington. Intervention group: Avg age: 57 Gender: 52.4% males Race/ethnicity: non-Hispanic white 89.7%	Glycemic control in DM type 2	The researchers found positive results in a group of diabetes mellitus type 2 patients who entered data into an electronic office medical record. They followed 83 patients for 12 months and found that the intervention group of 42 patients had better glycemic control than the "usual-care" group. Results indicated that 76% of the intervention group did access the electronic health record, 69% used e-mail, 43% entered blood glucose values, and 33% entered medication, nutrition and exercise information. The uploaded blood glucose levels showed a trend of improvement.
2008	Grant, Wald, Schnipper, Gandhi, Poon, Orav, Williams, Volk & Middleton	N: 244 patients with diabetes mellitus (DM) type 2 in northeastern U.S. avg age: 56.1 years mean income: $53,784	DM regimen adjustments	Patients used a PHR system linked to the office electronic medical record that allowed them to develop a "Diabetes Care Plan" that they would submit to their physician prior to an office visit. Through the PHR, the patients could see their laboratory results and medications. The authors predicted that the patients would experience improved care as well as improved communication with their physician. The high percentage of medication adjustments (53%) led the researchers to conclude that at the time of clinic visit, the PHR reduced barriers to medication change.

Year	Author	Sample	Dependent var	Findings
2008	Green, Cook, Ralston, Fishman, Catz, Carlson, Carrell, Tyll, Larson, & Thompson	N: 778 patients with uncontrolled essential hypertension Age Range: 25–75 years Mean = 59.1 Gender: 47.8% males Race/ethnicity: white 82.8% Education: college degree 50.4%	Blood pressure control	Three groups were studied: usual care; home BP monitoring and PHR; and home BP monitoring, PHR, and pharmacist care management. The latter group included pharmacist monitoring and medication changes. The PHR included current health conditions, laboratory test values, office visit notes, allergies, immunizations, medications and used clinical messaging to contact the health care professionals. Blood pressure was controlled in 56% of the group of patients who received the pharmacist monitoring as part of their protocol, which was 20% more than the group with the PHR but without the pharmacist monitoring and 25% more than the usual care patients without the PHR.

Year	Author	Sample	Dependent var	Findings
2002	Cimino, Patel & Kushniruk	N: 13 patients from New York Presbyterian Hospital Age 40–65 yrs: 85% > 60 yrs: 15% Gender: 61.5% males;	Patient use of PHR	System usage was monitored over a 36-month period. Of the patients who used the system and answered a follow-up survey, the majority indicated the system had improved their communication with health care providers. This was due to their ability to review lab values and trends prior to an office visit. Physicians agreed that communication was more efficient if the patient knew the lab values ahead of a visit and was prepared to discuss any deviations. The patients felt the system was easy to use, easy to understand and that their health status was improved due to the active role they were able to take. Usage rates varied possibly based on frequency of encounters for lab work, etc., however, the authors determined that 31-54% of the subjects would be permanent users based on the follow-up survey.

Literature Review of Impact of Demographic Characteristics on Intention to Adopt a PHR

Year	Author	Sample	Dep Var	Findings
2004	Moen & Brennan	49 mid-west U.S. homes	Health Information Management in the Household	Female household members are typically responsible for health record keeping in the home and they are more concerned about the health of their children, spouse or parents than their own. In addition, those people who spoke English as a second language expressed less confidence in their ability to obtain needed health information. As a result, they often relied on family members or friends with stronger English language skills to help them communicate with health care providers. The conclusion was that paper-based tools for record keeping are most common and storage strategies are based on the urgency anticipated for retrieval.
2000	Kim, Kingle, Sharkey, Park, Smith & Cai	681 patients from Hong Kong, Hawaii and the mainland U.S.; avg age 32, most respondents female	Assertiveness and communication apprehension during medical interviews	The authors confirmed the cultural differences in patient-doctor verbal communications. They noted the importance of effective communication, stating that it increased compliance with treatment, enhanced the patient-doctor relationship, and improved patient satisfaction levels. Results showed that mainland U.S. and Hawaii residents had stronger beliefs about participation and were more likely to indicate their preferences in medical care with their physicians, even though all three cultures preferred a mutual decision process between the patient and physician.

Year	Author	Sample	Dep Var	Findings
1997	Straub, Keil & Brenner	393 airline employees from Japan, Switzerland and the U.S.	Perceived usefulness of e-mail	E-mail usage was examined in multiple cultures by testing the technology acceptance model (TAM) in three countries. The TAM model did not explain technology adoption in one of the three countries (Japan). Perceived usefulness was considered important in both Switzerland and the U.S., but not in Japan. Although the authors caution not to draw the conclusion that cultural factors and technology adoption can be linked empirically, they do note some differences in Japanese culture that may explain the differences.

APPENDIX C
LETTER TO PATIENTS OF MEDICAL SPECIALISTS

S. S. Marathe, M.D., JD, PhD, MBA, MHA, FACP, FCCP, CMD, CDE
Diplomat American
Board Internal Medicine,
Nephrology, Geriatrics

Walid Omar, M.D.
Diplomat American
Board Family Medicine

Basant Farghaly, M.D.
Diplomat American
Board Family Medicine

MEDICAL SPECIALISTS
ST. AUGUSTINE - PALM COAST - PALATKA

Anil K. Mandal, M.D.
Diplomat American Board
Internal Medicine & Nephrology

Ehteshamul Anjum, M.D.
Diplomat American Board
Internal Medicine & Nephrology

October 23, 2009

Dear Patient:

We are considering the use of a personal health record (PHR) here at Medical Specialists. This will provide you, the patient, access to your health information 24 hours a day, seven days a week. You would have the ability to view the information on your home or other computer through a secure website maintained by our office. This would enable you to update your contact and insurance information. You could also request appointments and refills. In addition, you could obtain your current medication list and recent laboratory test results for your information or to take to another health care provider. This may save you time and money on patient questionnaires as well as avoidance of duplicate tests. E-mail is also available through this system to ease communication with our office. If you prefer to call on the telephone, that will still be available too.

A page of frequently asked questions is included with this letter to clarify issues you may have about this new service we might provide for you in the future. From approximately November 5th to December 23rd, a University of Central Florida student, Mrs. Alice Noblin, will be conducting research in our St. Augustine and Palm Coast offices to help us determine how our patients feel about this new service and if they are willing to use the PHR if we do provide it. This will be done with a four page questionnaire that should take no more than ten minutes of your time to complete, in the waiting room, prior to your office visit. If you do complete the survey, you are providing implied consent that you willingly participated in this research. However, you may discontinue the survey if you choose to at any time. While we hope you are willing to participate, it is voluntary and also anonymous. I will not be aware of which patients completed the survey or how individual patients responded to the survey. I will be given total numbers indicating if my patients are willing to adopt a PHR. I truly value your opinion and am very interested in these results.

If you do not have an appointment scheduled during this time but would like to participate, please feel free to come by the office to complete a questionnaire. We welcome everyone's opinion about the PHR because it is you, the patient, who will use it and benefit from it. Please also note that the PHR will be offered at no cost to you.

If you have questions, please direct them to me or Mrs. Noblin at anoblin@mail.ucf.edu or 407-823-2353. In addition, you may contact the Institutional Review Board at UCF at irb@mail.ucf.edu or 407-823-2901.

Sincerely,

Shriram Marathe, MD, PhD

665 State Road 207* Suite 102* Saint Augustine, Florida Telephone: 904-824-8158 * Fax: 904-823-1284
4869 Palm Cost Pky NW* Suite 2* Palm Coast, Florida 32137 * Telephone: 386-445-2003 * Fax: 386-445-7445
800 Zeagler Drive, Suite 510, Palatka, Florida 32177 * Telephone: 386-538-1000* Fax: 904-823-1284
www.med-spec.com

APPENDIX D
FREQUENTLY ASKED QUESTION SHEET

MEDICAL SPECIALISTS

Frequently Asked Questions about the Personal Health Record (PHR)

1. What is a personal health record?

- **It is a collection of important information about your health that you can update**
- **Medical Specialists will also update information such as laboratory test results**

2. Why would I want to use the personal health record?

- **The PHR will allow you to have access to much of the health information that is contained in your medical record at Medical Specialists. You will have access to the information via the secure patient web portal 24 hours a day, seven days a week. You can also communicate directly with your physician or the office staff via our secure messaging system. You can print information, such as your medication and allergy lists, to share with other health care providers. You can view laboratory test results. In addition to your test results, you will see the normal values for the tests. Diagnosis and billing information will also be available for you to view.**

3. What information is included in a personal health record?

- **At Medical Specialists the PHR will include information about:**
- **Your diagnosis**
- **Your laboratory test results**
- **Your medications, including the ability for you to request a refill**
- **Your allergies**
- **Your appointments, including the ability for you to request or cancel an appointment**
- **How to contact your doctor or our staff**
- **How to update your contact or insurance information**

4. Who has access to my personal health record?

- **You will be given secure log in directions. This means if you have access to a computer you may go into our system and see your information at any time. We will not share your log in information with anyone else.**
- **The Medical Specialists healthcare team will also have access to the information in your PHR. However, we will only access your PHR for updates and in response to your questions or concerns and will not release information without your consent. Also, when you are seen in the office we will review the information with you.**

5. Will I have to pay for access to the personal health record?

- **No, the PHR will be provided at no cost to you.**

6. Do I have to use the personal health record?

- **No, this is an optional service we will provide to our patients for their benefit. We hope all our patients will see the value and importance of this new communication tool. However, if you choose not to use the PHR when it becomes available to you, we will continue to communicate via US mail and telephone with our patients.**

APPENDIX E
NOTE ABOUT CONSENT AND QUESTIONNAIRE TO DETERMINE A PATIENT'S WILLINGNESS TO ADOPT A PHR

Thank you for agreeing to participate in this survey research! We appreciate you volunteering to help us determine if Dr. Marathe's patients would be willing to adopt a personal health record. We will report the findings to Dr. Marathe in the coming months. By answering the questions and completing the survey, you are agreeing to participate in this important research. However, you may discontinue the survey at any time, for any reason.

Thank you for your time!

Alice M. Noblin, UCF Student
anoblin@mail.ucf.edu
407-823-2353

A Personal Health Record (PHR) Questionnaire

Instructions: A Personal Health Record (PHR) is a medical record maintained by the patient and shared with health care providers (such as doctors) through a computer.

START HERE

		Strongly Disagree SD	Disagree D	Neither Agree nor Disagree NA/D	Agree A	Strongly Agree SA	Not Applicable N/A
1.	**I intend to use a personal health record (PHR) in the future.**	1	2	3	4	5	N/A
2.	**I think using the PHR would improve my overall health.**	1	2	3	4	5	N/A
3.	**I think I would find the PHR useful in maintaining a healthy lifestyle.**	1	2	3	4	5	N/A
4.	**I think the PHR will be useful for me to communicate with my doctor(s).**	1	2	3	4	5	N/A
5.	**I think the PHR will improve my ability to keep my medical information organized.**	1	2	3	4	5	N/A
6.	**I am scared that hitting the wrong key could cause the computer to destroy a large amount of my information.**	1	2	3	4	5	N/A
7.	**I hesitate to use a computer for fear of making mistakes I cannot correct.**	1	2	3	4	5	N/A
8.	**I am somewhat intimidated by the Internet.**	1	2	3	4	5	N/A
9.	**I will need expert help to use a computer.**	1	2	3	4	5	N/A
10.	**I find learning to operate a new type of computer software to be difficult.**	1	2	3	4	5	N/A
11.	**I know what health resources are available on the Internet.**	1	2	3	4	5	N/A
12.	**I know where to find helpful health resources on the Internet.**	1	2	3	4	5	N/A
13.	**I know how to find helpful health resources on the Internet.**	1	2	3	4	5	N/A
14.	**I know how to use the Internet to answer my questions about health.**	1	2	3	4	5	N/A
15.	**I know how to use the health information I find on the Internet to help me.**	1	2	3	4	5	N/A
16.	**I have the skills I need to evaluate the health resources I find on the Internet.**	1	2	3	4	5	N/A
17.	**I can tell high quality health resources from low quality health resources on the Internet.**	1	2	3	4	5	N/A
18.	**I feel confident in using information from the Internet to make health decisions.**	1	2	3	4	5	N/A

Please Continue on the Next Page

Instructions: For the following questions, check the box corresponding to the choice that best represents your answer.

CONTINUE HERE

19. **Overall, how would you rate your health during the *past 4 weeks*?**
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor
    - Very poor

20. **During the *past 4 weeks*, how much did physical health problems limit your usual physical activities (such as walking or climbing stairs)?**
    - Not at all
    - Very little
    - Somewhat
    - Quite a lot
    - Could not do physical activities

21. **During the *past 4 weeks*, how much difficulty did you have doing your daily work, both at home and away from home, because of your physical health?**
    - Not at all
    - A little bit
    - Some
    - Quite a lot
    - Could not do daily work

22. **How much bodily pain have you had during the *past 4 weeks*?**
    - None
    - Very mild
    - Mild
    - Moderate
    - Severe
    - Very severe

23. **During the *past 4 weeks*, how much energy did you have?**
    - Very much
    - Quite a lot
    - Some
    - A little
    - None

Please Continue on the Next Page

CONTINUE HERE

24. **During the *past 4 weeks*, how much did your physical health or emotional problems limit your usual social activities with family or friends?**
    - Not at all
    - Very little
    - Somewhat
    - Quite a lot
    - Could not do social activities

25. **During the *past 4 weeks*, how much have you been bothered by emotional problems (such as feeling anxious, depressed or irritable)?**
    - Not at all
    - Slightly
    - Moderately
    - Quite a lot
    - Extremely

26. **During the *past 4 weeks*, how much did personal or emotional problems keep you from doing your usual work, school or other daily activities?**
    - Not at all
    - Very little
    - Somewhat
    - Quite a lot
    - Could not do daily activities

27. **What is your gender?**
    - Male
    - Female

28. **Which of the following age categories describes you?**
    - 25 years of age or younger
    - 26-40 years of age
    - 41-55 years of age
    - 56-70 years of age
    - 71 years or older

29. **What is your current marital status?**
    - Single, never married
    - Partnered
    - Married
    - Separated
    - Divorced
    - Widowed

30. **What is your race/ethnicity?**
    - American Indian or Alaska Native
    - Asian
    - Black or African American
    - Native Hawaiian or other Pacific Islander
    - Hispanic or Latino
    - White

Please Continue on the Next Page

CONTINUE HERE

31. **What is the highest level of education you have completed?**
    - Less than high school
    - High school diploma/GED
    - Some college
    - Associate's degree (AS and/or AA)
    - Bachelor's degree
    - Master's degree or above

32. **Which of the following broad categories best describes your household income from all sources in 2008?**
    - $20,000 or less
    - $20,001 to $35,000
    - $35,001 to $50,000
    - $50,001 to $100,000
    - $100,001 or more

33. **How many years did you work at your longest held job?** _____

Which ONE of the following occupational categories best describes your longest held job:

- Service worker (includes policemen and firefighters)
- Sales worker (includes realtors, insurance agents, salesmen and sales clerks)
- Laborer
- Clerical worker (includes cashiers and mail carriers)
- Manager or proprietor
- Operative (includes manufacturing equipment)
- Craftsperson, foremen (includes military)
- Professional or technical (includes teachers)
- Farm worker
- Private household workers
- I have never worked outside the home

If you are unsure which category to choose, please write the job title here:

****Thank you for your time in completing this questionnaire.****

Please share any additional comments you have in the box provided below.

APPENDIX F
QUESTIONNAIRES DELETED DUE TO MISSING DATA

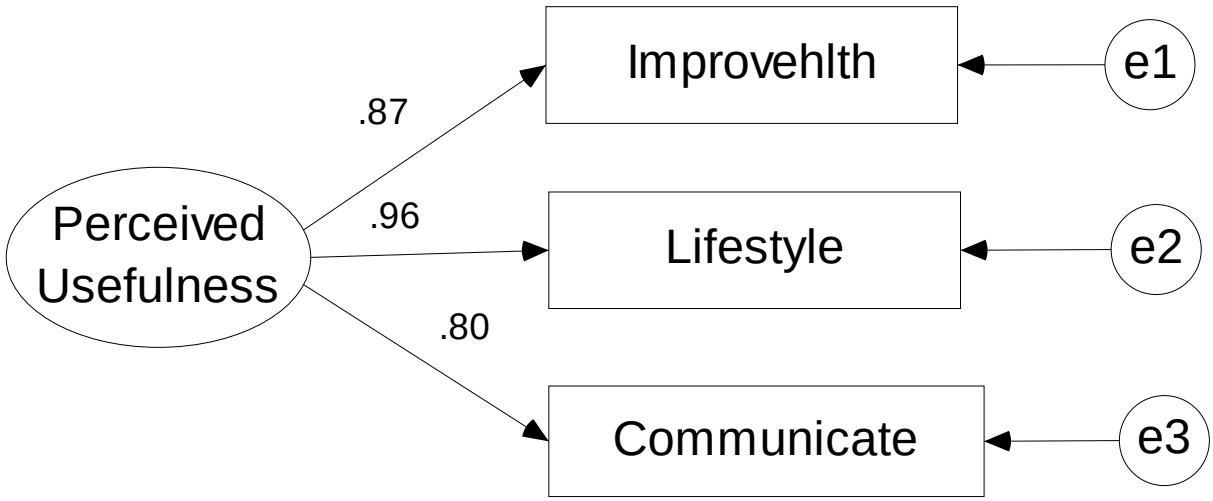
Question #	# of questionnaires deleted due to missing data
1	5
2	3
3	6
4	1
5	3
6	1
7	4
8	4
9	4
10	2
11	3
12	3
13	2
14	0
15	2
16	1
17	1
18	0
19	0
20	2
21	0
22	0
23	1
24	0
25	1
26	0
27	8
28	2
29	0
30	4
31	2
32	19
33	--
34	6

APPENDIX G
DESCRIPTIVE STATISTICS, SEM MODEL, AND GOF STATISTICS FOR PERCEIVED USEFULNESS

Correlation Matrix for Perceived Usefulness

Indicators	Mean	S.D.	1.	2.	3.	4.
1. Improvehlth	3.7669	1.08293	1			
2. Lifestyle	3.9174	1.07251	.837	1		
3. Communicate	4.1801	1.06846	.699	.769	1	
4. Organize	4.2140	1.06017	.661	.751	.852	1

Model for Perceived Usefulness



Goodness of Fit Statistics for Perceived Usefulness

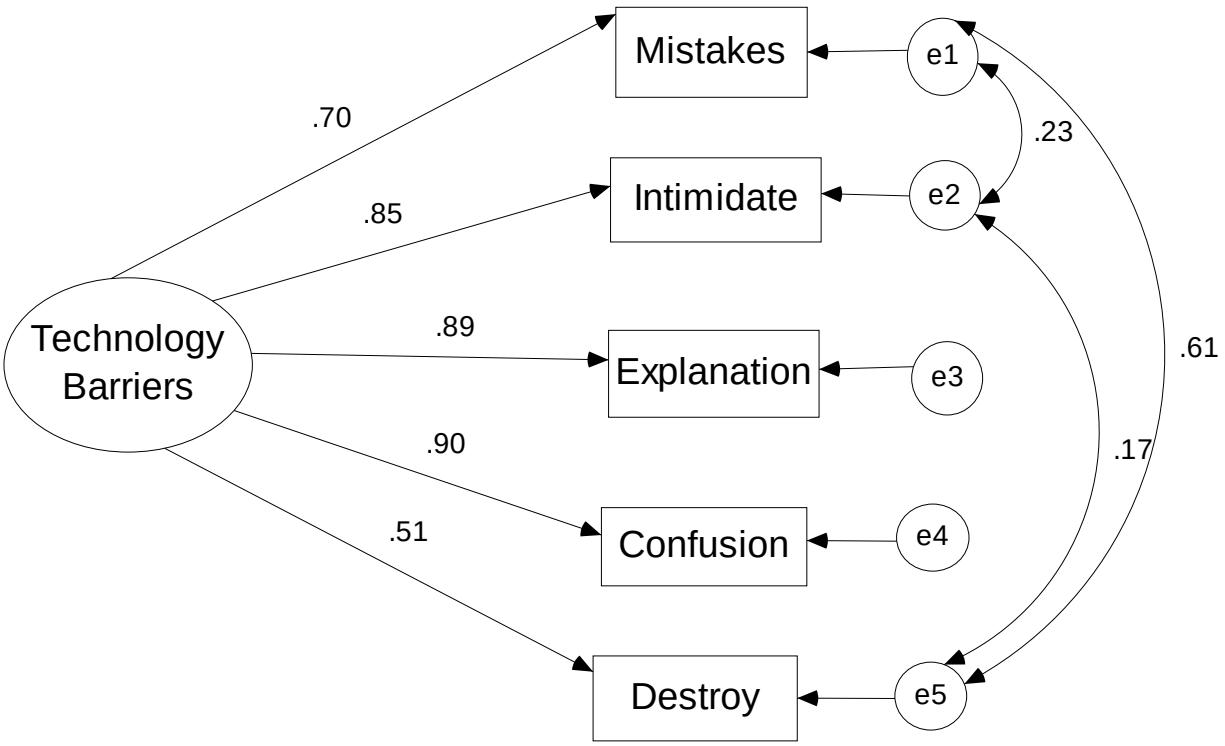
Index	Range	Initial Model	Revised Model
CMIN/DF	<5	81.7	-
GFI (Goodness-of-fit)	0-1 (the larger the better)	.841	1.00 (perfect fit)
AGFI	0-1 (the larger the better)	.204	-
RMSEA	<.05 (or .08)	.414	-
P-close	= or > .05	.000	-
Hoelter's critical N	= or > 200	18	-

APPENDIX H
DESCRIPTIVE STATISTICS, SEM MODEL WITH ERROR CORRELATIONS, AND GOF STATISTICS FOR TECHNOLOGY BARRIERS

Correlation Matrix for Technology Barriers

Indicators	Mean	S.D.	1.	2.	3.	4.	5.
1. Destroy	3.5572	1.29219	1				
2. Mistakes	3.8644	1.20801	.733	1			
3. Intimidate	4.0000	1.23811	.514	.679	1		
4. Explanation	4.0551	1.24031	.454	.600	.762	1	
5. Confusion	3.801	1.2830	.463	.643	.754	.798	1

Model for Technology Barriers



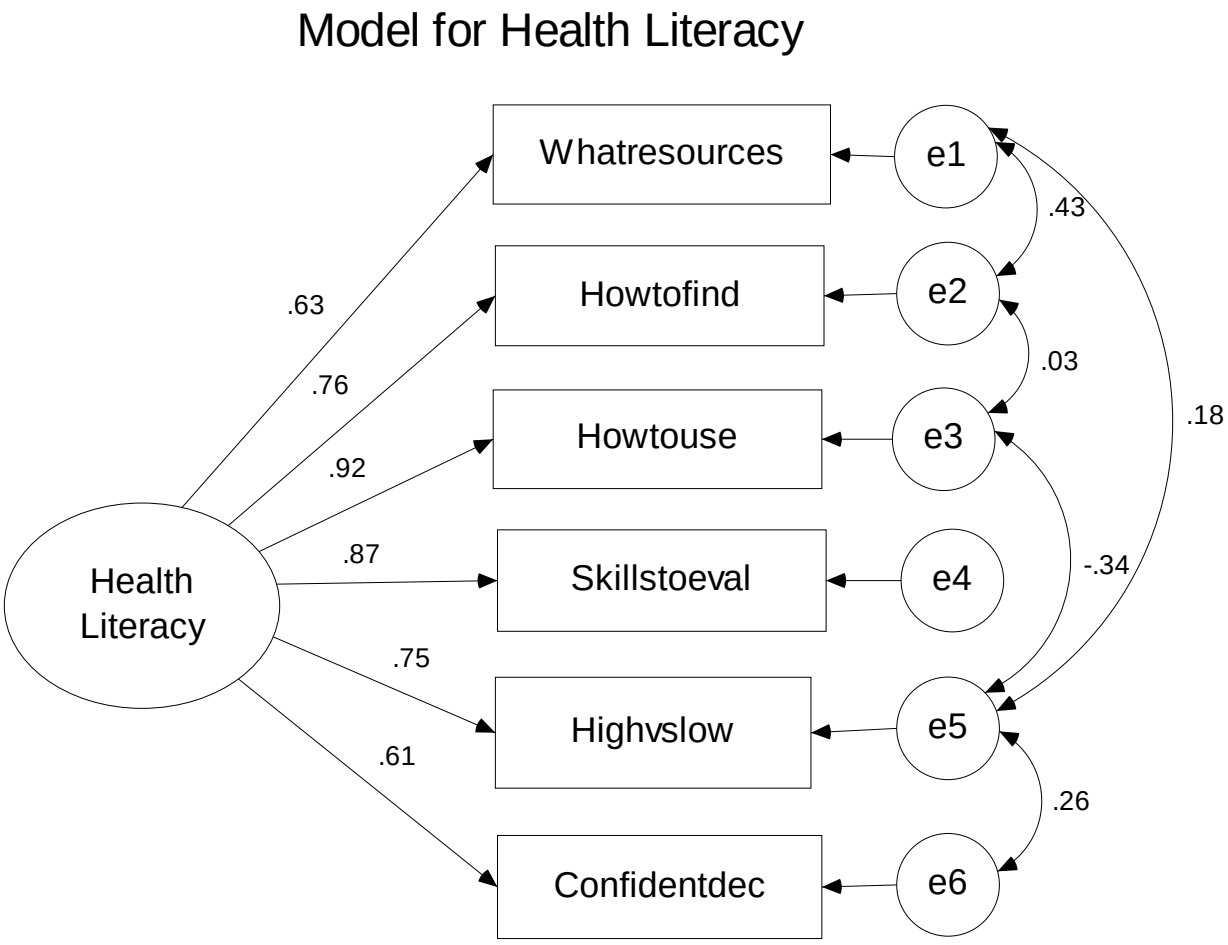
Goodness of Fit for Technology Barriers

Index	Range	Initial Model	Revised Model
CMIN/DF	<5	202.437	3.102
GFI (Goodness-of-fit)	0-1 (the larger the better)	.859	.995
AGFI	0-1 (the larger the better)	.577	.961
RMSEA	<.05 (or .08)	.290	.067
P-close	= or > .05	.000	.245
Hoelter's critical N	= or > 200	26	455

APPENDIX I
DESCRIPTIVE STATISTICS, SEM MODEL WITH ERROR CORRELATIONS, AND GOF STATISTICS FOR HEALTH LITERACY

Correlation Matrix of Health Literacy

Indicators	Mean	S.D.	1.	2.	3.	4.	5.	6.	7.	8.
1. Whatresources	3.3983	1.11838	1							
2. Wheretofind	3.5127	1.12294	.747	1						
3. Howtofind	3.6081	1.10633	.691	.895	1					
4. Useinternet	3.7331	1.10044	.528	.699	.739	1				
5. Howtouse	3.6992	1.06207	.594	.696	.718	.859	1			
6. Skillstoeval	3.6356	1.06211	.514	.632	.668	.758	.789	1		
7. Highvslow	3.2881	1.10087	.545	.535	.544	.519	.597	.657	1	
8. Confidentdec	3.4513	1.11435	.392	.409	.423	.497	.556	.550	.602	1



Goodness of Fit Statistics for Health Literacy

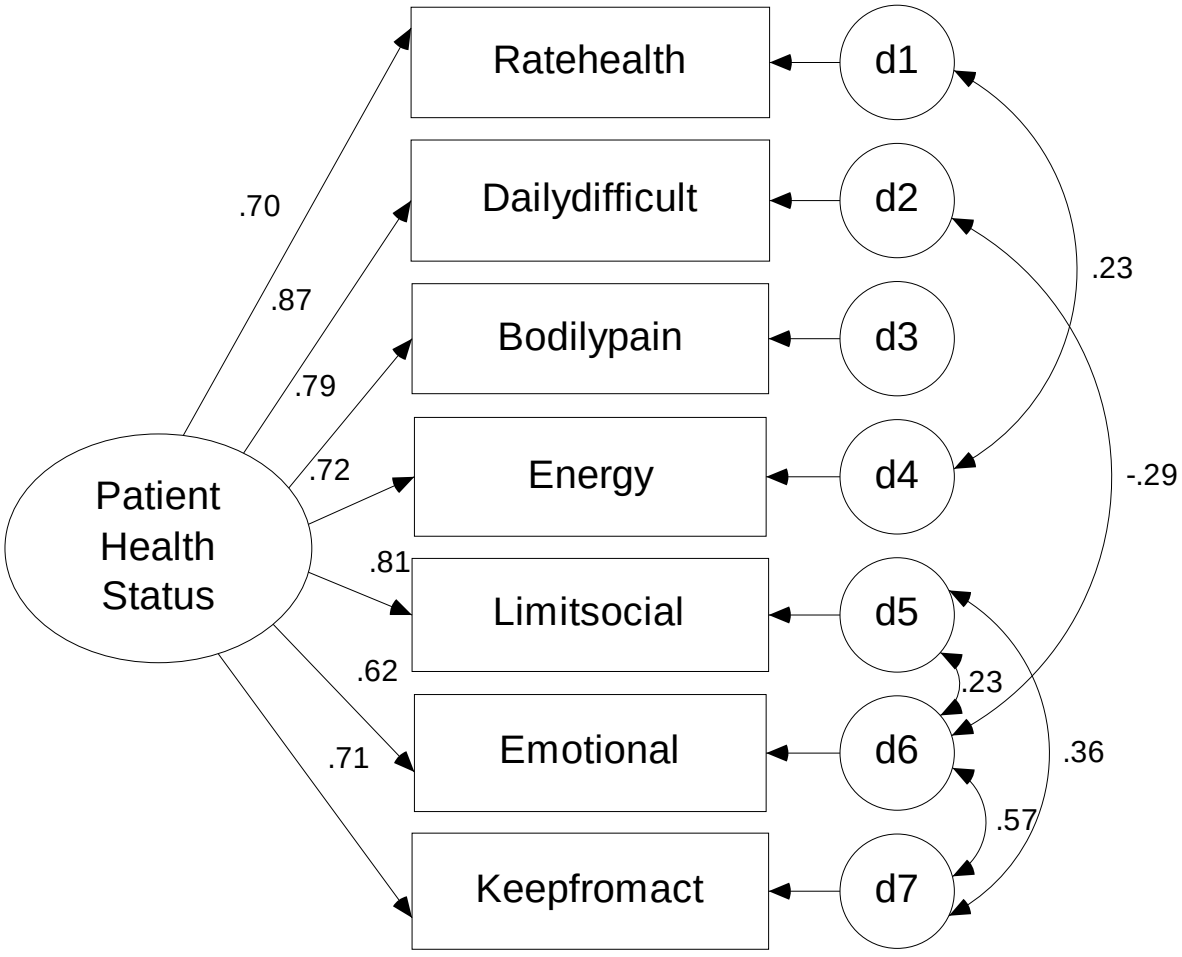
Index	Range	Initial Model	Revised Model
CMIN/DF	<5	31.176	3.441
GFI (Goodness-of-fit)	0-1 (the larger the better)	.726	.991
AGFI	0-1 (the larger the better)	.507	.951
RMSEA	<.05 (or .08)	.253	.072
P-close	= or > .05	.000	.156
Hoelter's critical N	= or > 200	24	325

APPENDIX J
DESCRIPTIVE STATISTICS, SEM MODEL WITH ERROR CORRELATIONS, AND GOF STATISTICS FOR PATIENT HEALTH STATUS

Correlation Matrix of Patient Health Status

Indicators	Mean	S.D.	1.	2.	3.	4.	5.	6.	7.	8.
1. Ratehealth	3.4809	1.27347	1							
2. Limitactivities	2.7140	1.27726	.529	1						
3. Dailydifficult	2.7013	1.31695	.611	.809	1					
4. Bodilypain	3.5614	1.52837	.558	.639	.702	1				
5. Energy	3.1059	1.01444	.616	.571	.609	.546	1			
6. Limitsocial	2.6504	1.23064	.564	.647	.703	.632	.610	1		
7. Emotional	2.7500	1.34378	.422	.431	.430	.457	.498	.610	1	
8. Keepfromact	2.4555	1.25773	.478	.570	.625	.547	.541	.726	.753	1

Model for Patient Health Status



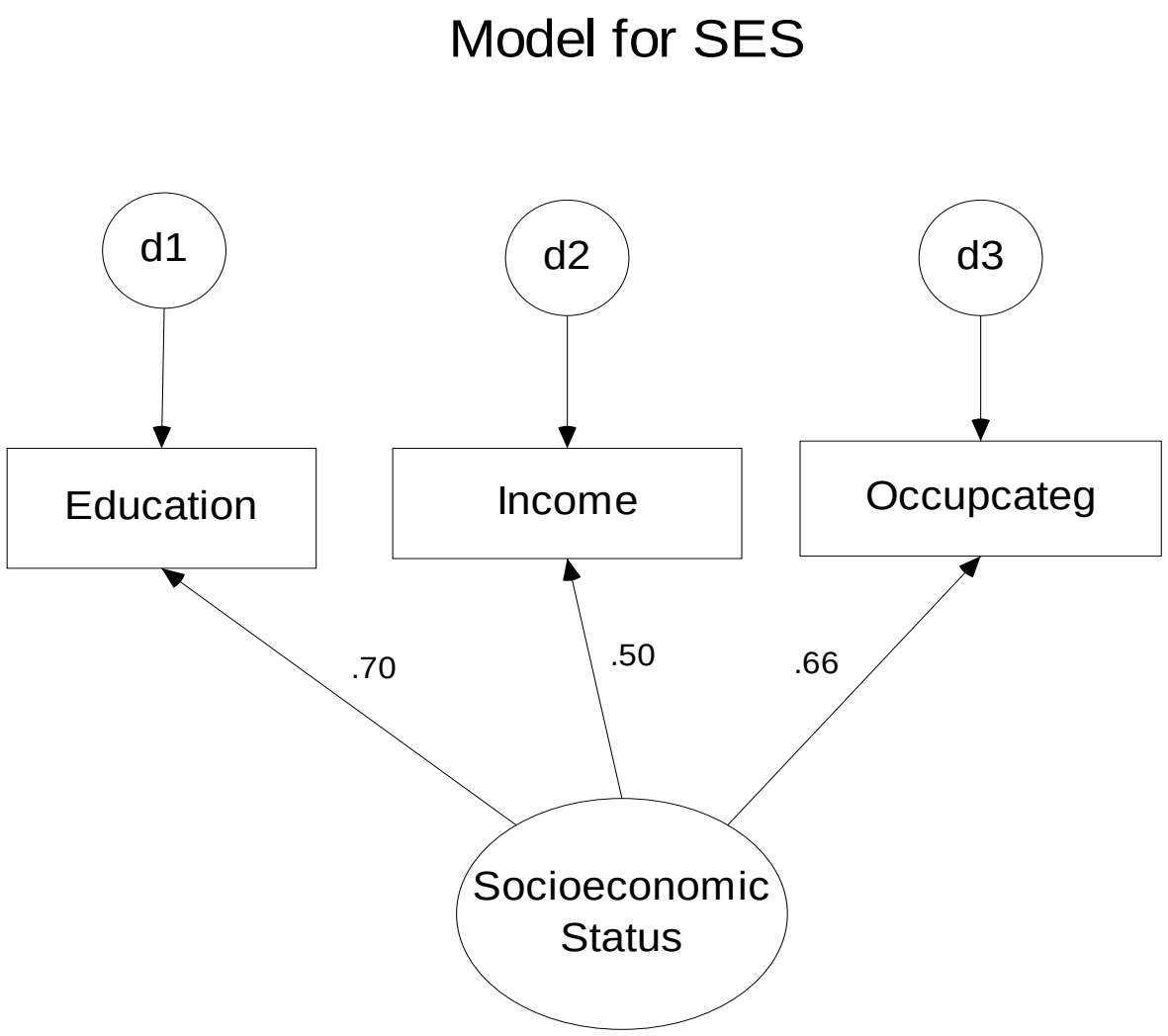
Goodness of Fit Statistics for Patient Health Status

Index	Range	Initial Model	Revised Model
CMIN/DF	<5	18.366	1.220
GFI (Goodness-of-fit)	0-1 (the larger the better)	.828	.993
AGFI	0-1 (the larger the better)	.690	.979
RMSEA	<.05 (or .08)	.192	.022
P-close	= or > .05	.000	.879
Hoelter's critical N	= or > 200	41	726

APPENDIX K
DESCRIPTIVE STATISTICS, SEM MODEL, AND GOF STATISTICS FOR SOCIOECONOMIC STATUS

Correlation Matrix for Socioeconomic Status

Indicators	Mean	S.D.	1.	2.	3.
1. Education	2.6674	1.20224	1		
2. Income	1.7987	1.14164	.350	1	
3. Occupcateg	N/A	N/A	.463	.328	1



Goodness of Fit Statistics for Socioeconomic Status

Index	Range	Initial/Revised Model
CMIN/DF	<5	
GFI (Goodness-of-fit)	0-1 (the larger the better)	1.00 (perfect fit)
AGFI	0-1 (the larger the better)	-
RMSEA	<.05 (or .08)	-
P-close	= or > .05	-
Hoelter's critical N	= or > 200	-

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