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Patient's Utilization of Health Information Technologies for Disease Self-Management

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Hahn School of Nursing and Health Science

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Patient's Utilization of Health Information Technologies for Disease Self-Management

by

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DISSERTATION: Patient's Utilization of Health Information Technologies for Disease Self-Management

DISSERTATION

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Abstract

Background: The rapid growth of Health Information Technologies (HITs) provides patients with greater opportunity to take control over their health. HITs utilization has been proven to be a critical component of disease self-management and can result in positive outcomes. Its widespread adoption and utilization is still relatively low among patients with chronic disease. It is important to understand the factors that may impact HITs utilization, such as the perceived Task-Technology Fit (TTF). A very limited number of studies have examined the relationship between HITs utilization and the perceived fit between task and technology in the context of TTF theory.

Objectives: The purpose of this study was to explore the factors that impact patient utilization of HITs for disease self-management. We examined the relationships between patient demographics and their utilization of HITs in relation to disease self-management and TTF.

Methods and Design: A quantitative descriptive correlational research design was used for this data-based study. Data from the most recent Health Information National Trends Survey (HINTS 5, cycle 2) collected in 2018 was used for this study, (*N*= 3,504).

Results: Sociodemographic disparities still exist among patient groups in terms of HITs utilization for disease self-management. Patients with lower education attainment and lower income were less likely to access their online medical records. Also, these study findings show a significant positive relationship between perceived TTF and patient utilization of the various HITs. Open communication and discussions with healthcare provider remains the most frequently reported HIT attribute associated with patient utilization of HITs for disease self-management.

Implications: Findings of this study may inform a better understanding of TTF factors. This new knowledge may influence HITs developers to include the patient perspective in future designs. These study findings may also assist researchers in developing tailored interventions that are driven by the unique individual patient technological needs for disease self-management, which in turn, can promote patient safety, improve health outcomes, and enhance the utilization of such technologies.
Keywords: Health Information Technology, Disease Self-management, Task-Technology Fit.

Dedication

This dissertation is dedicated to my family. To my always encouraging, ever faithful parents, Hamzeh Altawalbih and Huda Abo-Laila. To my brilliant and outrageously loving and supportive wife, Rawan Tawalbeh, and to our joyous and sweet little girl, Mira. Words cannot express the appreciation I feel for the prayers, support, and encouragement they provided me in every step of the way during this transformational journey.

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Dr. Ruth A. Bush and Dr. Jonathan Mack, members of my dissertation committee, who have shared their expertise, time, and assisted in guiding my research. I greatly appreciate their efforts in supporting my dissertation proposal and defense. Their work and insightful review demonstrated to me that concern for HITs in patient engagement and disease self-management should always transcend academia and provide a quest for our time.

I also extend my sincere appreciation to **Dr. Patricia Roth, Dr. Ann Mayo, Dr. Jane Georges** and all the professors at the Hahn School of Nursing and Health Science who dedicated their time and efforts to prepare the next generation of nursing and healthcare leaders and scholars, and bring transformational change to nursing and healthcare.

Finally, I thank my wife, Rawan Tawalbeh, for her love and support. She has always been my strength throughout the times. She has always believed in me and my capabilities, and she never doubted just what I can do. I know how blessed I am to be with someone as beautiful, intelligent, kind, and loving as you.

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CHAPTER I

Introduction

The rapid growth and development in Health Information Technologies (HITs) provide patients with a greater opportunity to take control over their health. Nurses and other healthcare professionals have had a long history of concern about patient engagement and empowerment. Ryan & Sawin (2009) argue that our expectations for patients and families to take control over managing their healthcare have surpassed our understanding of how to assist them to acquire the knowledge, skills, and social facilitation for health management.

In recent years, many healthcare organizations, hospitals, clinics, and individuals have adopted HITs to improve patient health outcomes and quality of care. The term Health Information Technology (HIT) refers to "the electronic systems health care professionals – and increasingly, patients – use to store, share, and analyze health information" (The Office of The National Coordinator for Health Information Technology [ONC], 2018). It is anticipated that HITs will not only lead to an improved patient experience, but also improve communication, patient-centered care, patient engagement, and overall improved health outcomes and quality of care.

Ghandi et al. (2003) point out that HITs have many potential benefits for patients and their families including access into a wide range of credible and individually tailored health information and knowledge. Patients can utilize HITs to improve their health and manage their diseases. Patients with chronic illnesses will be able to track their diseases in collaboration with their providers, promoting prompt interventions when they encounter a deviation or problem. Collaborative disease-tracking has the potential to

reduce communication barriers between patients and caregivers. Improved communication will make it easier for patients and caregivers to ask questions, to set up appointments, to request refills and referrals, and to report problems.

Background and Significance of Study

In the United States, there is a growing need to improve the quality of the healthcare delivery. Many initiatives have been supported to meet this need such as, the Affordable Care Act (ACA) that was signed into law in 2010. The ACA improves the quality of the healthcare by improving access to the health services and reduces cost (Werder, 2015). With the evolution of the Internet and the development of different technological tools around the world, information technology has many benefits and a positive impact on the healthcare delivery for both patients and healthcare providers (Bello et al., 2004; Hall et al., 2014).

The Institute of Medicine (2001) reports that HITs play a critical role in the designation of healthcare systems and should be integrated into patient care. Nowadays, many healthcare providers believe that HITs have many promising capabilities, such as improving the quality, efficiency, and safety of the health care activities. It also promotes the engagement of the patients and families in their health and ensures privacy protection of the personal health information (Centers for Disease Control and Prevention, 2016). In fact, the rapid growth and development in HITs provides patients with a greater opportunity to take control over their health (Agency for Healthcare Research and Quality [AHRQ], 2016). However, patient utilization for such technologies is still very low. However, several national surveys show that interest in PHRs is increasing. In 2011, 10% of Americans reported using electronic PHRs, a significant increase from only 3%

reporting PHR use in a 2008 survey (Markle Foundation, 2011). Moreover, recent data released by ONC showed that as of 2017, 52% of individuals have been offered online access to their medical record by a health provider or insurer. Over half of those who were offered online access viewed their record within the past year; this represents only 28% of individuals nationwide (Patel & Johnson, 2018). Thus, it is important to understand the factors that may affect patient utilization of different HITs.

It is known that HIT use is widely accepted among healthcare professionals and it focuses mainly on the exchange of health information between the healthcare providers (Ventura et al. 2011). Despite this wide use of HIT among healthcare providers, less is known about the preferences and utilization of HIT among patients with chronic disease (Hall et al., 2014). Thus, it is essential to ensure that patients are involved in the loop to be active collaborators in their healthcare management (Byers, 2015; Greene & Hibbard, 2012). Factors that impact the patient's HIT utilization, such as socioeconomic, individual, organizational, environmental, and human technology interaction, have been studied extensively in the literature. However, there are a limited number of studies that have examined the factors that impact patient utilization of such technologies for disease self-management (Bhattacherjee & Hikmet, 2007).

Research Questions

The aim of this study was to explore the factors that impact patient utilization of HIT for disease self-management. This study seeks to address the following research questions:

1. What are the patterns and trends of HIT utilization among the U.S. population?

2. What is the relationship between patient demographics and their utilization of HIT for disease self- management?
3. What is the relationship between perceived TTF and patient utilization of the HIT for disease self-management?
4. What is the relationship between patient demographics and access to their online medical records?

A review of the existing literature addressing the impact of TTF theory on technology utilization will ensure the need for further understanding of the situational characteristics of the task and technology and its impact on the patient's HIT utilization. The literature review section will discuss an overview of the TTF theory as a theoretical framework for further understanding its impact on patient's HIT utilization, perceived technology utilization, and the relationship between HIT and the disease self-management.

Conceptual Model

The conceptual model for this study was derived from the TTF Theory. Many theories have been used to explain technology acceptance and utilization. One important theory is the TTF (Goodhue & Thompson, 1995), which is defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue, 1998, p. 216). The perception of TTF is measured by users' evaluation where the different degree of the perception is associated with different outcomes (Goodhue & Thompson, 1995; Gu & Wang, 2009). The TTF is a model that proposes the best way to deploy technology to support individuals (Lin, 2014). Task refers to the actions that are completed by individuals in the process of turning the inputs into outputs. Goodhue

(1998) identified three main subtasks of technology users based on the task domain; these subtasks are to identify data, to access the identified data, and to integrate and interpret the accessed data. It is essential to consider the technology role and at the same time, the complexity of the tasks that will be supported by the information technology system in TTF (Goodhue & Thompson, 1995). Technology refers to the interactions of different tools that are needed by individuals to complete their tasks (Goodhue & Thompson, 1995). Drazin and Van De Ven (1985) defined Fit as the congruence, interaction, and internal consistency. For the purpose of this study, the perceived TTF is defined as the perception that the functionalities and capabilities of an information technology support the needs of the task of patient self-management.

According to this definition, if the technology fits the user's tasks and workflow, he/she will use the technology for these specific tasks. Conversely, if the technology hinders the user's workflow and tasks, he/she will not use it or, at least, try to avoid using it (Assis-Hassid et al., 2013). The TTF has a consistent and a clear message; when the technology characteristics and the tasks that should be performed are properly suited, the performance benefits and technology use will result (Zigurs & Buckland, 1998).

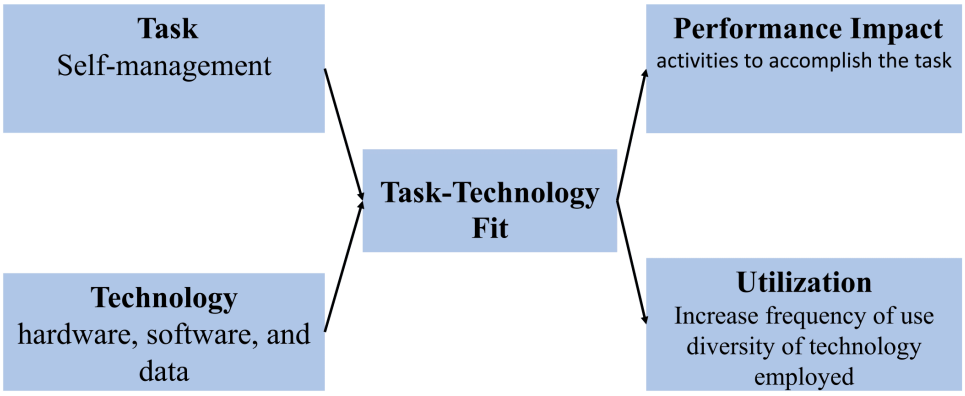

Figure 1: Study theoretical framework adapted from the TTF model (Goodhue, 1995).

Assumptions

Perceived Task-Technology Fit and Utilization

Perceived TTF and its impact on utilization has been studied extensively in the Management of Information Systems (MIS) literature and has successfully assessed the impact of technology and task characteristics on a user's utilization. Moreover, there have been numerous modifications to suit the TTF with the goals of specific studies (Dwivedi, Wade, & Schneberger, 2012; Furneaux, 2012). However, at the patient level, very limited empirical studies have tested the situational factors such as the task and technology characteristics in the context of patient utilization of HIT for self-management using the TTF theory.

Utilization

Utilization involves employing technology in completing specific tasks. It can be measured by the frequency of use of technology and the diversity of applications

employed (Goodhue & Thompson, 1995). Technology utilization depends on its perceived functionality to adequately meet a user's needs. That is, perceptions of improved TTF will result in an increased likelihood that users will utilize the technology to perform tasks (Dishaw & Strong, 1998). TTF has a direct impact on the perceived ease of use of specific technology. It also has a positive relationship with the utilization and perceived intention to utilize information technology (Chang, 2008; Wu, Chen, & Lin, 2004).

Health Information Technology

For this study, the term HITs include Internet use, health applications, computer or mobile devices (smartphones and tablets), electronic health records (EHRs), and electronic communication (E-mail, text messaging, social media, and video conferencing) to access and share health-related information or services.

Disease self-management

Disease self-management requires patients to be active partners in their healthcare delivery by being responsible for the activities that may directly affect their health, such as making lifestyle changes, tracking and reporting health status changes, and keeping medication schedule (Lorig & Holman, 2003). Moreover, self-management skills involve recognizing health problems, seeking solutions by using information sources, collaborating with providers, changing behavior, and evaluating information (Kinney, Kahana, Corbin, & Strauss, 1989). Incorporating HIT into patient care delivery has the potential to improve the reach of patient support, clinical management, and self-care (Fisher & Dickinson, 2011).

Methodology

A descriptive correlational research design was used for this study. Data from Health Information National Trends Survey (HINTS 5, cycle 2), fielded in 2018, was used for this study after obtaining permission to use the datasets (National Cancer Institute, 2018). (Appendix A). The HINTS is a nationally representative survey which has been administered every few years by the National Cancer Institute since 2003. The purpose of HINTS is to track trends in the public's rapidly changing use of new communication technologies while charting progress in meeting health communication goals in terms of the public's knowledge, attitudes, and behaviors (Nelson et al., 2004).

The HINTS's target population is adults aged 18 or older in the civilian non-institutionalized population of the United States. The survey was collected exclusively via mailed questionnaires. A nationally representative listing of home addresses was used as the sampling frame (National Cancer Institute, 2018).

Implication for Future Knowledge Development

Given the limited literature on the TTF factors and their impact on patient utilization of technology, this study add to the existing knowledge of the experiences and needs of patients who use HIT in self-management. Findings from this study may assist in evaluating the current theories and models through testing their usefulness to the patient. Modifications to these models can be made based on the study findings if necessary to better fit the patient's unique needs.

Understanding the TTF factors and their antecedents will inform HIT developers and policy makers to include the patient perspective for future design and implementation. The study findings may help in developing tailored intervention

programs that encourage more HIT utilization for self-management in different patient groups. Finally, the results of this study cannot be generalized because the data used for analysis was not nationally representative.

Conclusion

Integrating HIT into patient care has the potential to improve overall care delivery. Patient HIT utilization is a critical component in disease self-management. This requires understanding of the factors that may impact the patient utilization of HITs for self-management. The literature search revealed a gap of knowledge in the area of the perceived TTF factors and how they impact the patient use of HIT in activities of self-management. The TTF model was used as a theoretical framework for this study to understand the relationship and interaction between the study variables, which include self-management, HIT, patient, and utilization and performance. The potential significance of this study is to build upon the existing literature and decrease the gap in this area. The findings of this study may also assist in understanding the factors that encourage or hinder patient's utilization of HIT in self-management.

CHAPTER II

Review of the Literature

Health Information Technologies (HITs) are transforming the healthcare system by becoming mainstream tools to help patients in self-management tasks and decision-making. HITs are prompting the shift toward a healthcare model that is more focused on personal adoption and utilization of digital and web-based tools (Himes & Weitzman, 2016). A wide variety of products, technologies, and services are available for patients to use within HITs. Examples include, but are not limited to, cloud-based services, remote and mobile health technology, medical devices, tele-monitoring tools, assistant technologies, EHRs, and other applications of HITs. These technologies can help users to collect, share, and utilize health information for diverse purposes (Hemmat, Ayatollahi, Maleki, & Saghafi, 2017; ONC, 2014).

The recent innovations and advances in technology have caused the utilization of HIT to become popular in healthcare and other industries. Researchers can use the data generated by the different HITs platforms to inform healthcare goals, behaviors, and decisions. In addition, HIT has the potential to unlock the full power of information. For example, non-clinical self-generated information through an individual's mobile device includes air and water quality from work and physical environments, potential toxin exposure, and availability of social services and can improve individual health and well-being when and where it is needed most (ONC, 2014).

Giant technology companies, such as Apple and Google, are investing in HIT. Recently, Apple released EHRs enabling users to view "patient-centered" EHRs on iOS devices. Patients at participating hospitals and clinics can view their health information

from different providers at any time. Also, Google partnered with the American Medical Association (AMA) to promote mobile health IT development through wearable devices and applications. They launched "the AMA Health Care Interoperability and Innovation Challenge" to develop medical devices that support health information sharing between patients and providers to improve chronic disease management (Snell, 2018).

Despite the recent and evident widespread use in healthcare and other industries, HIT is a relatively new phenomenon that has rapidly taken over the healthcare industry (Forrest et al., 2014; Luchenski et al., 2013). As computerized electronic systems, HIT provides methods for collecting, storing, and displaying health information. The perceived benefits of HIT can be summarized as reducing human errors; improving the security of medical data; providing easier access to medical information; reducing duplication of efforts and documents; optimizing the documentation of health data; reducing costs of information and communication technology; supporting decision making activities; improving the quality of care; forming a data repository; reducing the need for paper, and improving chronic disease self-management (Chaudhry et al., 2006; Goldzweig, Towfigh, Maglione, & Shekelle, 2009; Poissant, Pereira, Tamblyn, & Kawasumi, 2005; Ventura et al. 2011).

Many healthcare professionals believe the promising capabilities of HIT will encourage patient activation, which is a characteristic of patients who view themselves as active collaborators in their own health care management. In addition, patient experience and engagement are becoming key parts of the modern healthcare. As the focus continues to shift towards better coordinated care efforts, there has not been enough focus on the concept of HITs for disease self-management (Byers, 2015; Demiris et al., 2008; Greene

& Hibbard, 2012; Mwachofi et al., 2016; Tang & Lansky, 2005). Therefore, the aim of this literature review is to clarify and develop an understanding of the concept of HITs and examine the situational characteristics of the task and technology and its impact on the patient's HITs utilization for disease self-management. The following section will provide an overview of the HITs concept and its defining attributes, perceived TTF and utilization, the relationship between HIT and disease self-management, and HIT utilization patterns. At the end of this literature review, a critical analysis for the current state of HITs utilization for disease self-management will be provided.

Health Information Technology

Uses of the concept. The use of a HIT concept has been changing throughout the history. It can be traced back to late1960s when technological advances moved data entry from punch cards to keyboards and data display from printed results to video display terminals (Trpathi, 2012). Searching online for a definition of HIT revealed many results; however, the basic generic definition of HIT is "the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making" (U.S. Department of Health and Human Services, 2004). This information stored and exchanged securely can be accessed by different groups of authorized professionals. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing efficient and quality integrated health (International Standards Organization (ISO), 2005; Health Information Technology, 2009; Thompson & Brailer, 2004; University of South Florida Health, 2018).

In the literature, the meaning of HIT is unstable. HIT can be defined according to its functions, type of data, or type of users. It is obvious there is a need to determine explicitly what HIT means especially from a patient's perspective. However, the definition of HIT according to its functions is the most common definition used in literature. According to the Office of the National Coordinator for Health Information Technology (ONC) (2018a), *health information technology (health IT)* is defined as "the electronic systems healthcare professionals and patients use to store, share, and analyze health information." Other related definitions found in the literature include *Consumer e-health,* which can be defined as the electronic tools and services that are designed for consumer utilization in an effort to broaden health IT (Hayrinen, Saranto, & Nykanen, 2008; Hung et al., 2013; ONC, 2014; Ricciardi, Mostashari, Murphy, Daniel, & Siminerio , 2013).

For the current study, the term Health Information Technology (HIT) includes Internet use to access resources for health education, information, advice, and peer support; health applications; computer or mobile devices (smartphones and tablets); EHRs and personal health records (PHRs); and electronic communication (secure e-mail, text messaging, social media, and video conferencing) to access and share health-related information or services.

Defining attributes. The defining attributes of HITs are the group of characteristics that are most frequently associated with the concept and appear repeatedly in the many different instances of a concept. It helps in distinguishing one concept from a similar one (Walker and Avant, 2011). Three main defining attributes have been identified and are most frequently associated with the concept of HITs. Those attributes

include patient-centeredness and engagement, readily accessible health information, and open communication.

Patient-centeredness. HIT itself is not patient-centered unless it fosters the patient-clinician relationship, encourages communication about things that matter, enables patients to know more about their health, and facilitates their involvement in their own care (Epstein & Street, 2011).

Patient-centered care behaviors contribute to better outcomes. These outcomes include the patient feeling known, involved, engaged, and knowledgeable. These outcomes are desirable and may mitigate a patient's distress associated with illness and uncertainty (Arora, Weaver, Clayman, Oakley-Girvan, Potosky, 2009).

HIT's objective of meaningful use is meant to engage patients in their care by allowing them to view and obtain their health information online (Pillemer et al., 2016). The new developments in HIT tend to make many patients more active participants in their own healthcare. Having access to their EHR may support patients' engagement by allowing them to know more information about their care (Milne et al., 2014).

Innovative studies that enabled patients to access their physician notes online after the clinical encounter showed that after reviewing their visit notes, patients reported feeling more in control of their care (White and Danis, 2013). A qualitative study conducted to examine patients' views and experiences in accessing their health records online showed how shared access to health records can encourage active patient participation and engagement in their care. In all focus groups, participants put knowledge from their records to use by learning more about their health issues, gaining more knowledge about their providers' views, and advocating for themselves in

discussions about their care (Woods et al., 2013). These patients may already be engaging in positive health behaviors and their level of involvement is likely to remain high (White and Danis, 2013).

Readily accessible health information. Patient access to health information has been described as fundamental to empowerment for patients (Mold et al., 2013). Patients place a high value on direct access to their own health information (Pillemer et al., 2016). HITs, including EHRs and patient portals, allow patients to access full and accurate information about all of their medical evaluations. Online access and services that are included in the different types of HITs can be accessed from a patient's home, workplace, or mobile computing device that provides patients with an opportunity to personalize their access to health information and make it radially available when needed (Mold & de Lusignan, 2015).

A quasi-experimental trial of primary care physicians (PCPs) and patient volunteers who provided patients with electronic links to access their doctors' notes suggested that open notes may be a powerful intervention for improving the health of patients and points to many avenues for future elaboration and inquiry. It also suggests that access to open notes can improve patient adherence to medications and care plans, facilitate the management and course of chronic disease, or decrease the incidence of medical errors. In this study, nearly 99% of patient respondents wanted continued access to their visit notes and 88% agreed that open notes would be a somewhat or very important factor in choosing a future doctor or health plan (Delbanco et al., 2012).

Open communication. The different HITs tools can be considered a bridge to improving communication and collaboration and can initiate open communication

between providers and patients, transforming visits from intermittent to steady follow-ups (Bowman, 2013). For example, the use of EHRs has the potential to facilitate patient-physician communication via electronic messaging (White and Danis, 2013). Patient portals provide a convenient means for communication between patient and health provider. HITs allow patients to communicate with their physicians or other healthcare workers by email or through a web portal. EHR online services include features for patients such as booking appointments or requesting prescription refills without the need for seeing their physicians. Patients who use EHRs online access reported positive experiences, satisfaction, and empowerment to communicate more effectively with clinicians (Mold & de Lusignan, 2015). In addition, hospitals can maintain communication with patients as long-term clients as the EHRs have become a useful tool for health information exchange between healthcare providers and patients (Burke et al., 2010).

In a qualitative study conducted to explore patient perceptions of having full electronic access to their health records, patients reported that viewing their record had a positive effect on care communication between visits as well as during clinical encounters. One benefit frequently described by patients was that access to health record information served to enhance communication about their care. Patients reported better recall of appointments and care issues, felt more prepared for in-person visits, and found a greater ability to communicate with providers inside and outside health system. Moreover, access to the record was considered to be a valuable supplement to communicating in-person with providers. Several patients reported feeling less reliant on providers and staff to relay pertinent information during or between visits, which, in turn,

allowed them to avoid situations such as remembering in-person discussions or waiting for a phone call to be returned (Woods et al., 2013).

HITs Empirical Referents

Empirical referents are classes or categories of actual phenomena that by their existence or presence demonstrate the occurrence of the concept itself (Walker & Avant, 2011). A thorough consideration of the factors that impact the fit between the task, the technology, and the population would inform but would not cover all considerations that guide the adoption of the appropriate technology for the intended task and setting. However, empirical evidence in these research areas may be lacking (Chan & Kaufman, 2009). Searching the literature did not reveal a specific instrument to measure the HITs' attributes from a patient perspective. However, Atkinson (2007) developed a questionnaire to measure perceived attributes of technology-based health education innovations. This instrument can be used to measure reactions to HITs' applications to predict and improve the likelihood of adoption. College students in 12 personal health courses reviewed a prototype eHealth intervention using a 30-item instrument based upon diffusion theory's perceived attributes of an innovation. This instrument can assist eHealth developers to determine and improve the adoption potential of their applications throughout the development stages.

Perceived Task-Technology Fit

Studies concerning the impact of the task-technology fit (TTF) and patient utilization of HIT for disease self-management is still very limited. Or and Karsh (2009) conducted a systematic review to identify the variables affecting patient adoption and utilization of HIT and found that among 94 different variables tested (including

sociodemographic characteristics, health, and treatment-related variables, and prior experience or exposure to computer/health technology, organizational factors, and environment), no studies examined the impact of social and task factors on patient acceptance and utilization of HIT. They concluded that future research guided by technology acceptance theories such as the TTF should fill those gaps to improve our understanding of patient HIT utilization, which, in turn, may improve design and implementation and patient utilization of HIT.

Perceived TTF and its impact on utilization have been studied extensively in the Management of Information Systems (MIS) literature and has successfully assessed the impact of technology and task characteristics on user's utilization. Moreover, there have been many modifications to suit the TTF with the goals of specific studies (Furneaux, 2012). However, at the patient level, very limited empirical studies have tested the situational factors, such as the task and technology characteristics, in the context of patient utilization of HIT for self-management using the TTF theory.

Utilization

Utilization involves employing technology in completing specific tasks. It can be measured by the frequency of the use of technology and the diversity of applications employed (Goodhue & Thompson, 1995). Technology utilization depends on its perceived functionality to adequately meet users' needs. That is, perceptions of improved TTF will result in an increased likelihood users will utilize the technology to perform tasks (Dishaw & Strong, 1998). TTF has a direct impact on the perceived ease of use of specific technology. It also has a positive relationship with the utilization and perceived intention to utilize information technology (Chang, 2008; Wu et al., 2004). Lam, Cho,

and Qu (2007) conducted a study to explore the impact of perceived TTF on the intent to adopt information technology in hotels. The study found that TTF interacts with perceived information technology beliefs and can influence the attitude formation of employees, leading to enhance their intent to utilize this new technology. Also, the TTF model has been adapted and used to study the introduction of information technology in the healthcare sector (Lepanto, Sicotte, & Lehoux, 2011). A study conducted by Chen, Yu, and Chen (2015) used the TTF model to evaluate the relationship between the task and technology characteristics and showed the information systems utilized in the hospital supported the task of patient-referral, improved the overall hospital performance, decreased patient wait time, and improved the quality of patient care.

Current research concerning the TTF and patient HIT utilization is still limited. One recent study conducted by Ali, Romero, Morrison, Hafeez, & Ancker (2018) to identify TTF problems and usability challenges in a newly implemented patient portal demonstrated that integrating the task-technology fit perspectives to evaluate patient portal; this can lead to significant improvements in the patients' ability to accomplish health management tasks (Ali et al., 2018). Another study by Mirabolghasemi and Iahad (2015) used the TTF model to assess the performance of cancer patients using Social Network Sites (SNS). That study indicated the fit between the characteristics of task and technology directly influenced the patients' performance. Another study conducted by Laugesen and Hassanein (2017) to assess the adoption of Electronic Personal Health Records (ePHR) by chronic disease patients for the task of self-management found that TTF had significant direct and indirect effects on the intention to utilize an ePHR. However, the results of these studies may not be generalizable due to the limitations.

These limitations include small sample size, targeting only one type of technology use, such as ePHR, targeting only one group of patients with a specific chronic disease, excluding all older adults who may not use the technology, and excluding patients with no access to a computer or Internet. Further studies considering the diverse patient population and usage of the various forms of HITs are needed to enhance generalizability.

Disease self-management

Disease self-management is a shared responsibility between patients and their healthcare providers. Most of the time, a greater responsibility rests on the patients' shoulders. Patients are expected to adhere to medications, track symptoms (e.g. blood pressure, glucose levels and pain) and follow guidelines for diet, exercise, and sleep. Patients who live with multiple chronic diseases may find it difficult to deal with all the self-management tasks without reasonable help. HITs have been shown to help patients with self-management. However, they can only do so if they are adopted and utilized (Or & Karsh, 2009).

Disease self-management requires patients to be active partners in their healthcare delivery by being responsible for the activities that may directly affect their health, such as making lifestyle changes, tracking and reporting health status changes, and keeping medication schedule (Lorig & Holman, 2003). Moreover, self-management skills involve recognizing health problems, seeking solutions by using information sources, collaborating with providers, changing behavior, and evaluating information (Kinney et al., 1989). Incorporating HIT into patient care delivery has the potential to improve the reach of patient support, clinical management, and self-care (Fisher & Dickinson, 2011).

HIT is widely and successfully used by different groups of patients. They use health-related information technology in self-care and self-management as clearly evidenced by the rapid growth in the use of the Internet by the general population seeking health information. Patients value the use of HITs' resources, such as the Internet, and they are motivated to use it to meet their perceived health needs (Winkelman, Leonard & Rossos, 2005). Patient utilization of technology for seeking health information and services is tangible because patients perceive a good, clear fit between technology and their perceived needs, wants, and capabilities (Gustafson & Wyatt, 2004).

In the literature, HIT utilization is showed to have a direct impact on self-management among diverse groups of patients. A systematic review and meta-analysis showed the utilization of HIT as a self-management approach improved glycemic control in patients with diabetes (Tao & Or, 2013). Another systematic review concluded that HITs' platforms could be integrated to develop more effective and efficient treatment strategies for patients with chronic kidney disease (Diamantidis & Becker, 2014). Gustafson et al. (1999) conducted a randomized controlled trial to examine how consumer health information systems potentially improve the quality of life in an HIV-positive patient and activate patient self-care. Patients were provided with information, decision support, and connections to experts and other patients through a computerized system called CHESS (Comprehensive Health Enhancement Support System). The study results suggested improvements in quality of life (active life, negative emotions, cognitive function, social support, and participation in healthcare). Patients also reported spending a shorter time during ambulatory care visits, making more phone calls to providers, and experiencing fewer and shorter hospitalizations. A qualitative study by

Taylor, Stone, & Huijbregts (2012) indicated that self-management programs for stroke survivors and their caregivers using video-conference technology greatly increased accessibility for people living in remote areas. Participants reported using such technology was valuable for information sharing. However, as HIT is becoming more commonly utilized by patients for self-management, studies that examine factors predicting patient acceptance and utilization of HIT are needed (Or and Karsh, 2009).

HITs Utilization Patterns

Chan and Kaufman (2009) argue that knowing HIT utilization patterns and how the technology plays a role in daily life would further inform the fit between technology and the intended health intervention or task. Leveraging this knowledge about the frequency and extent of use of different HITs can improve the selection of a technology that matches the needs of the patient self-management task. Integrating the technology and health intervention with minimal disruption of the existing utilization patterns and daily routines can also facilitate the positive adoption of health interventions (Blaya, Holt, and Fraser, 2008).

In the United States, one out of every two adults, or 133 million individuals, are living with at least one chronic disease (Ressler, Bradshaw, Gualtieri, & Chui, 2012). As one of the various HITs, the Internet has been recognized as a significant source of health information (Hung et al., 2013). Literature shows the Internet is valuable for disease self-management and can assist patients in health education, supplementing information obtained by a provider, getting advice from peers, and obtaining a second opinion regarding a health problem (Fox, 2009; Hung et al., 2013; Powell, Inglis, Ronnie, & Large, 2011). Findings from a national survey conducted by Fox and Duggan (2013) for

the Pew Research Center's Internet and American Life Project (2013) suggests that 80% of adult Internet users in the United States (approximately 113 million people) have searched for information on at least 1 of 17 health topics. Forty-six percent reported the online information led them to believe they needed care from a medical professional. The findings of this survey also suggested that women are more likely than men to go online to find a possible health diagnosis. In addition, younger people, white adults, those who live in households with higher income, and those with a college degree or advanced degrees, are more likely to utilize Internet to seek health information (Fox & Duggan, 2013).

Another national survey conducted for the California HealthCare Foundation (2010) suggested positive effects from HIT utilization particularly personal health records (PHRs) despite currently low usage (*n*=1,849). The results of this survey show only 7% of the respondents reported utilizing a PHR; 67% searched online for information about a disease or medical problem; 30% searched online for information about a doctor; 22% entered information on a web site about their weight, nutrition, or exercise; 21% entered information on a web site about a chronic illness; 15% renewed prescriptions online; 8% sent and/or received email from doctor; 6% looked at test results online; 6% used a medical device that connects to a computer, 5% posted online about their health or health care; 5% joined an online group about a health issue; and 2% used a health-related application on their cell phone. Moreover, respondents reported that utilizing HIT, such as PHRs, helped them in taking steps to improving their own health, being informed about their healthcare, and asking their providers more questions. Individuals with higher income were more likely to utilize a PHR. Lower-income adults, patients with chronic

diseases, and those without a college degree were more likely to experience positive effects of having their information accessible online. More than half of adult respondents reported an interest in utilizing online applications to track health-related issues as well as medical devices that can be connected to the Internet. More than 40% of respondents who do not have a PHR reported an interest in using one. The findings of this survey illustrated the increased use of online information-seeking compared to other health e-tools and which patient characteristics may have an impact on HIT utilization.

Most of the of the studies in the literature concerning HIT utilization patterns were conducted in the context of digital disparities in the adoption and utilization of various forms of health IT among minorities. HIT utilization for disease self-management among minority populations may have a significant potential to improve health and access to healthcare. However, several challenges including technical, practical, and human may hinder the HIT utilization and adoption among these groups. For example, a descriptive cross-sectional study conducted by Messias and Esrada (2017) to explore patterns of technology utilization for health information-seeking among the Hispanic population in South Carolina suggested an increase in accessibility and utilization of technologies, such as cellphones and Internet, of those seeking health information. The majority of participants indicated they considered the Internet a good source of health information. Another study conducted by Lee, Giovenco, and Operario (2017) examined the role of sexual minority identity as a factor associated with HIT use. The study concluded that utilization of HIT among older sexual minority adults was greater when compared to their heterosexual counterparts. Sexual minority participants were more likely than their heterosexual counterparts to use HIT for disease self-management

activities, such as using computers to look up health information on the Internet, fill a prescription, and communicate with healthcare providers by e-mail. The study suggests that HIT utilization may be an innovative way of reducing disparities in information access among minorities.

Barriers for Patient HIT Utilization

While patient HIT utilization has been proven to result in positive outcomes in its limited use so far, its widespread implementation faces several barriers, most notably concerns about security and privacy. The following section examines the current state of these barriers to further patient HIT adoption and utilization. Hung et al. (2013) pointed out the most common barriers for HIT utilization among patients included concerns about privacy and security, health literacy, and usability. These barriers are helpful in understanding the slow rate of HIT utilization by patients, including the use of electronic tools.

Privacy and Security Concerns. Numerous studies in the literature suggest patients have concerns regarding their health data security and privacy. Results of these studies show those concerns reduced the frequency of patients' access and utilization of their health records. Greater concerns are associated with ethnic and racial minorities (Lee et al., 2017; Messias & Esrada, 2017) Baby Boomers and patients with a chronic disease (Hung et al., 2013; Jha et al., 2009; Kisekka and Giboney, 2018; Slabodkin, 2017; Sun, Zhu, Zhang, & Fang, 2011; Witry, Comellas, Simmering, & Polgreen, 2018).

Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Hung et al., 2013). The inability to fully understand health

content gathered online has been identified as a major barrier across the different types of patient HITs. Many studies in the literature concluded that greater health literacy is significantly associated with greater perceived ease-of-use and perceived usefulness across all HITs and, ultimately, greater HIT utilization and adoption for disease self-management; (Bidmon, Terlutter, & Röttl, 2014; Hung et al., 2013; Mackert, Mabry-Flynn, Champlin, Donovan, & Pounders, 2016; Norman & Skinner, 2006; Paige, Miller, Krieger, Stellefson, & Cheong, 2018; Witry et al., 2018).

Usability is another barrier identified in the literature for patient HIT utilization. According to the ISO (2018), usability can be defined as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." Usability incorporates different characteristics of e-Health tools such as effectiveness, learnability, efficiency, speed, ease of use, interface quality, information quality, perceived usefulness, and error tolerance. Studies show HITs' tools with weak usability characteristics negatively impacted patient HITs utilization. Furthermore, patients who adopted e-Health tools often stop utilization if they find the tool difficult to use (ISO, 2018; Dexheimer et al., 2017; Hung et al., 2013; Segall et al., 2011; Yen & Bakken, 2012). Hung et al. (2013) pointed out some specific examples about poor usability attributes, which included a poor interface, complex navigating through functions, poor display of information, complicated functionality, and the amount of time it takes to perform a task (Finkelstein et al., 2012; Kellermann & Jones, 2012; Segall et al., 2011).

Critical Analysis

The current literature mainly focuses on patient factors such as sociodemographic and health status and their relationship with the patient utilization of HIT for disease self-management. This focus is inadequate to understand and to explain patient HIT utilization (Karsh, 2004). Other factors such as organizational, human-technology interaction, and environmental also have been studied. Very few studies in the literature examined the impact of task factors (such as the technology fit) on patient HIT utilization. Moreover, most studies in the literature failed to employ any theory or framework to guide the selection of factors that impact the utilization (Or and Karsh, 2009). This study will attempt to fill this gap by examining the task factors using the TTF model as a theoretical framework.

Gibbons (2011) argues that measuring success or failure in HIT utilization for disease self-management among diverse populations requires conducting ongoing surveillance and monitoring of national progress. He also points out that obtaining accurate estimates of HIT adoption and utilization will be a significant challenge due to the wide diversity in the types of technologies, types of users, and settings in which HIT may be employed. This study will add to the existing body of knowledge in attempts to overcome these challenges by including different types of technologies and users. Also, it will assist in providing estimates for HIT adoption and utilization at the national level since that data that will be used in this study are nationally representative.

Rational for Study

Few quantitative studies in the literature examine the patterns of patient HIT utilization for disease self-management in the context of the TTF theory. The purpose of

this quantitative descriptive correlational study was to explore the factors that impact patient utilization of HIT for disease self-management. Specifically, this study was conducted to quantitatively examine the relationship between TTF and patient HIT utilization.

Results from this study can guide more research on HIT's design, education, and policy making. Developing a clear understanding for the concept of HIT from the patients' perspective can help guide more research about how patients' view their health to be managed. The patterns and barriers that were examined in this study can inform the developers about patients' expectations as a stakeholder when designing patients HITs. Moreover, these study results can help healthcare providers better view their patients as partners and encourage them to be more active participants in their own healthcare. From a policy standpoint, considering the patients' perspective when implementing HITs will help healthcare providers to be more compliant with the federal requirement of "Meaningful Use," which requires implementing HITs that engage patients and family, empower individuals, and improve care coordination.

Conclusion

Health information technologies used by patients have a fairly well-known advantage. They can promote patient-centered healthcare, improve patient-provider communication, and educate patients through readily accessible health information. However, patient utilization of HIT remains low and involves changes at different levels including patients, healthcare providers, and healthcare organizations, all barriers for patients' HIT utilization identified in the literature. As healthcare increasingly becomes

high tech, the challenge for healthcare professionals, especially nurses, is to advocate and promote the implementation of HITs that are driven by individual patient needs.

CHAPTER III

Methodology

The purpose of this research study was to explore the factors that impact patients' utilization of Health Information Technology (HIT) for disease self-management. In addition, this study explored the relationship between Task-Technology Fit (TTF) and patient utilization of HIT for disease self-management. In this chapter, a description of the study design, data collection methods and instrument, sampling, and data analysis plan are presented.

Research Design

A quantitative descriptive correlational research design was used in this study to explore the relationship between patient characteristics and TTF and utilization of HIT for disease self-management among patients with chronic disease. The aim of the descriptive correlational design was to describe relationships among variables rather than to support inferences of causality. Correlational research design is often efficient in that it may involve collecting a large amount of data about a problem. It allows collection of extensive information about a specific health problem of a large number of individuals. Researchers may discover a large number of interrelationships in a relatively short amount of time (Polit and Beck, 2017).

Data source

Data from the most recent version of Health Information National Trends Survey (referred to as HINTS 5, Cycle 2) were used for this study. The HINTS is a nationally representative survey that has been administered every few years by the National Cancer Institute since 2003 (National Cancer Institute, 2018). The purpose of HINTS is to track

trends in the public's rapidly changing use of new communication technologies while charting progress in meeting health communication goals in terms of the public's knowledge, attitudes, and behaviors (Nelson et al., 2004). Specifically, this analysis used the second round of data collection for HINTS 5 (Cycle 2) collected from January through May, 2018. HINTS is one of the most comprehensive national-level datasets currently in existence and various health behavior fields use HINTS data. Research is conducted and findings published in the different scientific journals for several years after each successive survey (Lustria, Smith, & Hinnant, 2011). Program planners use HINTS data to identify barriers to health information usage across populations and to create more effective communication strategies. Social scientists utilize the data to test their theories of health communication in the information age and to provide recommendations for theory-driven interventions aimed at improving population health (Finney et al., 2012). Detailed descriptions of the HINTS instrument survey development, design, cognitive testing, and validity are available in the HINTS final report of 2007 (Cantor et al., 2009; Nelson et al., 2004). Data from HINTS 5, Cycle 2 were analyzed after obtaining permission to use the datasets from the National Cancer Institute.

Research Questions

1. What are the patterns and trends of HIT utilization among the U.S. population?
2. What is the relationship between patient demographics and their utilization of HITs for disease self- management?
3. What is the relationship between perceived TTF and patient utilization of HIT for disease self-management?

4. What is the relationship between patient demographics and access to their online medical records?

Study Aims

To describe the patterns and trends of HITs utilization among the U.S. population.

To examine the relationships between patient demographics and their utilization of the different HITs for disease self-management.

To examine the relationship between TTF and patient HITs utilization.

To examine the relationship between demographics and patients access to their online medical records.

Setting

Sample. The HINTS's target population is adults aged 18 or older in the civilian non-institutionalized population of the United States. The survey was collected exclusively via mailed questionnaires. A nationally representative listing of home addresses was used as the sampling frame (National Cancer Institute, 2018).

To reduce sampling error and ensure a greater level of representation of minority sub-groups, a stratified random sampling method was used to collect HINTS data. When there is homogeneity within strata and heterogeneity between strata, the estimates can be as precise as with the use of simple random sampling (Dudovskiy, 2011).

The sampling frame of addresses was placed into two explicit sampling strata: high concentrations of minority population and low concentrations of minority population. The goal of creating high- and low-minority strata and then oversampling the high-minority stratum is to increase the precision of estimates for minority subpopulations. The advantages in precision stem from the increase in sample sizes for

the minority subpopulations produced by the oversampling (National Cancer Institute, 2018).

Survey Eligibility and Data Collection. The collected surveys were reviewed to ensure they were eligible for inclusion in the final dataset. A total of 3,504 surveys were determined to be eligible out of the 3,547 total surveys returned. Survey inclusion in the final data set was determined by the age of the respondent, completion, and duplication (more than one questionnaire returned from the same household). Surveys completed by respondents who were 18 years old and above were considered eligible. Returned surveys were considered complete if at least 80% of the required questions in Sections A and B were answered. A survey was considered partially complete if the respondent answered between 50% and 79% of the questions in Sections A and B. Only 70 returned surveys identified as partially completed questionnaires. Both partially completed and completely answered surveys were included in the final data set. A total of 62 ineligible surveys were excluded from the final data set (2 surveys were completed by respondents who reported an age below 18, 2 were suspicious, 19 surveys were determined to be incomplete, 20 identified as duplicates). The final sample size (N=3,504) (National Cancer Institute, 2018).

Patient participants. The HINTS' target population included adults aged 18 or older in the civilian non-institutionalized population of the United States. The survey was collected exclusively via mailed questionnaires. A nationally representative listing of home addresses was used as the sampling frame (National Cancer Institute, 2018). Data collection for participants also occurred over 4 months (from January 26 through May 2, 2018) with a goal of obtaining 3,500 completed questionnaires. For this study, variables

from the following sections of HINTS5, Cycle 2 survey have been used for data analysis: Section A. Looking for Health Information; Section B. Using the Internet to Find Information; Section D. Medical Records; and Section O. You and Your Household to retrieve data about participant's demographics.

Measures of Interest

The independent variables for this study included patient demographics and the perceived task- technology fit. The demographic independent variables for the patients are included in the last three pages of the HINTS5, cycle 2 instrument.

According to Goodhue & Thompson (1995), TTF is defined as the extent to which a technology helps an individual in accomplishing his or her set of tasks. The perception of TTF is measured by the users' evaluation of how the different degree of the perception is associated with different outcomes (Goodhue & Thompson, 1995; Gu & Wang, 2009). The perceived TTF was measured using B8 and D11 questions that are included in the medical records section of the HINTS5 instrument (Table 1).

Table 1

Independent Variables

Demographics	Age
	Occupational Status
	Education
	Ethnicity/Race
	Gender
	Income

Perceived Task-Technology Fit	B8. Has your tablet or smartphone… a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity? b. Helped you make a decision about how to treat an illness or condition? c. Helped you in discussions with your health care provider?

The dependent variables for this study include HIT utilization and patient performance (outcome). Utilization captures employing technology in completing specific tasks. It can be measured by the frequency of use of technology and the diversity of applications employed (Goodhue & Thompson, 1995). Patient utilization of HIT for disease self-management was measured using B5, B9 and D6 questions that are included in the medical records section of the HINTS5, cycle 2 instrument.

Performance relates to the accomplishments of portfolio tasks by an individual. At any given level of utilization, a system with higher TTFs will lead to better performance since it more closely meets the task needs of the individual (Goodhue & Thompson, 1995). In this study context, patient performance outcomes were measured as the activities to accomplish the task of disease self-management. That is, disease self-management requires patients to be active partners in their healthcare delivery by being responsible for the activities that may directly affect their health, such as making lifestyle changes, tracking and reporting health status changes, and keeping medication schedule (Lorig & Holman, 2003). Moreover, self-management skills involve recognizing health

problems, seeking solutions by using information sources, collaborating with providers, changing behavior, and evaluating information (Kinney et al., 1989). Performance was measured using the D6 question that is included in the HINTS 5, cycle 2 instrument.

Table 2

Dependent Variables

Utilization	B5. In the past 12 months, have you used a computer, smartphone, or other electronic means to do any of the following? a. Looked for health or medical information for yourself b. Looked for health or medical information for someone else c. Bought medicine or vitamins online d. Looked for assistance for the care that you provide for someone else e. Used e-mail or the Internet to communicate with a doctor or a doctor's office f. Tracked health care charges and costs g. Looked up medical test results B9. Other than a tablet or smartphone, have you used an electronic device to monitor or track your health within the last 12 months? Examples include Fitbit, blood glucose meters, and blood pressure monitors.
Performance	D6. How many times did you access your online medical record in the last 12 months? 1 to 2 times 3 to 5 times 6 to 9 times 10 or more times

Data Analysis

For this quantitative research study, the Statistical Package for Social Sciences (SPSS, Version 25) was used for data analysis. Descriptive and inferential statistics were applied. To calculate the quantitative characteristics of the sample population, frequencies, percentages, and means were calculated for the demographic variables including age, occupational status, education, ethnicity/race, gender, and income. Sample descriptive statistics were compared against population demographics to determine of the sample was representative of the overall population.

The next step was conducting the appropriate inferential statistics. For this study, binary logistic regression was used to examine the relationship between respondents demographic characteristics including age, occupational status, education, ethnicity/race, gender, income and perceived TTF that was associated with patient self-management performance and HIT utilization behaviors including (1) using a computer, smartphone, or other electronic means for disease self-management activities; (2) using an electronic device to monitor or track health; and (3) number of access times to online medical record. Logistic regression has been previously utilized in research studies that used HINTS datasets.

Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained from the University of San Diego before conducting the study (Appendix B). HINTS is a de-identified dataset and was used for analysis in this study. HINTS datasets are public and free for use by researchers.

CHAPTER IV

Results

The purpose of this study was to explore the factors that impact patient utilization of Health Information Technologies (HITs) for disease self-management. Specific research aims addressed by the study included:

To describe the patterns and trends of HITs utilization among the U.S. population.

To examine the relationships between patient demographics and their utilization of the different health information technologies for disease self-management.

To examine the relationship between Task-Technology Fit and patient HIT utilization.

To examine the relationship between demographics and patient access to their online medical records.

Data Management Procedure

For the purpose of analysis, a new, reduced data set was created that included the variables of interest. Missing values recoded according to HINTS5, Cycle 2 codebook using the missing function (range plus one optional discrete missing value: low = -9, high= -1). For some variables, inapplicable responses were coded as system missing and were excluded from the analysis.

The Missing Completely at Random (MCAR) procedure was conducted using SPSS to determine that the missing data in participants' demographics was completely random. Demographic variables in the MCAR procedure included gender, age, income, education level, and employment status. The results were not significant (test has a significance level of $P>0.085$) (Tables 3 & 4).

Table 3

Univariate Statistics for MCAR test

	N	Mean	Std. Deviation	Missing		No. of Extremes[a,b]	
				Count	Percent	Low	High
B5a_recoded	2721	.8501	.35708	2	.1	.	.
B5b_recoded	2715	.6737	.46896	8	.3	0	0
B5c_recoded	2702	.3101	.46264	21	.8	0	0
B5d_recoded	2712	.2094	.40698	11	.4	.	.
B5e_recoded	2715	.4611	.49858	8	.3	0	0
B5f_recoded	2716	.4061	.49120	7	.3	0	0
B5g_recoded	2714	.4510	.49768	9	.3	0	0
B9_recoded	2709	.4164	.49305	14	.5	0	0
AgeGrpB	2673			50	1.8		
RaceEthn5	2523			200	7.3		
HHInc	2471			252	9.3		
SelfGender	2549			174	6.4		
Education	2696			27	1.0		
Occupation Status	2661			62	2.3		

a, b Univariate Statistics for MCAR test.

Table 4

Estimation Maximization Means for MCAR test.

EM Means[a]							
B5a recoded	B5b recoded	B5c recoded	B5d recoded	B5e recoded	B5f recoded	B5g recoded	B9 recoded
.8670	.6983	.3171	.2122	.4679	.4124	.4522	.4210

a. Little's MCAR test: Chi-Square = 99.002, DF = 81, Sig. = .085

The initial sample size for HINTS5, Cycle 2 was (*N*=3,504). For the purpose of this study, analyses were restricted to those participants who responded to the set of questions indicating they used different HITs and had access to online EMRs. For the research questions 2 and 3, "What is the impact of patient demographics on their utilization of HITs for disease self- management?" and "What is the impact of perceived Task-Technology Fit on the patient utilization of the Health Information Technology for disease self-management?" the analysis was restricted to those who answered "Yes" to any question in B5 (a - g) and B9 (Question B5: In the past 12 months, have you used a computer, smartphone, or other electronic means to do any of the following?

a. Looked for health or medical information for yourself

b. Looked for health or medical information for someone else

c. Bought medicine or vitamins online

d. Looked for assistance for the care that you provide for someone else

e. Used e-mail or the Internet to communicate with a doctor or a doctor's office

f. Tracked health care charges and costs

g. Looked up medical test results

Question B9: Other than a tablet or smartphone, have you used an electronic device to monitor or track your health within the last 12 months? Examples include Fitbit, blood glucose meters, and blood pressure monitors). The resulted new sample size was (*N*=2,723). This represents a reduction of approximately 23% in the original sample size (781 participants reported that they did not use any type of HIT for any reason).

For the research question number 3, "What is the impact of patient demographics on the frequency of access to EHR?" the analysis was restricted to those who only

reported they had been offered access to EHRs. Out of the 3,504 participants, 1,863 participants reported they had been offered online access to their medical records by their healthcare provider or health insurance (Figure 2).

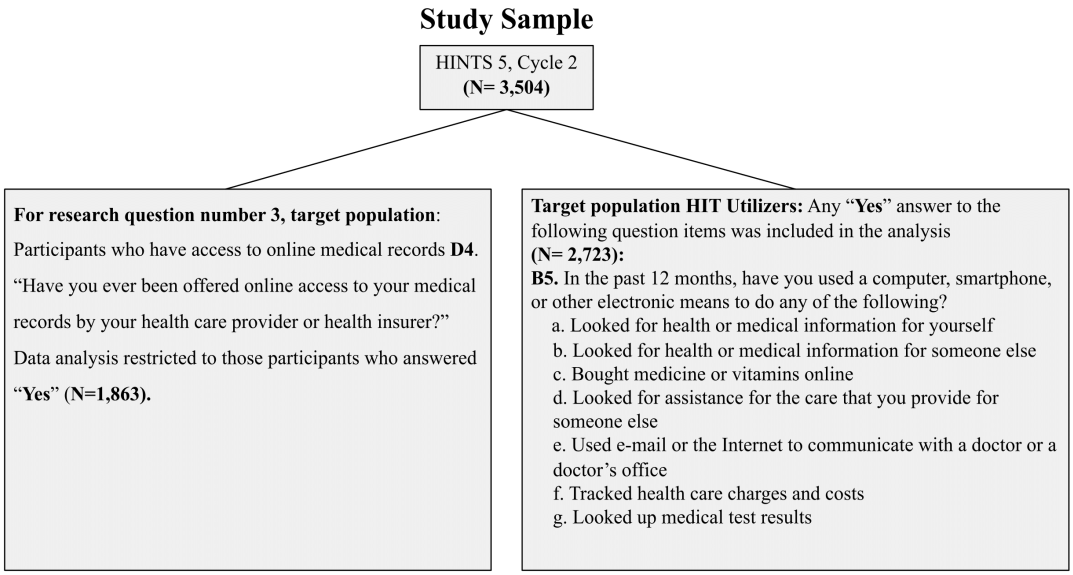

Figure 2. Study Sample

Research Questions

1. What are the patterns and trends of HIT utilization among the U.S. population?
2. What is the relationship between patient demographics and their utilization of HIT for disease self- management?
3. What is the relationship between perceived TTF and patient utilization of the HIT for disease self-management?
4. What is the relationship between patient demographics and access to their online medical records?

Data Analysis

The Statistical Package for the Social Sciences (SPSS) software package version 25 was used for data analysis in this study. The first set of analyses explored patient demographics (age, gender, race, income, education level, and employment status). In addition, a descriptive analysis conducted to describe the current patterns of different HITs' tools utilization. In the second set of analyses and for each research question, a binary logistic regression model was formulated to describe data and explain any relationships among each of the dependent binary variables and the independent variables.

Results

Sample Demographics

Although there was variation in the sociodemographic characteristics of respondents to HINTS5, Cycle 2, the sample was not generally representative of the U.S. population. Respondents in the sample tended to be male (59.6%), between 50 and 64 years old (33.4%), non-Hispanic White (65%), with an education level of college graduate or higher (50.8%), employed (55.8%), and had higher incomes of $75,000 or more (41.8%) (Table 5). Also see figures 3 to 6.

Table 5

Sample Demographics

Demographic Variable *N*= 2,723	**(%, *N*)**
Age, mean ± SD	54.1 ± 16.1
18-34	14.1% (377)
35-49	22.4% (598)
50-64	33.4% (894)
65-74	20.4% (544)
75+	9.7% (260)
Gender	
Male	59.6% (1518)
Female	40.4% (1031)
Race	
non-Hispanic White	65% (1639)
non-Hispanic Black or African American	12.8% (322)
Hispanic	13.4% (338)
non-Hispanic Asian	4.6% (116)
non-Hispanic Other	4.3% (108)
Highest Education	
Less than High School	4.3% (117)
High School Graduate	14.2% (383)
Some College	30.6% (826)
College Graduate or More	50.8% (1370)
Income	
Less the $20,000	13.5% (334)
$20,000 to < $35,000	12.2% (302)
$35,000 to < $50,000	12.8% (316)
$50,000 to < $75,000	19.7% (486)
$75,000 or more	41.8% (1033)
Occupational Status	
Employed	55.8% (1484)
Unemployed	44.2% (1177)

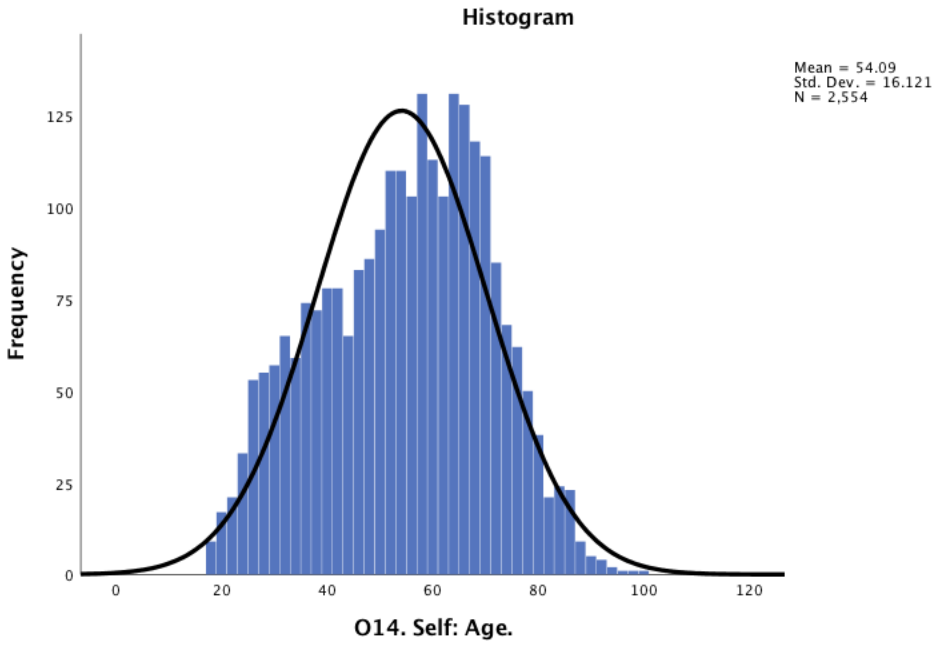

Figure 3. Sample Age.

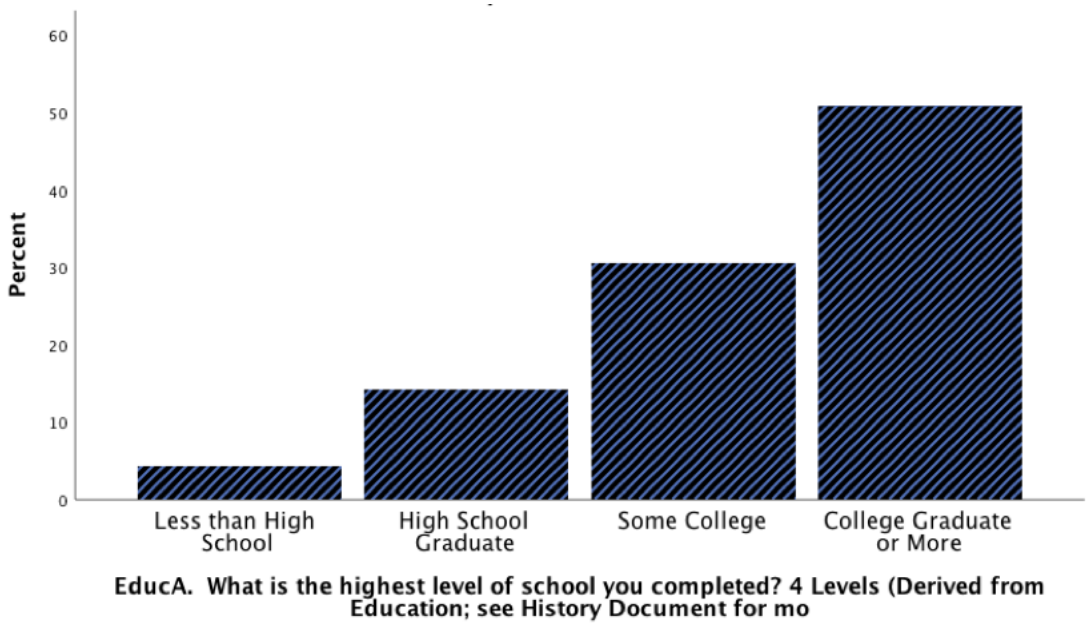

Figure 4. Sample Education Level.

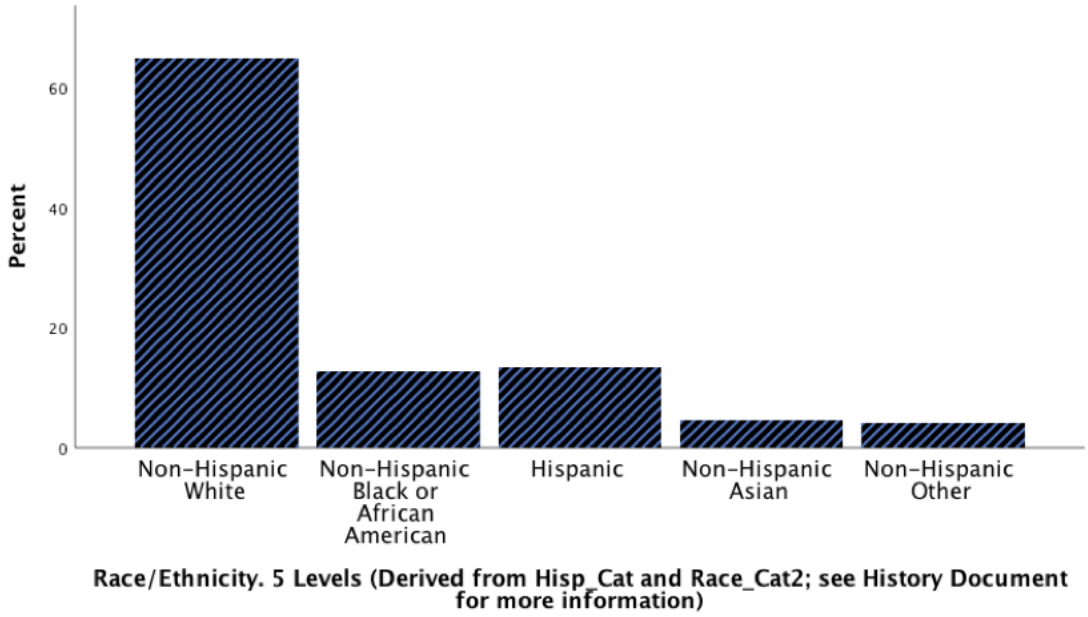

Figure 5. Sample Race/ Ethnicity.

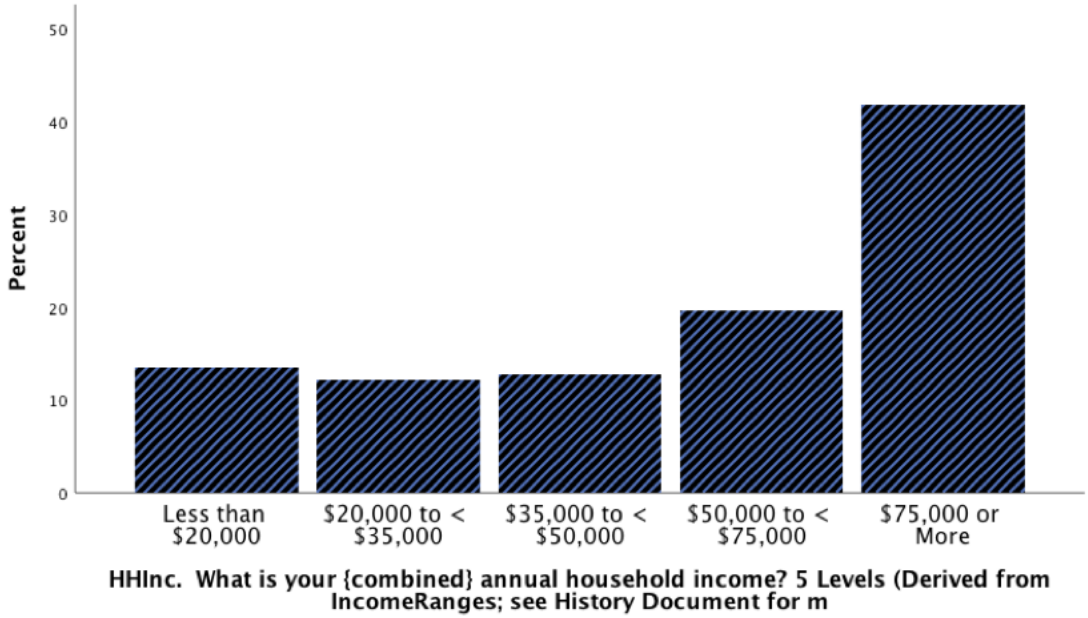

Figure 6. Sample Annual Household Income.

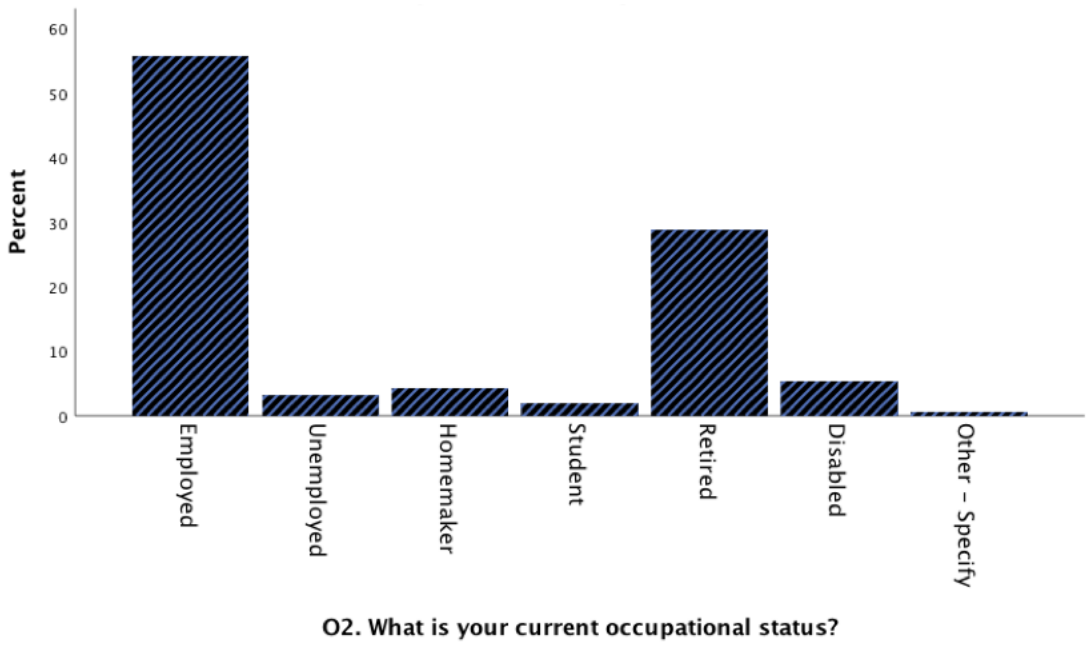

Figure 7. Employment Status.

HITs Utilization Patterns

Research question 1: What are the patterns and trends of HIT utilization among the U.S. population?

For this study, the term Health Information Technologies (HITs) include the use of Internet, health applications, computer or mobile devices (smartphones and tablets), electronic health records (EHRs), and electronic communication (E-mail, text messaging, social media, and video conferencing) to access and share health-related information or services. As noted previously, leveraging the knowledge about the frequency and extent of use of different HITs can improve the selection of a technology that matches the needs of the patient self-management task. Thus, a descriptive analysis was conducted to describe the current patterns of HIT utilization.

HITs Utilization and Perceived TTF

Internet use and Looking for Health Information. The majority of the participants (77.7%) reported using the Internet as their first choice when looking for information about health or medical topics compared to other resources such as books, brochures, or doctors (Figure 8).

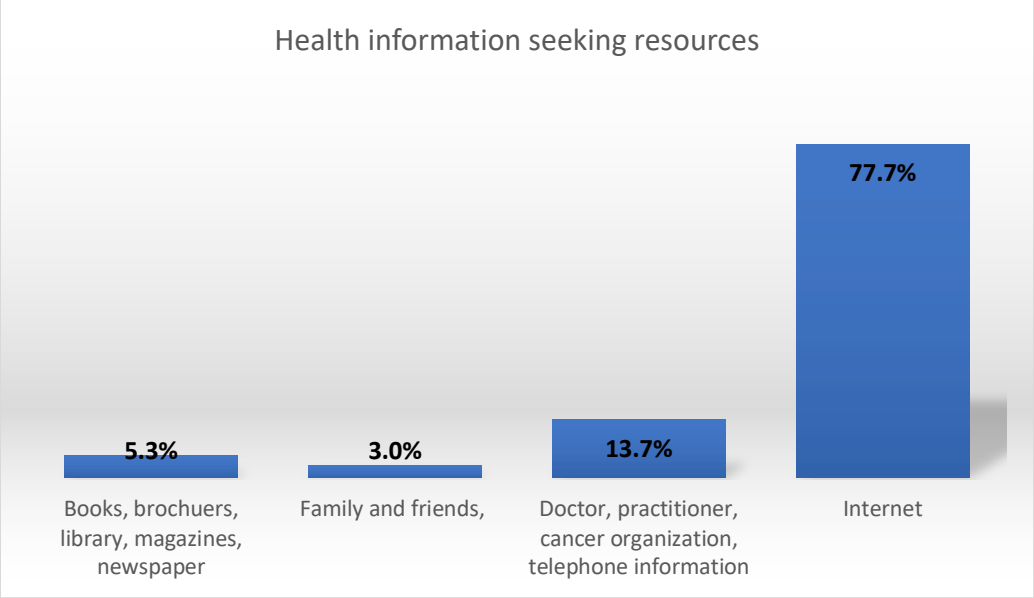

Figure 8. Resources usage for seeking health information.

Of the participants, 73.6% used the Internet to visit a social networking site, such as Facebook or Twitter, in the last 12 months; 16.5% indicated they have used the Internet to share health information on social networking sites such as Facebook or Twitter. Only 4.2% of the participants used the Internet to write an online diary or blog (i.e. web log). Only 7.3% used the Internet to participate in an online forum or support group for people with a similar health or medical issue. About one third (37.4%) used the internet to watch health-related videos on YouTube.

Tablets, smartphones, and other electronic devices. More than half of the participants (64.5%) indicated they have a tablet computer and more than three quarters (84.8 %) indicated they have a smartphone. Nearly half of those participants (52.4%) have "Apps" related to health and wellness on their tablet or smartphone. Only 22.7% of participants indicated they shared health information with a healthcare professional from either an electronic monitoring device or smartphone within the last 12 months.

Access to Online Medical Records

Over half of the participants (61%) indicated they had been offered online access to their medical records by their healthcare provider or health insurer. Of those, 79.3% have accessed their online medical records at least once in the last 12 months.

Participants reported two main reasons for not accessing their online medical records within the last 12 months: 1) they preferred "to speak to a provider directly" (77.6%) and 2) they "perceived lack of need" (63.6%). Additionally, 16.2% of participants indicated concerns related to privacy and security of online medical records as a reason for not accessing their online medical record, while 16.7% reported they did not access their online medical records for other reasons such as difficult access, computer down, did not remember, forgot login information, have not taken time to figure out, have not visited a doctor in more than 10 years, never took the time to set it up and login, in process of setting it up, inexperienced computer user, insurance provider change, just lazy, not comfortable, not interested, not sure how to do it, problems with set up, too complicated, and unaware of possibility . Only 10.4% of the participants indicated they do not have an online medical record. (Figure 9).

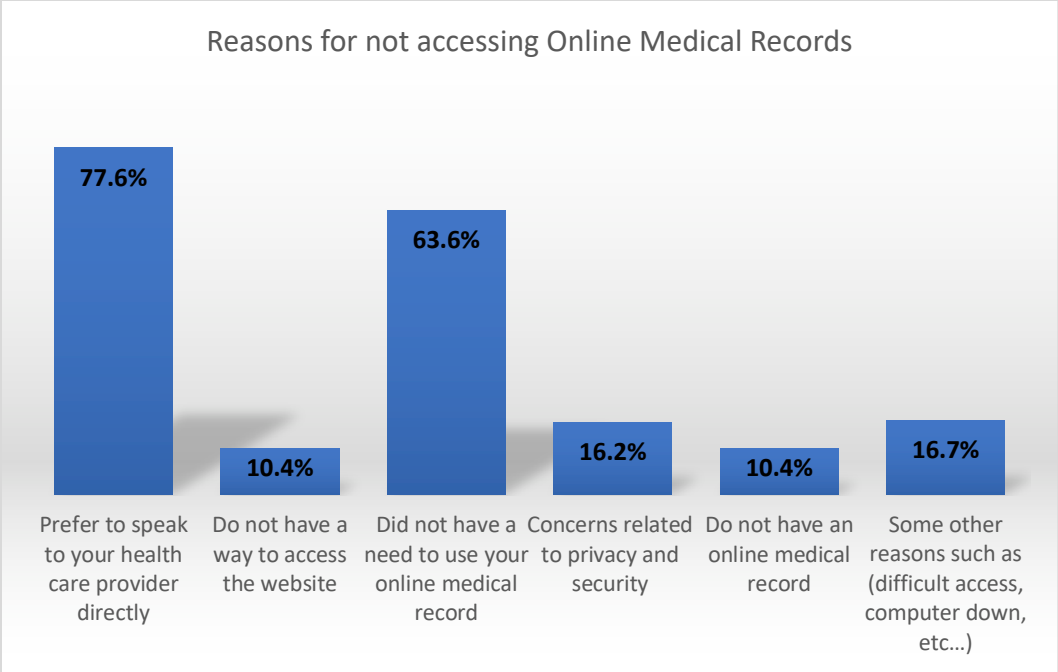

Figure 9. Reasons for not accessing Online Medical Records.

Online Medical Records Utilization

About two in five participants indicated they have used their online medical records in the last 12 months to request a refill of medications (40.7%) and to fill out forms or paperwork related to their healthcare (40.7%). About one in four indicated they used online medical records to help them to make a decision about how to treat an illness or condition (25.3%); to add health information to share with their healthcare provider such as health concerns, symptoms, and side effects (25%); and to download their health information to their computer or mobile device (27.4%). Half of the participants (50%) indicated they used their online medical records in the last 12 months to securely message their healthcare provider and staff (for example, e-mail). Only 7.5% used the online medical records to request correction of inaccurate information (Figure 10).

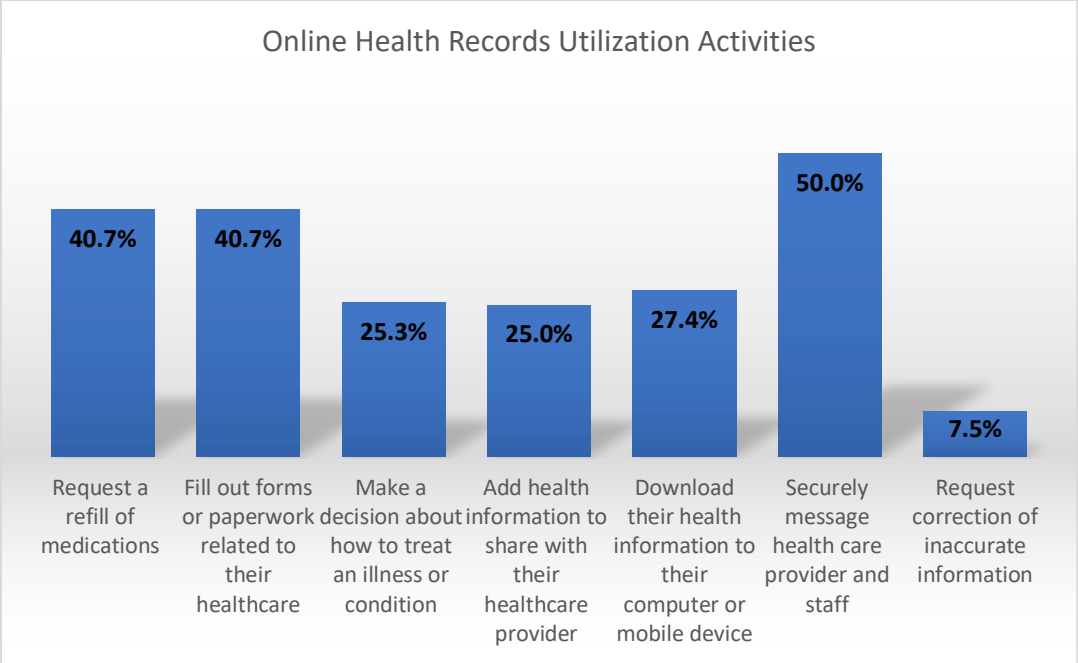

Figure 10. Online Health Records Utilization Activities.

Research question 2. What is the impact of patient demographics on their utilization of HITs for disease self-management?

Research question 3. What is the impact of perceived Task-Technology Fit on the patient utilization of the Health Information Technology for disease self-management? (TTF and utilization).

B5. In the past 12 months, have you used a computer, smartphone, or other electronic means to do any of the following?

B5a. Looked for health or medical information for yourself.

Demographics: There was a significant positive relationship among different age groups (except for patients 65-74 years old, *P*-value= 0.376) and using computer, smartphone or other electronic means to look for health information for themselves (Table 4). Patients 18-34 had the greatest odds of using electronic means to look for

health information (*OR* 2.53, 95% CI 1.29- 4.96) compared to those patients 75 years or older. Gender was also significant predictor; female patients were more likely to utilize electronic means to look for health information compared to male patients (*OR* 1.60, 95% CI 1.20- 2.14). High school graduates were less likely to utilize HIT to look for health information compared to college graduates (*OR* 0.49, 95% CI 0.32- 0.73). Non-Hispanic Black or African Americans had the lowest odds (*OR* 0.37, 95% CI 0.14- 0.96) to utilize HIT compared to all other non-Hispanic patients. No significant difference was found among other ethnic groups. Income and employment status were not significant predictors for utilizing HIT to look for health information.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools for looking for health information. Patients who answered "Yes" to using HIT tools, such as tablets or smartphones, to help them to track progress on a health-related goal (*OR* 1.72, 95% CI 1.22- 2.43), help them to make a decision about how to treat an illness (*OR* 2.81, 95% CI 1.90- 4.16), or help them in discussions with healthcare provider (*OR* 3.23, 95% CI 2.13- 4.92) were more likely to utilize such HIT tools compared to those patients who answered "No." (Table 6).

Table 6

Looked for health or medical information for yourself

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age**.** Reference: 75 or older		
18-34	2.53 (1.29, 4.96)	< 0.007
35-49	2.39 (1.27, 4.49)	< 0.007
50-64	2.47 (1.39, 3.40)	< 0.002
65-74	1.27 (0.749, 2.145)	< 0.376

Gender**.** Reference: Male		
Female	1.60 (1.20, 2.14)	< 0.001
Education**.** Reference**:** College graduate		
Less than high school	0.90 (0.40, 2.00)	< 0.795
High school graduate	0.49 (0.32, 0.73)	< 0.001
Some college	0.71 (0.51, 1.00)	< 0.054
Annual Income**.** Reference: $75,000 or more		
less than $20,000	0.93 (0.56, 1.55)	<0.785
$20,000 to < $30,000	01.26 (0.76, 2.06)	< 0.369
$35,000 to < $50,000	0.88 (0.56, 1.37)	< 0.564
$50,000 to < $75,000	0.87 (0.58, 1.28)	< 0.471
Race/ Ethnicity**.** Reference: Non-Hispanic all other		
White	0.58 (0.24, 1.40)	0.229
Black or African American	0.37 (0.14, 0.96)	0.041
Hispanic	0.47 (0.18, 1.20)	0.113
Asian	0.51 (0.18, 1.50)	0.225
Occupational Status**.** Reference**:** Employed		
Unemployed	0.89 (0.61, 1.29)	0.534
B8. Has your tablet or smartphone? Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.72 (1.22, 2.43)	<0.002
b. Helped you make a decision about how to treat an illness or condition?	2.81 (1.90, 4.16)	<0.001
c. Helped you in discussions with your health care provider?	3.23 (2.13, 4.92)	<0.001

B5b. Looked for health or medical information for someone else

Demographics: There was a significant positive relationship among different age groups (except for patients 65-74 years old, *P*-value= 0.129) and using a computer, smartphone or other electronic means to look for health information for someone else. Patients 35-49 had the greatest odds of using electronics to look for health information

for someone else (*OR* 3.53, 95% CI 2.17- 5.76) compared to those patients 75 years or older. Gender was also significant; female patients were more likely to utilize electronic means to look for health information for someone else compared to male patients (*OR* 1.60, 95% CI 1.29, 1.97). High school graduates were less likely to utilize HIT to look for health information for others compared to college graduates (*OR* 0.61, 95% CI 0.44- 0.83). An inverse significant relationship existed between income and utilizing HIT to look for health or medical information for someone else. Patients with income less than $20,000 (*OR* 0.68, 95% CI 0.47- 0.99) had the lowest odds of utilizing HIT to look for information for someone else. Race/ethnicity and employment status were not significant predictors in utilizing any HIT means to look for health information for someone else.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools for looking for health information for someone else. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to make a decision about how to treat an illness (*OR* 1.84, 95% CI 1.45- 2.35) or helped in discussions with a healthcare provider (*OR* 1.64, 95% CI 1.28- 2.10) were more likely to utilize such HIT tools to look for health information for someone else compared to those patients who answered "No." There was no significant difference was found among patients who answered "Yes" to the question of whether HIT helped them to track progress on a health-related goals compared to those who answered "No." (*P-value*= 0.103) (table 7).

Table 7

Looked for health information, someone else

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	2.43 (1.47, 4.00)	< 0.001
35-49	3.53 (2.17, 5.76)	< 0.001
50-64	2.22 (1.42, 3.48)	< 0.001
65-74	1.40 (0.91, 2.16)	< 0.129
Gender. Reference: Male		
Female	1.60 (1.29, 1.97)	< 0.001
Education, Reference: College graduate		
Less than high school	0.88 (0.49, 1.55)	< 0.646
High school graduate	0.61 (0.44, 0.83)	< 0.002
Some college	0.85 (0.67, 1.09)	< 0.191
Annual Income. Reference: $75,000 or more		
less than $20,000	0.68 (0.47, 0.99)	<0.043
$20,000 to < $30,000	0.70 (0.50, 1.00)	< 0.048
$35,000 to < $50,000	0.75 (0.554, 1.04)	< 0.085
$50,000 to < $75,000	1.11 (0.83, 1.49)	< 0.485
Race/Ethnicity. Reference: Non-Hispanic all other		
White	1.47 (0.90, 2.38)	0.123
Black or African American	0.85 (0.50, 1.47)	0.567
Hispanic	1.24 (0.72, 2.14)	0.432
Asian	1.75 (0.89, 3.46)	0.107
Occupational Status Reference: Employed		
Unemployed	0.87 (0.67, 1.13)	0.305
B8. Has your tablet or smartphone. Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.21 (0.96, 1.52)	0.103

b. Helped you make a decision about how to treat an illness or condition?	1.84 (1.45, 2.35)	<0.001
c. Helped you in discussions with your health care provider?	1.64 (1.28, 2.10)	<0.001

B5c. Bought medicine or vitamins online

Demographics: Patients 18-34 were less likely to utilize HIT to buy medicine or vitamins online (*OR* 0.56, 95% CI 0.34- 0.92) compared to those 75 years and older. No significant differences were found among other age groups. High school graduates were less likely to utilize HIT to buy vitamins or medicine compared to college graduates (*OR* 0.71, 95% CI 0.51- 0.98). Patients with an income of less than $20,000 had the lowest odds of using HIT to buy vitamins or medicine online (*OR* 0.59, 95% CI 0.40- 0.87) compared to those who reported an income of $75,000 or more. Gender, race/ethnicity, and employment status were not significant predictors for utilizing any HIT to buy vitamins or medicine online.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools to buy vitamins or medicine online. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to make a decision about how to treat an illness (*OR* 1.33, 95% CI 1.07- 1.65) or helped in discussions with a healthcare provider (*OR* 1.59, 95% CI 1.28- 1.98) were more likely to utilize such HIT tools to buy vitamins or medicine online compared to those patients who answered "No." There were no significant differences found between patients who responded "Yes" to the question of whether HIT helped them to track progress on a health-related goal compared to those who answered "No." (*P-value*= 0.114) (Table 8).

Table 8

Bought Medicine or Vitamins Online

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	0.56 (0.34, 0.92)	< 0.022
35-49	0.76 (0.47, 1.22)	< 0.256
50-64	0.82 (0.52, 1.29)	< 0.389
65-74	0.84 (0.54, 1.32)	< 0.451
Gender. Reference: Male		
Female	1.16 (0.95, 1.42)	< 0.140
Education. Reference: College graduate		
Less than high school	0.69 (0.38, 1.27)	< 0.237
High school graduate	0.71 (0.51, 0.98)	< 0.038
Some college	0.81 (0.64, 1.02)	< 0.068
Annual Income. Reference: $75,000 or more		
less than $20,000	0.59 (0.40, 0.87)	<0.006
$20,000 to < $30,000	0.58 (0.41, 0.83)	< 0.003
$35,000 to < $50,000	0.72 (0.53, 0.99)	< 0.044
$50,000 to < $75,000	0.76 (0.58, 0.98)	< 0.035
Race/Ethnicity. Reference: Non-Hispanic all other		
White	0.94 (0.58, 1.51)	0.801
Black or African American	0.68 (0.40, 1.18)	0.172
Hispanic	1.08 (0.64, 1.83)	0.777
Asian	0.93 (0.49, 1.74)	0.810
Occupational Status Reference: Employed		
Unemployed	1.07 (0.84, 1.38)	0.586

B8. Has your tablet or smartphone Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.19 (0.96, 1.46)	0.114
b. Helped you make a decision about how to treat an illness or condition?	1.33 (1.07, 1.65)	<0.010
c. Helped you in discussions with your health care provider?	1.59 (1.28, 1.98)	<0.001

B5d. Looked for assistance for the care that you provide for someone else

Demographics: There was a significant positive relationship among different age groups (except for patients 65-74, *P*-value= 0.080) and using computer, smartphone or other electronic tools to look for assistance for the care that they provide to someone else. Patients 35-49 were 5 times more likely to utilize HIT to look for assistance for the care they provide to someone else (*OR* 5.19, 95% CI 2.44-11.04) compared to those 75 years and older. High school graduates had the lowest odds (*OR* 0.50, 95% CI 0.33- 0.76) and were less likely to utilize HITs to look for assistance for the care they provide to someone else compared to college graduates. Gender, income, race/ethnicity, and employment status were not significant for using HIT to look for assistance for care provided to someone else.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools to look for assistance for the care provided to someone else. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to make a decision about how to treat an illness (*OR* 2.03, 95% CI 1.59- 2.60) or helped in discussions with healthcare providers (*OR* 1.54, 95% CI 1.20- 1.98) were more likely to utilize such HIT tools to looked for assistance for the care they provided to someone else compared to those patients who answered "No."

There was no significant difference found between patients who answered "Yes" to the question asking if HIT helped them to track progress on a health-related goal compared to those who answered "No." (*P-value*= 0. 314). (Table 9).

Table 9

Looking assistance for the care provided to someone else

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	3.27 (1.51, 7.06)	< 0.003
35-49	5.19 (2.44, 11.04)	< 0.001
50-64	3.03 (1.44, 6.37)	< 0.003
65-74	1.97 (0.92, 4.21)	< 0.080
Gender. Reference: Male		
Female	1.15 (0.92, 1.45)	< 0.226
Education. Reference: College graduate		
Less than high school	0.58 (0.29, 1.16)	< 0.122
High school graduate	0.50 (0.33, 0.76)	< 0.001
Some college	0.77 (0.60, 1.00)	< 0.053
Annual Income. Reference: $75,000 or more		
less than $20,000	1.00 (0.66, 1.52)	<0.994
$20,000 to < $30,000	0.83 (0.55, 1.25)	< 0.378
$35,000 to < $50,000	0.70 (0.48, 1.03)	< 0.069
$50,000 to < $75,000	0.79 (0.58, 1.069)	< 0.125
Race/Ethnicity. Reference: Non-Hispanic all other		
White	0.98 (0.57, 1.70)	0.951
Black or African American	0.94 (0.51, 1.75)	0.852
Hispanic	1.22 (0.67, 2.22)	0.519
Asian	1.26 (0.62, 2.53)	0.524
Occupational Status. Reference: Employed		
Unemployed	1.12 (0.84, 1.48)	0.444

B8. Has your tablet or smartphone. Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.13 (0.89, 1.43)	0.314
b. Helped you make a decision about how to treat an illness or condition?	2.03 (1.59, 2.60)	<0.001
c. Helped you in discussions with your health care provider?	1.54 (1.20, 1.98)	<0.001

B5e. Used e-mail or the Internet to communicate with a doctor or a doctor's office.

Demographics: Age, gender, race/ethnicity, and employment status were not significant predictors for utilizing HIT means to communicate with a physician or a physician's office via e-mail or the Internet. Patients with less than a high school education had the lowest odds (*OR* 0.52, 95% CI 0.29- 0.93) and were less likely to utilize HIT as means to communicate with a physician or a physician's office via e-mail or the Internet compared to college graduates. Patients with an income of less than $30,000 (*OR* 0.46, 95% CI 0.33, 0.64) had the lowest odds of using HIT as means to communicate with a physician or a physician's office via e-mail or the Internet compared to those who reported an income of $75,000 or more.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools to communicate with a physician or a physician's office via e-mail or the Internet. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to track progress on a health-related goal (*OR* 1.30, 95% CI 1.06-1.60) or helped in discussions with a healthcare provider (*OR* 3.37, 95% CI 2.71- 4.20) were more likely to utilize such HIT tools to communicate with a physician or a physician's office via e-mail or the Internet compared

to those patients who answered "No." There was no significant difference found between patients who answered "Yes" to the question that HIT utilization helped them to make a decision about how to treat an illness compared to those who answered "No." (*P-value*= 0. 175). (Table 10).

Table 10

Used email or Internet to communicate with a physician/physician's office

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	1.28 (0.78, 2.10)	< 0.325
35-49	1.33 (0.83, 2.14)	< 0.242
50-64	1.24 (0.79, 1.95)	< 0.356
65-74	1.18 (0.75, 1.85)	< 0.472
Gender. Reference: Male		
Female	1.04 (0.86, 1.27)	< 0.679
Education. Reference: College graduate		
Less than high school	0.52 (0.29, 0.93)	< 0.026
High school graduate	0.58 (0.43, 0.79)	< 0.001
Some college	0.70 (0.56, 0.87)	< 0.001
Annual Income. Reference: $75,000 or more		
less than $20,000	0.46 (0.32, 0.66)	<0.001
$20,000 to < $30,000	0.46 (0.33, 0.64)	< 0.001
$35,000 to < $50,000	0.57 (0.42, 0.77)	< 0.001
$50,000 to < $75,000	0.68 (0.53, 0.87)	< 0.002
Race/Ethnicity. Reference: Non-Hispanic all other		
White	0.89 (0.56, 1.41)	0.608
Black or African American	0.69 (0.41, 1.17)	0.167
Hispanic	0.68 (0.41, 1.14)	0.143
Asian	0.83 (0.45, 1.53)	0.555
Occupational Status Reference: Employed		
Unemployed	1.04 (0.81, 1.32)	0.773

B8. Has your tablet or smartphone. Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.30 (1.06, 1.60)	0.011
b. Helped you make a decision about how to treat an illness or condition?	0.86 (0.69, 1.07)	<0.175
c. Helped you in discussions with your health care provider?	3.37 (2.71, 4.20)	<0.001

B5f. Tracked healthcare charges and costs

Demographics: Age, gender, and race/ethnicity were not significant predictors for utilizing HIT as a means to track healthcare charges and costs. Patients with less than a high school education had the lowest odds (*OR* 0.42, 95% CI 0.22- 0.78) or were less likely to utilize HIT as a means to track healthcare charges and costs compared to college graduates. Income level was a significant predictor. Patients with an income less than $20,000 (*OR* 0.55, 95% CI 0.38- 0.80) had the lowest odds of using HIT as a means to track healthcare charges and costs compared to those who reported an income of $75,000 or more. Also, unemployed individuals were less likely to utilize HIT as a means to track healthcare charges and costs compared to those who were employed.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools to track healthcare charges and costs. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to track progress on a health-related goal (*OR* 1.63, 95% CI 1.33- 2.00) or helped in discussions with a healthcare provider (*OR* 2.09, 95% CI 1.69- 2.59) were more likely to utilize such HIT tools to track healthcare charges and costs compared to those patients who answered "No." There was no significant difference was found between patients who answered "Yes" to the question of whether HIT utilization helped them to

make a decision about how to treat an illness compared to those who answered "No." (*P-value*= 0.061). (Table 11).

Table 11

Tracked healthcare charges

	HINTS5, Cycle 2 (*N*=2,723) *OR* (95% CI)	*P* value
Age**.** Reference: 75 or older		
18-34	1.34 (0.81, 2.21)	< 0.250
35-49	0.99 (0.61, 1.61)	< 0.970
50-64	1.08 (0.68, 1.71)	< 0.761
65-74	1.02 (0.64, 1.62)	< 0.932
Gender**.** Reference: Male		
Female	0.98 (0.81, 1.19)	< 0.824
Education**.** Reference: College graduate		
Less than high school	0.42 (0.22, 0.78)	< 0.006
High school graduate	0.48 (0.34, 0.67)	< 0.001
Some college	0.76 (0.61, 0.94)	< 0.012
Annual Income**.** Reference: $75,000 or more		
less than $20,000	0.55 (0.38, 0.80)	<0.002
$20,000 to < $30,000	0.63 (0.44, 0.88)	< 0.007
$35,000 to < $50,000	0.86 (0.63, 1.17)	< 0.332
$50,000 to < $75,000	0.98 (0.76, 1.26)	< 0.850
Race/Ethnicity**.** Reference: Non-Hispanic all other		
White	1.10 (0.69, 1.75)	0.694
Black or African American	0.75 (0.44, 1.27)	0.279
Hispanic	1.13 (0.67, 1.90)	0.642
Asian	1.50 (0.81, 2.75)	0.198
Occupational Status**.** Reference: Employed		
Unemployed	0.75 (0.59, 0.95)	0.018
B8. Has your tablet or smartphon**e.** Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.63 (1.33, 2.00)	0.001

b. Helped you make a decision about how to treat an illness or condition?	1.22 (0.99, 1.51)	<0.061
c. Helped you in discussions with your health care provider?	2.09 (1.69, 2.59)	<0.001

B5g. Looked up medical test results

Demographics: Age, gender, race/ethnicity, and employment status were not significant predictors for utilizing HIT to look up medical test results. Patients with less than a high school education had the lowest odds (*OR* 0.45, 95% CI 0.25- 0.82) or were less likely to utilize HIT as a means to look up medical test results compared to college graduates. Income level was a significant predictor. Patients with an income of less than $20,000 (*OR* 0.51, 95% CI 0.35- 0.73) had the lowest odds of using HIT as a means to look up medical test results compared to those who reported an income of $75,000 or more.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing HIT tools to look up medical test results. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to track progress on a health-related goal (*OR* 1.24, 95% CI 1.01- 1.53) or helped in discussions with a healthcare provider (*OR* 4.02, 95% CI 3.23- 5.01) were more likely to utilize such HIT tools to look up medical test results compared to those patients who answered "No." There was no significant difference found between patients who answered "Yes" to the question asking if HIT utilization helped them to make a decision about how to treat an illness compared to those who answered "No." (*P-value*= 0. 415). (Table 12).

Table 12

Looked up medical test results using HIT

	HINTS5, Cycle 2 (N=2,723) OR (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	0.84 (0.51, 1.37)	< 0.480
35-49	0.87 (0.54, 1.40)	< 0.560
50-64	1.03 (0.65, 1.63)	< 0.892
65-74	1.07 (0.68, 1.68)	< 0.764
Gender. Reference: Male		
Female	1.19 (0.98, 1.45)	< 0.080
Education. Reference: College graduate		
Less than high school	0.45 (0.25, 0.82)	< 0.009
High school graduate	0.52 (0.38, 0.72)	< 0.001
Some college	0.71 (0.57, 0.89)	< 0.003
Annual Income. Reference: $75,000 or more		
less than $20,000	0.51 (0.35, 0.73)	<0.001
$20,000 to < $30,000	0.63 (0.45, 0.88)	< 0.007
$35,000 to < $50,000	0.86 (0.63, 1.17)	< 0.003
$50,000 to < $75,000	0.98 (0.76, 1.26)	< 0.011
Race/Ethnicity. Reference: Non-Hispanic all other		
White	0.84 (0.53, 1.34)	0.468
Black or African American	0.62 (0.36, 1.05)	0.076
Hispanic	0.63 (0.46, 0.85)	0.468
Asian	0.72 (0.56, 0.93)	0.849
Occupational Status. Reference: Employed		
Unemployed	0.99 (0.77, 1.26)	0.921
B8. Has your tablet or smartphone… Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	1.24 (1.01, 1.53)	<0.039
b. Helped you make a decision about how to treat an illness or condition?	0.91 (0.73, 1.14)	<0.415
c. Helped you in discussions with your health care provider?	4.02 (3.23, 5.01)	<0.001

B9. Other than a tablet or smartphone, have you used an electronic device to monitor or track your health within the last 12 months? Examples include Fitbit, blood glucose meters, and blood pressure monitors.

Demographics: Gender, education, race/ethnicity, and employment status were not significant predictors for utilizing other HITs such as Fitbit, blood glucose meters, and blood pressure monitors as a means to monitor or track health within the last 12 months. Patients 18-34 had the lowest odds of utilizing other HITs to monitor or track their health (*OR* 0.33, 95% CI 0.20- 0.54) compared to those 75 years and older. Income level was significant predictor. Patients with an income of $35,000 to $50,000 (*OR* 0.70, 95% CI 0.51- 0.96) had the lowest odds of utilizing other HIT means to monitor or track health compared to those who reported an income of $75,000 or more.

TTF and Utilization: A significant positive relationship was found between perceived TTF and utilizing other HIT means to monitor or track health. Patients who answered "Yes" to the question of whether HIT tools, such as tablets or smartphones, helped them to track progress on a health-related goal (*OR* 4.50, 95% CI 3.63- 5.56) were 4.5 times more likely to utilize other HIT means, such as Fitbit, blood glucose meters, and blood pressure monitors, to monitor or track health compared to those patients who answered "No." In addition, patients who reported that HIT helped them in discussions with a healthcare provider (*OR* 1.67, 95% CI 1.34- 2.07) were 1.7 times more likely to utilize such HIT tools to monitor or track their health compared to those patients who answered "No." There was no significant difference found between patients who answered "Yes" to the question of whether other HIT utilization helped them to make a

decision about how to treat an illness compared to those who answered "No." (*P-value*= 0.785). (Table 13).

Table 13

Other electronic devices

	HINTS5, Cycle 2 (N=2,723) OR (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	0.33 (0.20, 0.54)	< 0.001
35-49	0.40 (0.25, 0.64)	< 0.001
50-64	0.60 (0.38, 0.94)	< 0.025
65-74	0.87 (0.56, 1.36)	< 0.548
Gender. Reference: Male		
Female	0.88 (0.72, 1.07)	< 0.189
Education. Reference: College graduate		
Less than high school	0.98 (0.55, 1.72)	< 0.932
High school graduate	0.77 (0.56, 1.06)	< 0.104
Some college	0.90 (0.71, 1.12)	< 0.341
Annual Income. Reference: $75,000 or more		
less than $20,000	0.78 (0.54, 1.12)	<0.180
$20,000 to < $30,000	0.80 (0.57, 1.13)	< 0.208
$35,000 to < $50,000	0.70 (0.51, 0.96)	< 0.029
$50,000 to < $75,000	0.83 (0.64, 1.07)	< 0.151
Race/Ethnicity. Reference: Non-Hispanic		
White	0.75 (0.47, 1.20)	0.234
Black or African American	0.75 (0.44, 1.28)	0.287
Hispanic	0.75 (0.44, 1.28)	0.279
Asian	0.79 (0.42, 1.45)	0.428
Occupational Status. Reference: Employed		
Unemployed	1.01 (0.79, 1.29)	0.958
B8. Has your tablet or smartphone. Reference: No		
a. Helped you track progress on a health-related goal such as quitting smoking, losing weight, or increasing physical activity?	4.50 (3.63, 5.56)	0.001

b. Helped you make a decision about how to treat an illness or condition?	1.03 (0.83, 1.28)	<0.785
c. Helped you in discussions with your health care provider?	1.67 (1.34, 2.07)	<0.001

Research question 4. What is the impact of patient demographics on the access to their online medical records?

Online Health Records access and patient demographics. To answer research question 4, "what is the relationship between patient demographics and access to their online medical records?," analysis was restricted to those who reported having online access to medical records "D4. Have you ever been offered online access to your medical records by your health care provider or health insurer?" (*N*= 1,863) (Figure 1). The main outcome of interest for this research question was utilizing EHR. Participants were asked: "D6. How many times did you access your online medical record in the last 12 months?", with responses categorized as "none," "1 to 2 times," "3 to 5 times," "6 to 9 times," and "10 or more times." A dichotomous variable for accessing online medical records was created by dividing respondents into "none" access and "at least once" access. A binary logistic regression model was formulated and included demographics as independent variable and the online medical record access new dichotomous variable as dependent. The results are shown in Table 10.

Regression results: Gender, race/ethnicity, and employment status were not significant predictors for accessing online medical records in the last 12 months. Patients 50-64 had the highest odds (1.64 times more likely) and were more likely to have accessed their online medical records at least once in the last 12 months (*OR* 1.64, 95%

CI 1.06- 2.52) compared to those 75 years and older. Patients with less than a high school education had the lowest odds (*OR* 0.37, 95% CI 0.20- 0.68) and were less likely to have accessed their online medical records at least once in the last 12 months compared to college graduates. Income level was also highly significant. Patients with an income of less than $20,000 (*OR* 0.43, 95% CI 0.29- 0.65) had the lowest odds of accessing their online medical records compared to those who reported an income of $75,000 or more (Table 14).

Table 14

Online medical records access

	HINTS5, Cycle 2 (*N*=1,863) *OR* (95% CI)	*P* value
Age. Reference: 75 or older		
18-34	1.66 (1.00, 2.76)	< 0.049
35-49	1.56 (0.97, 2.49)	< 0.066
50-64	1.64 (1.06, 2.52)	< 0.025
65-74	1.33 (0.88, 2.00)	< 0.182
Gender. Reference: Male		
Female	0.83 (0.67, 1.04)	< 0.107
Education. Reference: College graduate		
Less than high school	0.37 (0.20, 0.68)	< 0.001
High school graduate	0.60 (0.43, 0.84)	< 0.003
Some college	0.69 (0.54, 0.89)	< 0.004
Annual Income. Reference: $75,000 or more		
less than $20,000	0.43 (0.29, 0.65)	<0.001
$20,000 to < $30,000	0.53 (0.36, 0.77)	< 0.001
$35,000 to < $50,000	0.67 (0.47, 0.95)	< 0.024
$50,000 to < $75,000	0.68 (0.51, 0.90)	< 0.008

Race/Ethnicity. Reference: Non-Hispanic all other		
White	1.11 (0.65, 1.90)	0.709
Black or African American	1.34 (0.73, 2.44)	0.341
Hispanic	0.47 (0.18, 1.20)	0.113
Asian	0.51 (0.18, 1.50)	0.225
Occupational Status. Reference: Employed		
Unemployed	0.95 (0.72, 1.26)	0.724

CHAPTER V

Discussion

HITs Utilization Patterns

Health Information Technology (HIT) is a relatively new phenomenon to healthcare and several studies demonstrate a large portion of the United States population are interested in utilizing HIT to manage their healthcare (Bauer et al., 2017; Hung et al., 2013).

This study demonstrates that information technologies utilization within a large sample is increasing, mirroring the widespread acceptance of the Internet and technology use in everyday life. An interesting finding is the majority of the participants reported the Internet as their first choice when it comes to looking for health-related or medical information instead of other resources such as physicians or healthcare providers. Participants also utilized the Internet to perform different health-related activities of which the two most popular were visiting a social networking site, such as Facebook or Twitter, and watching health-related videos on YouTube. These findings are congruent with the majority of studies on Internet adoption and usage as well as studies on computer usage, which demonstrated increased male tendency to keep up-to-date with new technologies at the level of computer and Internet skills, the range of online activities undertaken, the frequency of appearances, and time spent online (Bujala, 2012; Dufour et al., 2016; Muscanell & Guadagno, 2012).

This study's findings showed a high percentage of smartphone ownership (84.8%) with moderate use of apps (52.4%) related to health and wellness. These findings support the most recent results from the 2018 Pew Research Center report, which indicates high

smartphone ownership rates (>90%) in all American demographic subgroups with no major differences in smartphone ownership based on gender, race/ethnicity, education level, income or community type (Pew Research Center, 2018).

These study findings show the senior patient population consistently has lower rates of technology utilization than other age groups in this sample in terms of disease self-management activities. However, a report by the Pew Research Center (2017) showed technology-adoption climbed among older adults and this group is more digitally connected than ever. According to the report, some groups of seniors who are younger, more affluent, and have higher education levels, report owning and utilizing various technologies at rates similar to adults under the age of 65. These findings are consistent with this study's findings. For example, there were no significant differences among patients from different age groups in terms of utilizing different HITs for disease self-management activities, such as using e-mail or the Internet to communicate with a physician or a physician's office, tracking healthcare charges and costs, and looking up medical test results. Nevertheless, a digital divide continues to be notable between younger and older Americans in other disease self-management activities. Many seniors who are older with lower educational levels continue to have a distant relationship using HITs (Pew Research Center, 2017).

HITs Utilization and Patient Demographics

Gender: This study's findings demonstrate that gender remains statistically significant in terms of seeking health information when controlling for other demographic variables. In fact, this study found females are more likely to use the different HITs than males to look for health or medical information for themselves or for

someone else. These findings are consistent with other studies in the literature that demonstrated females were more likely to seek health-related information using the Internet and other HIT. The Internet utilization gap between males and females has been gradually decreasing. Males were more likely to use Internet than females in the early 2000s. However, this gap closed by 2008 and Internet utilization became equal among the two gender groups (Pew Research Center, 2015). Literature in this field demonstrates females have a remarkable social motive for and experience greater enjoyment in health-related information searches, explained by social role interpretations, suggesting these needs should be met when offering health-related information on the Internet (Bidmon & Terlutter, 2015 & Tarver et al., 2018). In this study, no significant gender differences were found in HIT utilization for other disease self-management activities, such as online medical records access, communication with healthcare providers, tracking healthcare costs, or looking up test results.

Education Level: Education attainment or level was a significant predictor for utilizing HIT for disease self-management activities with the exception of not using other electronic devices including Fitbit, blood glucose meters, and blood pressure monitors to monitor or track health. This study's findings show education-related disparities in HIT utilization; patients with a higher education level are more likely to utilize different HITs for disease self-management. Many studies in the literature support this finding. It is not surprising to find less prevalent HIT use among patients with less education. For HIT patient users and early adopters there is a consistent trend in the literature to be more educated than the population average (Choi, 2011; Riddell & Song, 2017; Tavares & Oliveira, 2018; Van Der Heide et al., 2018; Zhang, Yu, Yan, & Spil, 2015).

Income: Although technology is becoming more affordable and Internet access is increasingly ubiquitous, a digital divide between rich and poor remains (Soltan, 2019). According to a 2012 report by Pew Research Center, individuals with higher income are still more likely than others to have stronger and reliable access to digital resources. The digital divide has especially far-reaching consequences when it comes to HIT utilization for disease self-management. This study's findings show the annual household income was a significant predictor for HIT utilization to perform certain disease self-management tasks. In general, individuals with an annual household income of less than $20,000 were less likely to use HIT to look for health or medical information for someone else, buy medicine or vitamins online, use e-mail or the Internet to communicate with a physician or a physician's office, track healthcare charges and costs, look up medical test results, or access their online medical records. For low-income patients, inadequate access to technology can prevent them from performing the activities crucial to proper disease self-management. Interestingly, this study also shows widespread ownership of smartphones (84.8 %) among patient groups with different income levels. This may be a digital resource to continue to leverage. Additionally, many low-income patients, facing the challenge of illiteracy, may benefit from using HIT tools because of HITs use of graphics and vocal engagement; using such HIT tools may help to improve patient access to health information that could have a positive effect on disease self-management.

Race/ethnicity: An interesting finding of this study is there was no difference among racial/ethnic groups in terms of utilizing HIT to perform different disease self-management tasks, although Black or African American individuals had the lowest odds of utilizing HIT to look for health or medical information for themselves. The literature

shows mixed findings regarding the differences in health information-seeking behaviors among racial groups. For example, a considerable number of studies report Latinos are less likely to use online technology resources to look for health information (Gonzalez, Sanders-Jackson, & Emory, 2016). Other studies did not find any association between race/ethnicity and health information-seeking on the Internet (Jacobs, Amuta, & Jeon, 2017).

However, there could be a few explanations for this finding. First, there is a lack of cultural sensitivity of current mainstream online health information resources and whether it is adequately inviting for usage by patients of low-socioeconomic status and low-literacy African Americans (Birru & Steinman, 2004). Second, African Americans may utilize technology to access health information, but they still may prefer other venues. A recent study by Randolph, Cary, and Gonzalez-Guarda (2017) found the majority of participants (75%) preferred to receive education about health topics in a face-to-face setting instead using online methods. Third, this finding may be due, in part, to the study sample, which was predominantly White.

Employment status: As a socioeconomic factor, many studies reported that employment status is a significant indicator for using technology, such as the Internet, at home. These findings infer that patients who are either unemployed or do not work are less likely to have the economic resources to afford such technologies compared to those who work full-time or part-time (Zhang et al., 2015). Also, the literature shows communities with higher unemployment profiles usually have lower incomes compared to other communities with higher employment profiles. As a result, such communities or groups are yet to develop the capacity and interest in using technology for health-related

purposes (Hung et al., 2013; Jiang, West, Barton, & Harris, 2017; Peacock et al., 2017; Zhang et al., 2015).

Interestingly, this study's results contradict the literature findings and show no significant difference between employed and unemployed patients in terms of utilizing technology to perform different disease self-management tasks except for tracking healthcare charges and costs. Unemployed patients were less likely to track healthcare costs using HIT. An explanation for these findings can be that the unemployed patients' group in this study included students, retired people, disabled people, homemakers, or other non-working individuals. Just because this group reported as unemployed does not mean they are necessarily low income. For example, students in this study may rely on their family's income to support their expenses, but they still report as unemployed. Also, the retired patients in this study counted as unemployed; however, they may have a high retirement income that could mean health technologies are affordable for them. Thus, unemployment reported in this study was not necessarily associated with low income, making the use of health technology unaffordable as reported in the literature.

HITs Utilization and Perceived TTF

The Task-Technology Fit is defined as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue, 1998. p. 216; Goodhue & Thompson, 1995). The perception of TTF is measured by users' evaluation where the different degree of the perception is associated with different outcomes (Goodhue & Thompson, 1995; Gu & Wang, 2009). In this study, the perceived TTF was measured by whether HIT helped patients with the following main disease self-

management tasks: Tracking progress on a health-related goal, helped in decision-making, or helped in discussions and communication with healthcare provider.

In general, this study's findings show that patients who perceived different HITs helped them with different disease self-management activities were more likely to utilize different HIT tools. Specifically, patients who reported that different HITs helped them with discussions and communication with their healthcare providers are more likely to utilize different HIT tools to perform the different disease self-management tasks, such as looking for health or medical information, buying medicine or vitamins online, using e-mail or the Internet to communicate with a physician or a physician's office, tracking healthcare charges and costs, looking up medical test results, and using other electronic devices to monitor or track health, such as Fitbit, blood glucose meters, and blood pressure monitors. For the other perceived TTF questions, HITs helped tracking progress on a health-related goal but if it helped in decision-making, the results were mixed. For example, patients who perceived that HIT helped them in tracking progress on a health-related goal were more likely to utilize the different HIT tools for most of the disease self-management tasks in this study with two exceptions: buying vitamins or medicine and looking online for assistance in providing care to another. In these cases, there was no significant difference. Also, patients who perceived that HIT helped them in the decision-making were more likely to utilize HIT tools for the following disease self-management tasks: looking for health or medical information, buying medicine or vitamins online, and looking for assistance in providing care for another. For other tasks, no significant difference was found.

This study's findings are consistent with the majority of the studies in this area. Open communication remains the most frequently patient-reported attribute associated with utilizing HIT. Many studies in the literature reported on how the different HIT tools are bridging the communication and collaboration gap between patients and their healthcare providers. Also, many studies demonstrated that HITs can initiate open communication between providers and patients, thereby transforming visits from intermittent to steady follow-ups. Consistent with the literature findings, this study demonstrates that technology utilization depends on its perceived functionality to adequately meet patients' needs including patient-healthcare provider communication and decision-making support activities (Bowman, 2013; Choi, 2011; Greenberg et al., 2018; Heffner & Mull, 2017; Kim, Yuan, Liebschutz, Cabral, & Kazis, 2018; Mackert et al., 2016; Tarver et al., 2018). That is, perceptions of improved TTF will result in an increase in the likelihood that patients will utilize the technology to perform tasks (Dishaw & Strong, 1998). It also shows that perceptions of improved TTF has a positive relationship with the utilization and perceived intention to utilize information technology (Chang, 2008; Wu et al., 2004).

Online Health Records Access and Utilization

This study's findings show the individuals who have been offered online access to their medical records (61%) and accessed it at least once within the last 12 months (79.3%) grew significantly from the previous year. According to the ONC (2018b), as of 2017, 52% of individuals have been offered online access to their medical records by a health provider or insurer. Over half of those who were offered online access viewed

their record within the last 12 months. The ONC data were based on the HINTS5, Cycle 1, which was released in 2017.

This significant increase in patient access and adoption of online medical records can be explained by the HIT Meaningful Use Stage 3. As part of this stage, providers were required to engage unique patients with the information in their online medical records. In 2018, eligible hospitals and providers were required to report on Stage 3 objectives for the entire calendar year. Participants must have attested to eight objectives with related measures to meet Stage 3 Meaningful Use requirements. Objectives included electronic patient health information protection, clinical decision support intervention implementation, robust electronic prescribing use, patient access to health data, and care coordination through patient engagement (Green, 2015).

However, recent changes for Meaningful Use Stage 3 requirements may have an effect on patient access and adoption of EHRs. These changes include reduction in threshold for the following: providing patient access under the patient electronic access to health information objective to more than 50%; patient-specific education under the patient electronic access to health information objective to more than 10%; view, download, or transmit under the coordination of care through the patient engagement objective to at least one unique patient (or their authorized representatives); secure messaging under coordination of care through the patient engagement objective to more than 5%; send a summary of care under the Health Information Exchange objective to more than 10%; request/accept summary of care to more than 10%. (Centers for Medicaid & Medicare Services, 2018).

Patients with lower education attainment and lower income were less likely to access their online medical records. Younger patients were more likely to access their online medical records. These findings were consistent with the literature (Carroll et al., 2017; Greenberg et al., 2017; Strekalova, 2017). The top three online medical records activities that were frequently performed and reported by the participants include communicating with healthcare providers, requesting medication refills, and filling out forms or paperwork related to their healthcare. Patients utilize online medical records as a convenient method to bridge the communication and collaboration gap with their healthcare providers. Patients view their online portals as a way to transform visits from intermittent to steady follow-ups (Bowman, 2013; Powell & Myers, 2018;). Studies show that utilization of EHRs has the potential to facilitate patient-physician communication via electronic messaging, email, or through a web portal (Irizarry et al., 2017; White & Danis, 2013). Electronic health record online services include features such as booking appointments or requesting prescription refills without the need for patients to see their physicians. The literature shows that patients who utilize EHRs online access reported positive experiences and satisfaction, and that the process empowered them to communicate more effectively with clinicians (Mold & de Lusignan, 2015).

Study Limitations

The first limitation of this study was lack of information regarding the survey instrument validity and reliability statistics. An extensive search for data about the HINTS instrument validity and reliability has been done; however, the literature search did not yield any results. The HINTS5, Cycle 2 Methodology report that is available at the National Cancer Institute (NCI) website provides a detailed description of and

information about the HINTS survey instrument development, design, and cognitive testing. However, validity and reliability statistics are not available. The NCI was contacted to obtain such data if it is available. Their response was similar to most population-level health surveys; that individual items are not easily measured with traditional measures of reliability (e.g., internal consistency). Most of the items, however, are subjected to rigorous cognitive testing to ensure the content and construct validity of the items. As such, according to the NCI, there is no formal information about the reliability or validity of specific HINTS iterations.

> *"A colleague at NCI, Gordon Willis, mentions this, "So… for 'validation' of our garden-variety (a la HINTS) measures – if not psychometrics, what? The emphasis in the survey field is not so much on what I call 'metric evaluation' (i.e., a number, like Cronbach alpha, response rate…) but on 'process evaluation' – has an accepted process been used to establish validity. This is what cognitive testing is for (something HINTS does for every cycle of data): The more overt expression of this method, as an explicit means for validation."*

Future work to overcome this limitation may include conducting reliability and validity statistics for the HINTS instrument items. Potential statistical approaches include Pearson Correlation Coefficients, path analysis, and factor analysis.

The second limitation of this study was that HINTS data may have had the same limitations as all self-report surveys. These limitations included low response rates, potential sampling bias, and social desirability issues particularly about issues surrounding the digital divide and socioeconomic disparities (Tarver et al., 2018). The

overall response rate was 32.9% (HINTS5, Cycle 2 Methodology Report, 2018), response rates are not a deterministic indicator of bias (Groves, 2006). Maitland et al. (2017) conducted a nonresponse bias analysis for the HINTS4, Cycles 1 and 3, collected in 2011 and 2013. They found that communities with higher concentrations of low socioeconomic status, young households, and minority and Hispanic populations had lower response rates. According to this study, nonresponse bias tends to occur when the response rate is less than 100% and the non-respondents to a survey may have answered differently than those who did respond, resulting in biased findings that may not accurately reflect the population of interest. Maitland et al. (2017) also concluded many of the demographic influences on nonresponse to the HINTS, such as age and socioeconomic status, can be compensated for with standard weighting procedures. This weighting helps reduce the bias to the extent these demographics are correlated with health information-seeking behavior. Maitland et al. (2017) explain that "there is some evidence from the level of effort analyses and comparisons with other surveys that estimate in HINTS could be biased towards finding higher levels of health information seeking." However, due to the unique nature of HINTS, it is hard to determine precisely to which extent this is bias (Maitland et al., 2017 p.11).

The third limitation of this study was the design. It was descriptive correlational and not designed to test any causal relationships between constructs or items in the survey related to patient utilization of HITs because HINTS is a cross-sectional survey. Also, this study was intended to describe current patients' HITs utilization at the national level and not intended to assess change over time at the individual level. Therefore, the

findings of this descriptive correlational study do not begin to explore why patients are utilizing or not utilizing HITs for disease self-management.

Implications of the Findings

This study contributes to the body of knowledge with regard to patient utilization of HITs for disease self-management. Moreover, it provides description to the current state and trends of utilizing such technologies at the national level because the data that was used for analysis was nationally representative. Thus, the results of this study can be generalized. This study's findings also support findings of previous studies with regard to patient utilization of HITs. Additionally, the findings of this study assist in clarifying and understanding some the TTF factors and their antecedents and provide information about the characteristics of patients who utilize these technologies. HITs developers and policy makers may use this study's findings to include the patient perspective for future design and implementation as well as develop tailored intervention programs that encourage more HIT utilization for self-management for different patient groups.

Nursing Informatics

The rapid growth and development in HITs provide patients with a greater opportunity to take control over their health. Nurses have had a long history of concern about patient engagement and empowerment. Ryan & Sawin (2009) argue that our expectations for patients and families to take control over managing their healthcare have surpassed our understanding of how to assist them in acquiring the knowledge, skills, and social facilitation for health management. Although core nursing values and care remain unchanged, HITs strongly influence nurses' daily work flow with regard to patient communication, data, and care. Nowadays, nurses are involved in health informatics at

every level. Nurses can pursue informatics roles including leadership and management, advocacy, risk analysis, compliance, consultation, research, evaluation, and education. As advocates in an ever-changing and multi-focused technological environment, nurse informaticists can use this study's findings to create interventions that promote patient engagement and inspire them to adopt HIT innovations.

Recommendations for Future Research

Based on this study's findings, a suggestion for future research should focus on integrating other TTF constructs such as ease of use, system reliability, compatibility, presentation, accessibility, confusion, and meaning in the context of consumer health information technologies. These constructs may give researchers a better understanding about patients' behavior in terms of utilizing and adopting HITs. To the best of the researcher's knowledge, only one recent study in addition to this research has used some of the TTF constructs to understand patient utilization of HITs for disease self-management.

Additionally, based on this study's findings, more research is still needed to focus on examining HITs features that are appealing to the patient, such as decision support tools and tracking health goals. Other features have been studied extensively in the literature including HITs and patient-provider communication.

Conclusion

Integrating HITs into patient care has the potential to improve overall care delivery and patient health outcomes. In an ever-changing and multi-focused technological environment, understanding the factors that may affect patient utilization of HITs is a critical component in the health self-management. The literature revealed a gap

of knowledge in the area of the perceived TTF factors and how they impact the patient use of HIT in activities of self-management. The TTF model was used to explain and understand the relationship and interaction between the study variables, which include disease self-management and HITs utilization. The results of this present study show that sociodemographic disparities still exist among patient groups in terms of HIT utilization for disease self-management. Also, it shows a significant positive relationship between perceived TTF and patient utilization of the different HITs. The potential significance of this study is to build upon the existing literature and decrease the gap in this area. Findings of this study may also assist in understanding the factors that encourage or hinder patients' utilization of HITs in self-management.

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Appendix A

University of San Diego

Mahmoud Altawalbih <maltawalbih@sandiego.edu>

RE: HINTS: email from contact form

4 messages

Keefe, Brian <Brian.Keefe@icf.com> Mon, Oct 15, 2018 at 6:47 AM
To: "maltawalbih@sandiego.edu" <maltawalbih@sandiego.edu>, "NCIhints@mail.nih.gov" <NCIhints@mail.nih.gov>

Hi Mahmoud,

Thank you for the question.

HINTS, like most population-level health surveys, contains mostly individual items that don't lend themselves to traditional measures of reliability (e.g., internal consistency). Most of the items, however, are subjected to rigorous cognitive testing to ensure the content and construct validity of the items. As such, there is no formal information about the reliability or validity of specific HINTS iterations.

A colleague at NCI, Gordon Willis, mentions this, "So… for 'validation' of our garden-variety (a la HINTS) measures – if not psychometrics, what? The emphasis in the survey field is not so much on what I call 'metric evaluation' (i.e., a number, like Cronbach alpha, response rate…) but on 'process evaluation' – has an accepted process been used to establish validity. This is what cognitive testing is for (something HINTS does for every cycle of data): The more overt expression of this method, as an explicit means for validation, is by my colleague Kristen Miller and colleagues, who recently wrote a book that confronts this issue very directly : http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118383540.html. "

One method used by survey methodologists to test for validity is to do a record check where they compare, for example, self-report data with objective data or the same data from a different source. For example, comparing self-report access to care with medical records. Here's an example: Pierannunzi, Hu, and Balluz (2013): "A Systematic Review of Publications Assessing Reliability and Validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011" Medical Research Methodology. As you can imagine, it's not always possible to do these types of tests and they tend to be expensive.

HINTS 5, Cycle 2 will be released in mid to late November, so we are just about a month away from release.

Thanks!

Regards,

Brian

Brian P. Keefe | Technical Specialist | +1.301.407.6894 direct | brian.keefe@icf.com | icf.com

ICF 530 Gaither Road, Rockville, MD 20850 USA

From: maltawalbih@sandiego.edu [mailto:maltawalbih@sandiego.edu]
Sent: Thursday, October 11, 2018 2:07 PM
To: NCIhints@mail.nih.gov
Cc: Keefe, Brian <Brian.Keefe@icf.com>
Subject: HINTS: email from contact form

Name: Mahmoud Altawalbih
Phone: 714-797-4362
Subject: Current research with HINTS data
Email: maltawalbih@sandiego.edu
Comments: Dear Sir/ Madam, I am a Ph.D student and I am planning to use the HINTS data in my dissertation. I tried to search for the HINTS survey instrument validity and reliability statistics but I could not find anything in the literature or on your website. So can please provide me with these statistics or any resources that I can use to retrieve this information. Also, I am wondering when the HINTS 5, cycle 2 dataset is going to be released? Your help is greatly appreciated! Best regards, Mahmoud Altawalbih

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Mahmoud Altawalbih <maltawalbih@sandiego.edu> Mon, Oct 15, 2018 at 10:00 AM
To: Brian.Keefe@icf.com

Hello Brian,

Thank you so much for the information and resources. I have one more question please, do I need to obtain the NCI permission to use the HINTS data in my dissertation?

Best regards,
Mahmoud Altawalbih
[Quoted text hidden]

Keefe, Brian <Brian.Keefe@icf.com> Mon, Oct 15, 2018 at 10:52 AM
To: Mahmoud Altawalbih <maltawalbih@sandiego.edu>

Hi Mahmoud,

No, you do not need NCI's permission. HINTS is a public-use dataset, so it is available to anyone who would like to use it. Thanks!

-Brian

[Quoted text hidden]

Mahmoud Altawalbih <maltawalbih@sandiego.edu> Tue, Dec 18, 2018 at 6:07 PM
To: just4mor@gmail.com

[Quoted text hidden]

Appendix B

Date: 3-8-2019

IRB #: IRB-2019-188
Title: Patient's Utilization of Health Information Technologies for Disease Self-Management
Creation Date: 12-4-2018
End Date: 12-5-2019
Status: Approved
Principal Investigator: Mahmoud Altawalbih
Review Board: USD IRB
Sponsor:

Study History

Submission Type Initial	Review Type Expedited	Decision Exempt

Key Study Contacts

Member Mahmoud Altawalbih	Role Principal Investigator	Contact maltawalbih@sandiego.edu
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