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Perceived Usefulness and Perceived Ease of Use Impact on Patient Portal Use

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Abstract

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MBA, Southern Illinois University Carbondale, 1998

BS, Gwynedd Mercy College, 2007

BS, University of Tirana, 1994

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Patient portals are web-based tools that provide patients with access to their health records and enhance communication with providers. Despite the efforts in expanding their use and patients interest in using them, patient portal usage remains low. Higher use of portals is associated with greater patient engagement and better healthcare quality and outcomes. This study investigated the impact of perceived usefulness (PU) and perceived ease of use (PEU) on patient portal usage. The conceptual framework was based on the Technology Acceptance Model, which suggests that PU and PEU of a system affect attitude and behavioral intention toward using the system, and ultimately the use of the system. The research questions focused on whether PU and PEU significantly affect portal usage. Participants included a convenience sample of 432 patients of Abington Health, located in Abington, PA, who had access to Abington's eClinicalWorks patient portal. Cross-sectional data collected from the completed online surveys included responses to Davis' PU and PEU measurement scale, self-reported portal login frequency and login duration, and some patient demographics. Data was analyzed by using chi-square test of independence and multinomial logistic regression. The study found that a significant relationship exists between PU and login frequency, PU and login duration, and PEU and login duration; however, the impact of PU and PEU on portal usage was not significant. The study could be repeated among a different population using a different patient portal. This study helps understand the relationship between PU/PEU and portal usage, something healthcare providers can capitalize upon when promoting portal use, and ultimately, encouraging greater patient engagement in their own health.

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Chapter 1: Introduction

Introduction

Patient portals are web-based applications made available by healthcare providers and intended for patient use. Patients are provided with a username and password and can securely access health information, such as visit summaries, lab results, and prescriptions, as well as securely send an e-mail message to their provider (Ammenwerth, Schnell-Inderst, & Hoerbst, 2012). They are primarily designed to enhance communication between patients and providers, provide education to patients, and provide patients with access to their health information (Ammenwerth et al., 2012; DelBanco et al., 2012). Patient portals are typically connected to electronic health records (EHRs) which are information systems maintained and used by providers to track and record patients' medical history, procedures, medications, allergies, and other medical care information (Cleveland, 2015; Sayles, 2013). Portals have received much attention in the last decade, with the expansion of EHRs, the emergence of patient-centered care initiatives, and government funding made available to healthcare providers after the passage of Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. The HITECH Act provided financial incentives for the expansion of EHRs and other information systems among eligible hospitals and providers with the condition that hospitals and providers demonstrate meaningful use of the systems. These were called Meaningful Use criteria. Meaningful use criteria were designed to evolve during the three stages of meaningful use. One of the meaningful use requirements was availability and usage of patient portals. Patient portals are currently made available by hospitals,

physicians' offices, and other ambulatory care services. While patient portals started mostly as a part of a government mandate their use has proven to be beneficial for patients and providers. When used on a regular basis by patients, they have great potential to increase interactions between providers and patients and educate patients regarding their own health (Ammenwerth et al., 2012). More educated and engaged patients have the potential to become more proactive in their own health issues, tend to have better health outcomes (Kaphingst et al., 2014), and incur fewer healthcare costs (Geyer, 2015; James, 2013). While interest in patient portal usage is high, their usage is low (Landi, 2016, para 1).

Researchers have shown that use of patient portals varies depending on multiple factors that can be categorized as: (a) patient-related, such as demographics, literacy, and health conditions; (b) provider-related, such as provider usage and encouragement given to patients to use the portal; and (c) portal-related, such as system characteristics. Some researchers (focused on patient-, provider-, or portal-related studies) have explored perceptions about such tools from a qualitative exploration viewpoint. A gap exists because the researchers have not focused on measuring patients' perceptions about patient portals and how those perceptions may impact usage. According the Technology Acceptance Model (TAM), perceptions about usefulness and ease of use of a system affect attitude toward using the system and behavioral intention to use the system, which leads to the actual use of the system (Davis, Bagozzi, & Warshaw, 1989). Researchers have shown that perceived usefulness and perceived ease of use could count for 30-40% of the variance of a system's usage (Holden & Karsh, 2010, p. 159). Measurement of

patients' perceptions on portal usefulness and ease of use would give providers an opportunity to identify contribution of perceptions to portal usage. If perceived usefulness (PU) and perceived ease of use (PEU) have a statistically significant relationship to portal usage, the task of changing such perceptions among patients will receive greater attention. By exercising greater attention and awareness efforts, it may be possible to change perceptions about patient portals and improve usage of the patient portals. Greater usage of portals has the potential to improve patient behaviors, their engagement in their own health issues, and ultimately, their health outcomes.

The introduction chapter includes background on the topic, problem statement, the purpose of the study, research questions and hypothesis, theoretical framework, nature of the study, definitions, assumptions, as well as scope and delimitations.

Background

In my review of the literature, I found that most of the patient portal research was focused on patterns of patient portal usage, compliance with federal government requirements pertaining to Meaningful Use - specific to patient portal usage, identifying impact of portal usage on patient engagement and health outcomes, and exploring factors that may contribute to the patient portal usage. Studies that were specific to contributing factors to portal use addressed mostly patient demographics, patient health literacy, patient health condition, impact of promotion from providers, or portal features. Typically, providers and system designers have not included patients in the process of designing a patient portal; however, some researchers collected patients' input and comments. Portal features were mostly explored through qualitative studies in the format

of asking patients and/or providers about features used most, critique about certain features, or desired features for patient portals (Schnipper et al., 2008; Urovitz et al., 2012; Weingart, Rind, Tofias, & Sands, 2006; Zarcadoolas, Vaughon, Czaja, Levy, & Rockoff, 2013). Providers were also interested in patient's opinions about electronic health records and other healthcare technologies. A 2010 survey of healthcare consumers by Buzzback Research showed that 79% of respondents were more likely to choose a provider who made online or mobile systems (such as patient portals) available to patients (Sorrels & McGillvray-Dodd, 2010, p.32). Yet, about six years after those surveys were conducted, the average overall portal adoption rate was only 29% (Landi, 2016, para 1). While providers have provided online patient portals, there is a gap between the expressed interest and usage of patient portals. Apparently, availability does not imply usage.

The gap between expressed interest on web-based technologies and actual usage of patient portals has led to some researcher's interest on understanding consumers' perceptions on patient portals; however, most of these researchers have explored patients' satisfaction and thoughts about portals as well as overall perceptions on portal usefulness (Lobach, Willis, Macri, Simo, & Anstrom, 2006; Volk, Pizziferri, Wald, & Bates, 2005; Zarcadolas et al., 2013). Researchers have studied patient portal use in other countries, as well; although specific studies on measuring patients' perceptions have been limited. There has been one study that measured perceived usefulness of the patient portal among a diabetes population in Netherland; however, the relationship between perceived usefulness and portal use has not been measured (Ronda, Dijkhorst-Oei, & Rutten, 2014).

Research indicated that the impact of perceived usefulness or perceived ease of use on portal usage were not measured in any of the U.S.-based studies.

According to the TAM (Davis, Bagozzi, & Warshaw, 1989), perceived usefulness and perceived ease of use can predict usage of an information system. A study that focuses on identifying whether significant relationships exist between perceived usefulness and patient portal use, as well as between perceived ease of use and portal use, was substantiated by the TAM and would fill the gap that exists in the current literature. Most importantly, my study will aid the understanding of the impact of patients' perceptions in portal usage and contribute to closing the gap between the expressed interest in using the portal (approximately at 79%) (Sorrels & McGillvray-Dodd, 2010, p.32) and actual usage of the portal (approximately at 29%) (Landi, 2016, para 1).

Problem Statement

The main problem is that a valuable information technology, such as patient portals has become available to patients; however, it is not utilized at the expected levels. Researchers of factors contributing to patient portal usage have identified issues related to perceptions but they have not quantified their contribution to portal usage.

As discussed in prior sections, patients' engagement in their own health is positively associated with better health, better use of preventive services, and overall better healthcare decisions (Agency for Healthcare Research and Quality, 2013; Kaphingst et al., 2014). Greater engagement can empower patients (Hanberger, Ludvigsson, & Nordfeldts, 2013), improve quality of care (Ammenwerth et al., 2012; James, 2013) and reduce healthcare costs (Geyer, 2015; James, 2013). Patient portals

have the potential to increase patient engagement in their own health and health-related decisions (Ammenwerth et al., 2012; DelBanco et al., 2012). The Center for Medicare and Medicaid Services (CMS) recognized the potential of patient portals, and required eligible hospitals and providers to increase the use of patient portals, as part of the Meaningful Use requirements. As discussed above, meaningful Use requirements were implemented in stages. Specifically, when CMS finalized Meaningful Use Stage 2 requirements, it required eligible hospitals and professionals to provide at least 50% of the patients with access to a patient portal, engage at least 5% of their patients by viewing, downloading or transmitting their record, and send clinical reminders or generate patient-specific education for at least 10% of their patients (Center for Medicare and Medicaid Services [CMS], 2012).

Given resources made available by the federal government and the need to comply with Meaningful Use requirements, most hospitals and physician offices have made patient portals available to patients; however, research showed that patients use them less than expected (Ancker et al., 2011; Lesselroth et al., 2011; Schickedanz et al., 2013; Terri, 2013). Researchers have studied patient portal benefits and have described usage patterns and differences among certain populations. Some have focused on socioeconomic and clinical characteristics of patients using patient portals (Ammenwerth et al., 2012; Ancker, et al., 2011). Others have explored patients' perceptions on portal usability and utility from a perspective of portal design and usefulness via qualitative studies (Haun et al., 2014; Keselman et al., 2007; Zarcadoolas, Vaughon, Czaja, Levy, & Rockoff, 2013). Patients' perceptions about patient portals can play a role in their

attitude, behavior, and ultimately, usage of patient portals (Davis et al., 1989). Based on a review of current literature, I have found that the researchers have not studied the impact of U.S. patient perceptions, specifically, perceived usefulness and perceived ease of use on patient portal usage. Research have examined the current state and usage patterns of patient portals, general perceptions of patients toward portals, and the impact of portal usage in patients' engagement and health outcomes. Yet, researchers have not quantified factors, such as perceived usefulness and perceived ease of use on patient portal usage. Hence, investigating the potential impact of perceived usefulness and perceived ease of use on the use of patient portals would fill in the research gap and contribute to measuring the extent to which perceptions of usability and ease of use matter.

Purpose of the Study

The purpose of this quantitative study was to measure the extent to which patients' PU and PEU predict use of patient portals by patients. While PU and PEU were only two of the multiple factors that may affect portal usage, measuring their impact on portal usage had the potential to help providers understand the specific role of PU and PEU and better allocate efforts in changing perceptions and increasing patient portal usage by patients. Use of patient portals can leverage health resources that are already available to patients, lower healthcare costs, contribute to greater engagement of patients in their own health, and contribute to better health outcomes.

Research Questions and Hypotheses

This research addressed two central questions and their related hypotheses:

Research Question1: Does perceived portal usefulness affect portal usage significantly?

$H_0$1: There is not a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

H_a1: There is a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

Research Qustion 2: Does perceived portal ease of use affect portal usage significantly?

$H_0$2: There is not a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

H_a2: There is a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

Theoretical Framework

I utilized TAM (Davis at al., 1989) to develop the concept that perceived usefulness and perceived ease of use are related to the use of patient portals. TAM explains voluntary usage of an information system or computer technology as a function of perceived usefulness and perceived ease of use for the particular computer technology (Davis et al., 1989). According to TAM, a system's perceived usefulness and perceived ease of use lead to a certain attitude toward using the system, which in turn leads to

behavioral intention to use the system, and ultimately affects the actual use of the system. TAM originated from the Theory of Reasoned Action. Researchers consider TAM the gold standard for evaluating acceptance and use of new information technologies, including voluntary use of information systems in healthcare. Additionally, researchers have found that this theory accounts for 30% to 40% of the acceptance of information technology (Holden & Rada, 2011; Hyun, Johnson, Stetson, & Bakken, 2007).

Other theories that supported the proposition that user perceptions are related to the use of patient portals were the Fit between Individual, Technology, and Task (FITT) developed by Ammenwerth, Iller, and Mahler in 2006 and Diffusion of Innovations by Rogers, originated in 1962 and last updated in 2003. FITT was adapted by Honekamp and Ostermann in 2011 to visualize that adaption of information technology depends on the fit between three components: individual (computer anxiety and motivation), task (complexity of what's to be accomplished), and technology (usability, functionality, and performance). Among these three components emerge concepts of individuals' feelings, functionality (also known as usefulness), and usability (also known as ease of use), which are similar to those presented in the TAM. Diffusion of Innovations theory rests on the premise that an innovation is successfully adapted when it has a perceived relative advantage, is compatible with existing values and practices, is perceived as simple and easy to use, can be tried without risk, and provides observable results (Rogers, 2003). Again, perception about usability and ease of use appeared as contributing factors to adaptation of an innovation. I provide details on the theoretical foundation in Chapter 2.

These three theories include perceived usefulness and perceived ease of use as potential factors in successful adaptation of an information technology or innovation. Patient portals fit the definition of innovation or information technology because they are relatively new and require patients to log in and navigate through a portal by using a computer. Use of patient portals is voluntary and patient portals are not the only way patients can receive information or communicate with providers. From this perspective, the TAM supported best the proposition that perceived usefulness and perceived ease of use of patient portals have an impact on patient portal usage by patients.

Nature of the Study

The research design for this study was solely quantitative. Quantitative analysis is used to examine relationships between variables. Variables in this study are listed below.

Independent variable 1: PU is the degree to which a person believes that using a patient portal would enhance his or her management of their own health and health information.

Independent variable 2: PEU is the degree to which a person believes that using a patient portal would be free of effort.

Dependent variable: Usage of patient portal is the frequency of using the patient portal provided by the selected healthcare organization (from daily to monthly) and duration of portal use (from 15 minutes to more than one hour.)

I collected data in collaboration with Abington Health by reaching out to their patient population. With the assistance of Abington Health informatics officers, I distributed an electronic survey link internal messages within the patient portal. I made

the survey available and collected via the SurveyMonkey application. I entered and examined the data in SPSS by using cross tabulation and multinomial regression.

Definitions

Considering the variety of patient portals and the need for a clear understanding and consistent reference to them, is important to provide some definitions. HealthIT.gov (2014) defines a patient portal as

> a secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an Internet connection. Using a secure username and password, patients can view health information such as: recent doctor visits, discharge summaries, medications, immunizations, allergies, and lab results. (para 1)

> Throughout the study, "patient portal" may also be referred to as "portal."

Table 1 shows the operative definitions associated with patient portals, perceived usefulness, and perceived ease of use.

Operational definitions

> *Patient Portal or Portal:* A secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an Internet connection. Using a secure username and password, patients can view health information such as: recent doctor visits, discharge summaries, medications, immunizations, allergies, and lab results (HealthIT.gov, 2014).

Perceived Usefulness or PU: The degree to which a person believes that using a

patient portal would enhance his or her management of their own health and

health information (adapted from Davis et al., 1989).

Perceived Ease of Use or PEU: The degree to which a person believes that using

a patient portal would be free of effort (adapted by Davis et al., 1989).

Assumptions

I used the Chi-square test of independence to study the relationship between

perceived usefulness and perceived ease of use, and patient portal use measured by login

frequency and duration. The underlying assumptions of Chi-square are individual

observations are independent of each-other (Field, 2013) as well as "no more than 20% of

the expected counts are less than 5 and all individual expected counts are 1 or greater"

(Yates, Moore & McCabe, 1999, p. 734). Independence of observations means that each

patient completes one survey only independently. Expected counts are the frequencies

that are projected for each cell. Upon data collection and data entry into SPSS,

descriptive statistics analyses and cross tabulation helped confirm the assumptions.

According to Field (2013), an additional consideration is that predictors are uncorrelated

with external variables, which are not included in the model (p. 311). If that is the case,

the model becomes unreliable because other variables that are correlated with the

predictors could predict the outcome in a similar way. The independent variables,

perceived usefulness and perceived ease of use are based on the TAM, which already

takes into account external variables. Results of the regression analysis provided

confirmation that assumptions mentioned above were not violated.

Scope and Delimitations

There are many factors that can impact the use of patient portals by patients; however, the scope of this study was limited to finding the relationships between perceived usefulness and perceived ease of use, and portal use by patients. I chose to focus on these because such relationships had not been studied thus far among the US patient population. Specifically, the research problem in this study required measuring perceived usefulness, perceived ease of use of patient portals, and the frequency and duration of patient portal use. The degree of specificity of perceived usefulness and perceived ease of use could incorporate various factors, such as occupation, education, or level of comfort with computers, all of which make it difficult to define the exact root cause and establish a causal relationship between perceived usefulness and portal use or perceived ease of use and portal use.

Another concern was the quality of self-reported data and the accuracy of data provided, which depends on the participants memory, condition, and honesty. Also, in the process of agreeing to complete the questionnaire, perceived usefulness or perceived ease of use could have been affected and reflected in the responses; thus not reporting the true value that existed up to that point. This could have affected internal validity of the study.

In social studies, it is important to have a diverse sample, representative of different cultures and communities. I describe the inclusion criteria for the participants in Chapter 3. The geographical area selected for the study, Abington and surrounding townships may not have been a true representation of the different cultures that exist in larger geographical areas. Considering merging of cultures in today's society, finding the

perfect representation of the population in one geographical area was difficult. Further, patients who chose to complete the questionnaire may have chosen to do so because they already had an interest in patient portals or a predisposition to use them; hence, adding more to the external validity concerns. Issues related to participants' selection may have affected generalizability of the results.

Limitations

This study was cross-sectional, which is a design that lends itself to critique in terms of internal validity. Given the nature of variables (PU, PEU, frequency, and duration of portal use) as well as lack of before-and-after comparisons in this study, independent variables may not have been manipulated and control techniques may not have been used; however, statistical analysis such as cross-tabulation and bi-variate percentage analysis are intended to help address this pitfall (Frankfort-Nachmias and Nachmias, 2008).

There was less concern with construct validity, given that the validity of the perceived usefulness and perceived ease of use scales had been already tested. Cronbach alpha reliability test results indicated that usefulness and ease of use were two distinct factors, which supported construct validity (Davis et al., 1989).

The study could have also been limited in terms of the sampling method. Convenience sampling, which I chose chose for this study may not have been representative of the entire patient population of Abington Health and Holy Redeemer Hospital and Medical Center, thus leading to issues of external validity. There were no

reactive arrangement issues projected because I completed the study in its natural setting. Overall, generalizability was affected by the representativeness of the participant pool.

Significance

A well-known problem in the US healthcare system is that spending more in healthcare has not resulted in higher health outcomes (Bradley & Taylor, 2013). Patient engagement is an important factor influencing patient's knowledge and health education, and overall self-reported health outcomes (Kaphingst, 2014). Patient engagement has also been identified as an important aspect of patient-centered healthcare programs that can contribute to improvements in quality of care and health outcomes (Gordon and Betty Moore Foundation, 2013). Research indicated that engaged and activated patients have incurred up to 21% less healthcare costs in comparison to those not engaged (James, 2013).

Patient portals are applications that provide patients with access to their medical information and have the potential to increase patient engagement in their own health and healthcare related decisions (Ammenwerth et al., 2012). Access to physician notes can help patients feel more in control of their own health and increase adherence to the medication regimens (DelBanco et al., 2012), as well as improve healthcare costs (James, 2013; Landi, 2016). Following Meaningful Use Stage 2 requirements, eligible professionals were required to provide at least 50% of the patients with access to a patient portal, engage at least five percent of their patients by viewing, downloading or transmitting their record, and use the patient portal to send clinical reminders or generate patient-specific education for at least 10% of their patients (CMS, 2012). However, a

2013 KLAS survey indicated that patient portals were not being used by patients at the

expected levels (Terri, 2013). A recent athenahealth's research, showed that patient portal

adoption rates are still low, at 29% (Landi, 2016). While a number of studies had focused

on the impact of patient portals on patient engagement, disease management, and

compliance with medication and treatment plans, research focused on identifying reasons

why patients decide to use or not to use patient portals had been mostly qualitative. The

impact of various factors on the actual usage of patient portals had not been measured.

     Figure 1 shows a visualization of the research accomplished and research

outcomes related to patient portals and where PU and PEU fit in the scheme of patient

portals research.

Potential factors related to patient portal use	Portal Usage by Patients	Patient Behavior Associated with Portal Usage	Potential Health Outcomes Associated with Portal Usage
• Patient demographics • Patient characteristics • Utilization of health services • Promotion by providers • Portal features • Portal Functionality • Portal Usability • **PU** • **PEU**	• Frequency of use • Duration of use	• Patient engagement • Disease management • Compliance with medications	• Better health outcomes • Better self-reported health • Decreased healthcare costs

Figure 1: Visualization of Patient Portal Research.

The associations between potential factors such as: patient demographics, patient characteristics, utilization of health services and promotion by providers, and portal usage have already been studied. An understanding of those associations is important but there is not much that can be done to change those factors with the hope of impacting patient portal usage. Researchers have studied portal features, functionality, and usability mostly from a qualitative perspective in order to understand what patients look for in a portal, which is related to their perceptions. My study on perceived usefulness and perceived ease of use of patient portals could have revealed that these factors are significantly related with greater use of patient portals. This research mattered because it measured the role of perceived usefulness and perceived ease of use on portal usage. With better understanding of how much these two factors affect usage, healthcare organizations could have allocated greater or different efforts to address and manage patients' perceptions. For example, existing patient portal promotional materials or public relations communication at Abington Health, located in Abington, Pennsylvania could have been changed to contribute to creating more favorable perceptions on portal usefulness and ease of use.

Another important consideration was the design process of patient portals. Conversations with U.S.-based health information managers and vendors who design patient portals revealed that while patients were the intended users of patient portals, they were not considered as a 'party' in the process of designing or testing them. There were only a few exceptions pertaining to studies that involved patients in the process of designing and testing a portal, such as the Swedish diabetic patient portal 2.0 (Hanberger,

Ludvigsson, and Nordfeldt, 2013). Findings from this study have opened new horizons regarding the importance of patient involvement in the portal design process and building more favorable perceptions toward patient portals. These efforts have the potential to impact use of patient portals positively, and as already established above, ultimately, contribute to better health outcomes for patients and decreased healthcare costs.

Given the sample used for this study, there was limited generalizability of the results. Results of this study benefited Abington Health, the chosen settings for this study. In addition, the significant relationships between perceived usefulness and perceived ease of use and patient portal could increase the interest on expanding this type of research in other healthcare organizations. Also, awareness about patients' perceptions was increased and brought to the attention of patient portal providers. Measuring the impact of perceived usefulness and perceived ease of use was intended to be a small contribution to the wide array of factors that impact portal usage; however, it was important to make the first step in measuring perceptions, because perceptions can be managed. Ideally, better perceptions would be associated with higher usage of portals; higher portal usage can improve patient engagement; better patient engagement may have better health outcomes and lower healthcare costs; thus, an opportunity for social change.

Summary

Patient portals are web-based applications that provide patients with the opportunity to access their health information generated by healthcare providers as well as interact with the providers. When this experience is frequent and meaningful, it has been proven to positively contribute to patient engagement in their own health, health

outcomes, and even health care costs. Despite these benefits, use of patient portals in the

United States, remains low. Patient portal research has been extensive in the last 5 years

but most of the studies address patterns of portal use among various groups of patients

and benefits of patient portal use. There are also studies that address contributing factors

to portal usage, such as demographic and socioeconomic factors, role of provider's

engagement with the portal, or portal features.

The focus of this study was the specific relationship between perceived usefulness

and portal usage as well as between perceived ease of use and portal usage. The

proposition that such relationships exist was based on the Technology Acceptance Model

developed by Davis et al. in 1989. While there were delimitations and limitations to this

study, this was believed to contribute to the overall body of knowledge pertaining to

patient portals. Understanding the relationship between perceived usefulness and

perceived ease of use and patient portals is beneficial to providers, portal designers, and

patients. Reflection on findings and targeted actions make it possible to affect patients'

perceptions in ways that can improve patient portal usage, with the ultimate goal of

improving patient engagement and health outcomes. In Chapter 2, I provide greater

details on the theoretical framework for the study and research pertaining to patient

portals.

Chapter 2: Literature Review

Introduction

Patient portals have become an important aspect for many healthcare organizations. To date, most researchers have focused on understanding portal usage patterns, as well as the impact of patient portal usage on patient health outcomes. The description of such usage patterns has primarily focused on gender, ethnicity, race, literacy, and socioeconomic status. In addition, some of the research has been conducted during the patient portal implementation phases, thus allowing providers to see the impact of certain changes on patient portal usage by patients or providers. In this line of research, providers have studied changes in portal features or provider efforts in promoting the use of portals and their relationship to levels of new portal accounts created or actual portal usage. Researchers have also explored what functionality and usability patient and providers would like to see in patient portals as well as general perceptions about patient portals. The impact of such perceptions on patient portal usage in the United States has not been measured.

Theories, such as Technology Acceptance Model (TAM) or Fit between Individual, Task, and Technology (FITT) help explain adaption and usage of information systems, including those in health care. Further, these theories bring up the importance of users' perceptions on usefulness and ease of use in the adoption and use of a new information technology. Patient portals are information systems made available and supported by providers and intended to be used by patients and providers; as such, their usage can be explained by investigating perceived usefulness and perceived ease of use.

This chapter includes a literature search strategy, a description of the theoretical foundation, a review of the current literature, and a summary.

Literature Search Strategy

I conducted a literature review using the online libraries of Walden University and DeVry University. The primary goal of this literature review was to find existing research related to patient portals and obtain an unbiased collection of studies from which inferences can be made about the portal usage issues that may not have been studied. Another goal of the literature review was to better understand theories that can explain usage of

To access scholarly peer reviewed information, the following library databases were accessed: Medical Literature Analysis and Retrieval System Online (MEDLINE), the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews, Google Scholar, PubMed, Health Technology Assessments, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, ProQuest Central, and Science Direct.

The key search term strategy for this broad literature review included the definition of an explicit set of inclusion and exclusion criteria. The criteria provided a foundation for the review by reliably guiding which studies to include or exclude. The criteria also defined the variables that will be used in this study. The inclusion criteria for this literature review included various definitions of constructs of interest, including: sample characteristics, study design, time frame, publication type, and effect size information. The key search terms included: *patient portal, personal health record,*

perceived usefulness, perceived ease of use, electronic health records, and meaningful

use. The scope of the literature review in terms of years searched and types of literature

included a broad range of peer-reviewed literature, including published articles mostly

from 2010 to 2015; however, in some cases, the dates were expanded to include literature

from as early as 1985 in order to review the theoretical foundation, as well as the history

of patient portals.

Theoretical Foundation

Patient portals present a new information technology that is intended primarily for

patient use. While the expectation for usage is high, usage is not mandatory. In order to

meet the high expectations for higher levels of usage and achieve the benefits portals

offer, patients need to adapt this technology. Several theories address general adaption of

technologies; however, three of them stand out, in terms of better relating to the adaption

of the new information technology of patient portals: TAM, FITT, and Diffusion of

Innovations.

Davis et al. developed TAM in 1989, with the intention of explaining behaviors

related to computer usage, and it derives from the Theory of Reasoned Action. TAM is

believed to be a good model for explaining voluntary usage of a system (Adams, Nelson,

& Todd, 1992; Davis et al., 1989; Hyun et al., 2007). At the core of this model are

perceived usefulness (PU), which refers to the "degree to which a person believes that

using a particular system will enhance task performance within a certain context" and

perceived ease of use (PEU), which refers to the "degree to which a person believes that

using a particular system would be free of effort" (Davis, Bagozzi, & Warshaw, 1989, p.

985). Davis et al. (1989) do not focus on what external variables contribute to forming

certain perceptions on usefulness and ease of use. Instead, they explain the impact of

perceived usefulness and perceived ease of use on behavioral intention to use and actual

use of a computer systems. Figure 2 shows the original TAM model presented by Davis

et al.
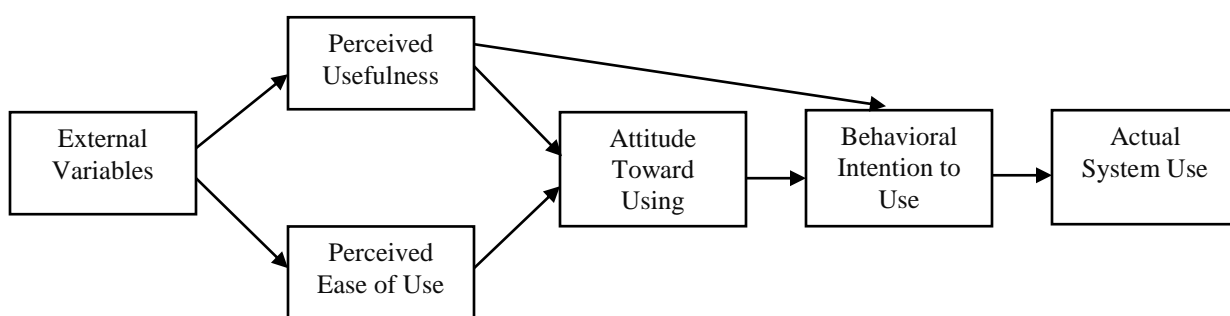
Figure 2. Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw,

1989).

According to TAM, perceived usefulness and perceived ease of use are

statistically distinct dimensions or constructs, which is important when considering the

regression analyses planned after data collection. In studying personal health record user

needs among different users, Lafky and Horan (2008) argued that TAM was a nonfitting

theory because the tasks on the personal health record were new to users (in United

Kingdom) and not well-defined, which made it difficult to measure perceived usefulness.

Such concerns are valid; however, they are less relevant about a decade later in the

United States, considering that healthcare organizations were required to make portals

available and encourage patients to create a patient portal account and use it since at least

2012 (after the emergence of HITECH Act and Meaningful Use Stage 2 requirements).

TAM has been used successfully used in studies evaluating PU and PEU of Ambient

Intelligence Applications (Röcker, 2009), in measuring PU and PEU of electronic

markets and their use by customers (Hendershon & Divett, 2003), and in measuring

perceived barriers to using a web portal among patients with diabetes in Netherland

(Ronda, Dijkhorst-Oei, & Rutten, 2014). In addition, Adams, Nelson and Todd (1992)

have tested the relationship between perceived usefulness, perceived ease of use, and

usage of a system by using structural equation modelling. Researchers consider TAM a

gold standard in evaluating information systems. Literature review revealed that this

theory accounted for 30 to 40% of the acceptance of information technology in a study

conducted by Holden & Karsh in 2010 (p. 159).

Another supporting theory was Fit between Individual, Task and Technology.

According to the FITT framework, adoption of information technologies in healthcare

depends on (a) attributes of the individual, such as computer anxiety and motivation; (b)

attributes of the clinical tasks and processes, such as organization and task complexity;

and (c) attributes of the technology, such as usability, functionality, and performance

(Ammenwerth et al., 2006). Figure 3 visualizes FITT model as adapted by Honekamp &

Ostermann (2011).
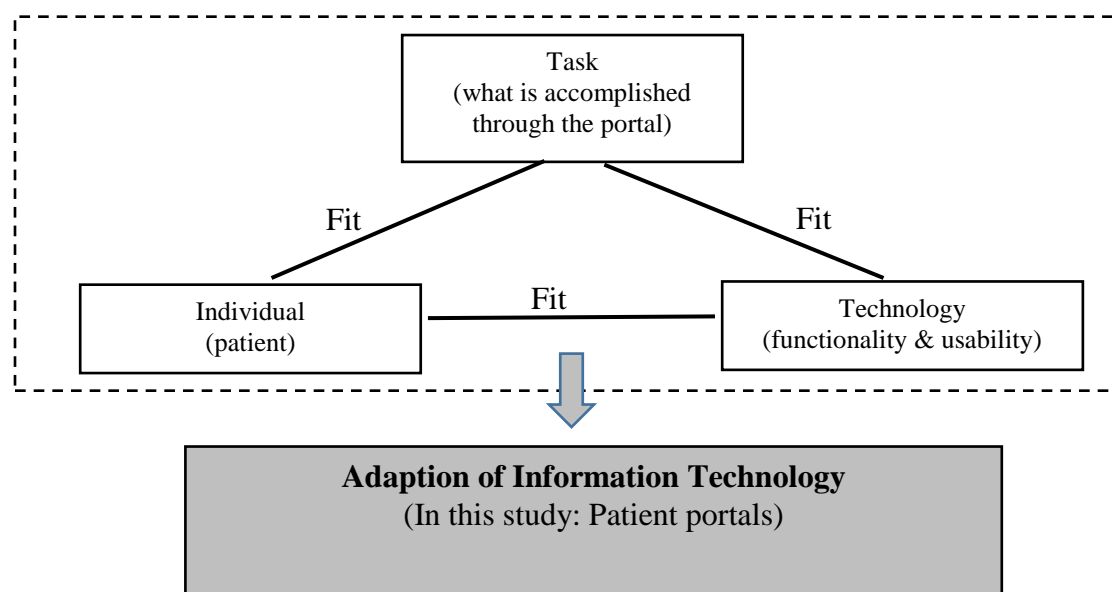
Figure 3. Adapted FITT Model (based on Honekamp & Ostermann, 2011)

Figure 3 is created based on a similar figure presented by Honekamp and

Ostermann (2011), which is the delta portion of the figure surrounded by the dashed line

(including individual, task, and technology). The rectangle "Adaption of Information

Technology" is added to show the connection of these three components to the adaption

of information technology. Notes in parenthesis within the rectangles are added to clarify

representation of each of the model elements in this study.

FITT framework is an applied model, which means it is already tested and

evaluated (Logan, 2012). Honekamp and Ostermann (2011) used FITT to evaluate health

information systems prototypes based on results from patient-system interactions. Their

quantitative study revealed that the evaluation using FITT is suitable for evaluating new

health information systems. Lesselroth (2011) used FITT to develop a survey that measured three variables: provider attitudes toward the task at hand – medication reconciliation, provider's perceptions of health information technology, and the local organizational climate for implementation. The data collected enabled evaluation of provider perceptions on the new information system and revealed certain associations between provider attitude, provider perceptions, and implementation climate, as well as implementation effectiveness.

The FITT model is built on the premise that adoption depends on the alignment between individual, technology, and task (Price & Lau, 2014). While this theory does not explain perceived usefulness and perceived ease of use as contributing factors to use of information systems, it includes concepts of individuals feelings, functionality (also known as usefulness), and usability (also known as ease of use), which are similar to those in the TAM. Thus, it provides further support that perceived usefulness and perceived ease of use are related to usage of an information system.

A third theory, Diffusion of Innovations by Rogers explains diffusion as the process of communicating innovation over time among a group or society (Rogers, 2003). According to Rogers (2003), for an innovation to be successful, it must have a relative advantage, it must be compatible with existing values and practices, it must be simple and easy to use, it must have trialability, and it must demonstrate observable results. It is important to note that the relative advantage is not absolute but depends on the perceptions of the user. Also, simplicity and ease of use are the degree to which users perceive innovation as ease to understand and use.

All three theories discussed above support the fact that user perceptions on usability and ease of use are factors in successful adaptation of an innovation, information technology, or application. FITT and Diffusion of Innovation are not specific in terms of measuring user's perceptions of usefulness and ease of use on the actual system usage. TAM is more specific and better suited for this study because as per Adam et al. (1992), it mathematically links perceived usefulness and perceived ease of use, to the actual usage of the system. Last, two other factors that make TAM a good fit for the patient portal study are voluntary usage of the system and lack of captive use, which respectively mean that the technology may not be mandatory for use and there may be another alternative in completing the task (Adam, Nelson, & Todd, 1992, p. 233). The use of patient portals is not mandatory and patients are generally presented with other alternatives in receiving their medical information, exchanging information with providers, and/or obtaining general health information. These circumstances support use of TAM as the theoretical foundation for this study.

Literature Review

Patient portals are web-based applications that have the potential to increase patient engagement in their own health and health-related decisions (Ammenwerth et al., 2012; DelBanco et al., 2012). HealthIT.gov (2014) defines a patient portal as,

"…a secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an Internet connection. Using a secure username and password, patients can view health information such as:

recent doctor visits, discharge summaries, medications, immunizations, allergies, and lab results" (para 1).

The concept of patient portals is similar to electronic personal health records or patient accessible electronic health records in terms of providing patients with access to their health information electronically; however, there are important differences in terms of ownership. Personal electronic health records are primarily maintained by patients and patient portals are maintained by the healthcare provider; information in the patient portal is updated upon updates made in the electronic health record, which is owned by the provider (Kruse, Argueta, Lopez, & Nair, 2015).

Design, functionality, and usability of patient portals vary depending on the type of system and the healthcare setting that provides the portal to patients. Some patient portals simply provide access to lab and test results, and discharge and visit summaries; others provide additional features, such as appointment scheduling, e-mail communication with the provider, bill payment, prescription refills, review of coverage and benefits, health education materials, or health forms (HealthIt.gov, 2014, para 2).

The idea of patient portals has been discussed since 1990s (Ammenwerth et al., 2012; Sethi, 1999); Some prior studies have focused on patient accessible electronic health record (Beard et al., 2011), systems that allow updating medications and other personal health information, such as open notes (Lesselroth et al., 2011; DelBanco et al., 2013), or systems that provide the ability to communicate with the health care providers electronically, mostly via e-mail (Schickendanz et al., 2013). The main idea in using such systems has been increasing patient's access to their own information as well as

interaction with healthcare providers – which are now considered inherent functions of patient portals.

With the advent of the American Recovery and Reinvestment Act (ARRA) of 2009, particularly, the HITECH Act within the ARRA, financial incentives for implementation and use of electronic health records, and Meaningful Use requirements promoted patient portal development and implementation (Adler-Milstein et al., 2014; HealthIT.gov, 2009). Patient portals were explicitly addressed in Meaningful Use (MU) Stage 2 requirements, core objective number seven (Center for Medicare Medicaid Services [CMS], 2012). Under this measure, eligible providers were to provide more than 50% of all unique patients with online access to their information and the ability to view online, download, and transmit their health information within four business days of the information being available to the eligible hospital or provider. In addition, MU Stage 2 specified that "more than 5 percent of all unique patients seen during the Electronic Health Record (EHR) reporting period (or their authorized representatives) view, download, or transmit to a third party their health information." (CMS, 2014, para 3). MU Stage 2 specified usage, as well as availability of the patient portals. For the required patient portal features to function properly, hospitals must have EHRs. Despite the thirty billion dollars invested by the US government to support meaningful use of electronic health records, including patient portals, the analysis of data collected from the 2008-2013 American Hospital Association Annual Survey showed that only 59% of hospitals have implemented a basic EHR, and only 10.4% of hospitals have met the patient view, download, and transmit criteria (Adler-Milstein et al., 2014, p. 1668). Further

investigation of this compliance rate, indicated that only 11.6% of the hospitals had the transmit function, 27.5% had the download function, and 39.3% had the view function on their patient portals (Adler-Milstein et al., 2014, p. 1669).

During the development and finalization of Meaningful Use Stage 3 requirements in 2015, CMS expected higher use of patient portals and proposed that 25% of patients should view, download, and transmit their health information; 35% of the patients should receive a secure message using the electronic health record messaging function or in response to a secure message by the patient; and more than 15% of patients should contribute to patient-generated health data (Medicare and Medicaid Programs; Electronic Health Record Incentive Program—Stage 3, 2015). After the comment period, these expectations were not finalized as a rule; instead eligible hospitals and providers were only required to show that at least one patient used the view, download, and transmit functions (Medicare and Medicaid Programs; Electronic Health Record Incentive Program-Stage 3 and Modifications to Meaningful Use in 2015 Through 2017, 2015). While the expectations on availability of functions remain high, expectations on usage of such functions have been significantly moderated. In fact, early in 2016, CMS announced the end of Meaningful Use program sometime in 2016 and its replacement with a program focused on patient outcomes (Slavitt, 2016). Changes in health policy and the ever changing government requirements may not provide consistent levels of motivation from healthcare providers to promote use of patient portals. At the same time, a new conceptualization of patient portals is emerging. Companies, such as Zobreus, are offering patients new ways of tracking their health information from multiple providers

through a single portal and engaging in health-related forum discussions (Zobreus, 2016).

Given the role patient portals play on patient engagement, health outcomes, and

healthcare costs, as well as the health information infrastructure that is already in place,

efforts to increase use of patient portals should persist.

Low levels of patient portal usage raise questions about the reasons why patients

do not use patient portals or do not realize the portal functionality potential. Research on

patient portals reveals focus on several areas, such as patient adaption of portals by

demographic characteristics, patients' health condition and utilization or health services,

patient health literacy, provider endorsement, as well as patient portal usability and

utility.

Many researchers have analyzed patterns of portal usage in relation to patient

demographics, such as age, gender, race, income level, education, occupation. Multiple

studies have found that a digital divide exists between younger and older patients, as well

as black and non-black patients, when it comes to access and use of patient portals

(Ancker at al., 2011; Roblin, 2009; Schickendaz at al., 2013; Weingart, Rind, Tofias, &

Sands, 2006). There are also differences in access and usage between Medicare/Medicaid

patients and patients with private insurance; the later are more likely to enroll and use the

patient portal (Ancker et al., 2011; Weingart, Rind, Tofias, & Sands, 2006). In his

qualitative study, Wald (2010) also found that differences in patients' demographic

characteristics were potential factors in the adaption and usage of patient portals. Such

findings help understand the impact of patient demographics on portal usage; however,

there is not much providers can do to change them with the hope of increasing portal usage.

Chronic conditions and utilization of health services were also studied as potential factors on patient portals' usage. Ancker et al (2011) found that patients who had more clinic visits or chronic conditions were more likely to activate and use the patient portal account. Phelp, Taylor, Simpson, Samuel, and Turner (2014) focused specifically on the use of patient portal by patients with chronic renal disease in UK and found that patients accessed the portal regularly in preparation for their encounter and in retrieving lab results. Different from such findings, in studying facilitators and barriers of patient portal usage among patients with diabetes, Urovitz et al. (2012) found that disease management aspects motivated patients to use the portal; however, poor perceived usability, discoverability, and appropriateness of information created the mentality among patients that use of the portal was a waste of time. Understanding that patients' chronic conditions and greater utilization of health services contributes to greater usage of patient portal is important; however, these are not variables that we would want to increase in order to increase patient portal usage. An issue of interest that deserves further elaboration is the poor perception of portals.

Some of the patient portal research has focused on the impact of language proficiency and health literacy on using portals. For example, Schickendaz et al. (2013) found that language barriers were a reason for not using e-mail communication with providers. In their qualitative study, Keselman et al. (2007) found that use of professional medical terminology, abbreviations, and complex concepts without explanations made it

difficult for patients to understand their health information and subsequently, limiting usage of patient portals. Study findings revealed that patients would appreciate comprehensive, consistently structured and better organized documents, as well as additional embedded features in the portal, such as medical dictionaries.

The use of patient portals by providers and promotion of portal use play an important role in the use of portals by patients. Physician endorsement or indifference was found to make a difference in the use of personal health records provided by Veteran's Administration facilities (Nazi, 2013). In their longitudinal study, Wald et al. (2010) explored access and usage patterns of patient portals on certain portal functions, upon promotion and/or marketing practices of medical practices and found that patients increased their activity on the eJournal function of Patient Gateway (portal) 3 weeks prior to their visit with the provider. Wald's (2010) follow up qualitative study found that practice leadership focus, staff engagement, marketing practices, and incentives were identified as potential factors in adoption and use among patients, providers, and staff. A later observational, cross-sectional study of ethnically diverse, low income population showed that patients who used e-mail to communicate with providers were concerned that such communication would add more work for providers in a practice that is already busy (Schickendaz et al., 2013). Schickendaz et al. (2013) found that while 71 percent of the patient population they studied were interested in using e-mail communication with providers, only 19 percent reported using it, mostly due to the perception of dynamics between patients and healthcare providers (such as inefficient communication in a busy practice) and concerns about maintaining privacy or confidentiality. These studies

brought up the issue of patient perceptions toward the portal and the practice offering it and even pointed out that certain perceptions are a barrier in portal usage.

Findings from the above mentioned studies demonstrated important relationships between chronic conditions, utilization of health services, patients' health literacy, support or promotion from the provider and usage of patient portals. In addition, many of the qualitative studies revealed important patient perceptions on usability, discoverability and organization of information on the portal, concerns about privacy and security, concerns about portal-related office operations, or suggestions in relation to certain desired features, all of which related to perceived usefulness and perceived ease of use. Recognizing the importance of these factors, researchers have addressed patient portal utility and usability aspects in at least 76 and 20 studies respectively published from 2006 to 2014 (Irizarry, DeVito, & Curran, 2015).

A number of those studies have addressed functionality and usability of certain systems in the process of implementing them. Weingart, Rind, Tofias, and Sands (2006) studied the adaption of PatientSite portal among ambulatory care patients, and measured the use of certain features of the portal such as radiology, lab results, and clinical messaging. In studying a medication management module embedded within the Patient Gateway portal (a patient portal used by multiple ambulatory facilities in Massachusetts), Schnipper et al. (2008) analyzed the design and deployment strategy in terms of usage and patient satisfaction. Their findings included patient comments on interface and functionality, such as the balance between structured and free text data, coded data, dropdown menus, scroll bars, etc. These comments and the overall findings highlighted

the need for usability and functionality testing as well as inclusion of patients in the portal development process (Schnipper et al., 2008). Further research on the Patient Gateway portal showed that feature activation, such as secure messaging, requests for prescriptions, appointments, referral authorizations, chart information on allergies, medications, health library, lab reports, or radiology reports was a potential factor in adoption and use of the patient portal (Wald, 2010). Aside from gathering patients' perceptions via comments, these studies did not elaborate on whether those perceptions impacted portal usage.

Some researchers have studied functionality and usability of patient portals by interviewing patients to solicit feedback on the portal usage experience. For example, in their qualitative study, Zarcadoolas, Vaughon, Czaja, Levy, and Rockoff (2013) interviewed focused groups from three geographical sites in New York. Questions pertained to general usage and experience with patient portals and findings revealed that patients preferred user-friendly formats, mouseovers/clicks for just-in-time information, and format similarity to social media websites. Last, Hanberger, Ludvigsson, and Nordfeldt (2013) involved Swedish diabetic patients in the design of Web 2.0 portal, and then, measured usage of the portal along with clinical and health-quality measures for a period of two years. Portal usage findings were considered promising but relatively low. Again, studies showed an interest in collecting data about patients' comments or perceptions on patient portal functionality and usability; however, existing studies did not show how the perceptions could impact usage.

Through qualitative or mixed-methods studies, researchers have identified

facilitators and barriers to using the portal, specifically related to usability and ease of use. In evaluating experiences of diabetic patients with the patient portal, Urovitz et al. (2012) found that barriers to portal use included usability, discoverability and appropriateness, specifically, whether the patients perceived the portal to be worth it or a waste of time. Schickedanz et al. (2013) focused on studying use of e-mail to communicate with providers in community clinics of the San Francisco Department of Public Health. They found that 71 percent of the patients were interested in this feature because they considered it efficient; however, only 19% of the patient used it, primarily because of privacy concerns. While the study did not specifically involve patient portals, it is valuable given that electronic communication is an important feature of patient portals. Haun et al. (2014) who focused on the experience of veterans using the secure messaging feature in the My HealtheVet portal system. Their study showed that one of the barriers in using the secure messaging feature was not being able to locate the link needed to access the feature. Findings from these studies showed that patients' perceptions on portal usability, features, and ease of use may be a facilitator in using the patient portal or certain portal features.

Perceived barriers to using a patient portal were also studied via quantitative studies. Ronda, Dijkhorst-Oei, and Rutten (2014) studied a large sample of diabetes patients in Netherland and measured their perceived usefulness of the portal, as well as their frequency of portal use. After categorizing participants in the study as users, non-users, and early quitters, they found differences in their perceived usefulness of the portal. Specifically, users perceived lab results and the possibility of re-reading consults

significantly differently from non-users. Ronda, Dijkhorst, and Rutten (2014) also found

lack of awareness as the main reason for patients not to request log in information. Their

study did not focus on the potential contribution of perceived usefulness to portal use.

Perceptions and feedback on utility and usability were studied from a perspective

of ambulatory care providers, as well. Results show that providers' perceptions also

matter. Their perception of workflow alignment and system integration issues was found

to affect use of the portal and promotion of the portal to patients (Nazi, 2013; Schnipper

et al., 2008; Wald et al., 2007). Research results provided excellent feedback on portal

design from a perspective of providers, although patient views and purpose of portal use

were typically different from those of providers. The important connection was that

perceptions do matter for providers, who represent the other party using the portal to

share patient health information, provide educational materials, or respond to patients.

Other studies that deserved attention in this literature review are those focused on

electronic personal health records (PHRs). PHRs present a similar concept to patients,

with the exception of some functions and maintenance aspects (PHRs are maintained

mostly by patients and patient portals are maintained mostly by the provider). Given the

similarity in the type of information they both contain, as well as their common purpose

(to engage patients in their own health), it was valuable to consider PHR research.

Studies on perceived usefulness and perceived ease of use of PHRs were helpful in better

understanding patients' perceptions on health-related systems that they are expected to

use. In order to identify barriers to optimal use of PHRs, Keselman et al. (2007) surveyed

patients about their experience with reviewing their health records in the PHR. The data

were analyzed via descriptive statistical and thematic analysis and showed that providers'

notes, laboratory test results and radiology reports were the most difficult records

sections for lay reviewers. In addition, professional medical terminology, lack of

explanations of complex concepts (e.g., lab test ranges) and suboptimal data ordering

emerged as the most common comprehension barriers. Overall, a need for more

consumer-friendly PHR was identified. Lafky and Horan (2008) studied preferences and

the intent to use certain features of a personal health record (PHR) based on the health

status of the users. They found observable differences between (medically) disabled and

non-disabled users when considering the PHR. In addition, they found that the rationales

for the various preferences were different between the two groups. While the theme of

perceived usefulness and perceived ease of use emerged, there were no specific measures

of these variables or their impact on PHR usage. In a qualitative study, Weitzman, Kaci,

and Mandi (2009) focused on understanding acceptability, early impact, policy

considerations, and design requirements in relation to a Personally Controlled Health

Record (PCHR). Among other findings, patient beliefs, attitudes, and preferences toward

the PHCR were identified. Some of the barriers to adapting the PCHR were uncertainty

about locus and extend of patient responsibility in maintaining accurate information in

the PCHR, and uncertainty about responsibility for clarifying meaning and the time

required to complete assumed tasks in the PCHR. On the other side, it was also found that

the perceived value of the system for advancing knowledge and supporting care

facilitated acceptability of the PCHR. These findings indicate that patients did not fully

understand their tasks or roles in relation to the PCHR but when they did, they valued the

system because of what it could do for them. Such findings support the case for measuring the actual impact of perceived usefulness on portal usage. Another PHR study that deserves attention was done in United Kingdom (UK) by Greenhalgh, Hinder, Stramer, Bratan, and Russell (2010). Researchers studied the adoption, non-adoption, and abandonment of the HealthSpace PHR. They dedicated a qualitative aspect of their study to perceived usefulness and perceived ease of use, particularly by soliciting patient preferences for ways to document and monitor their conditions in the system. Again, there was no measurement of the potential impact that perceived usefulness and perceived ease of use could have had on the PHR usage. After the passage of HITECH Act of 2009 in the United States, the focus shifted from PHRs to patient portals, and so did the focus of research studies.

Literature review revealed that the research pertaining to patients' perceived usefulness and perceived ease of use of patient portals was mostly qualitative. Themes identified in many studies show that certain perceptions can facilitate or become barriers in using patient portals. Quantifying the impact of perceived usefulness and ease of use of patient portals on the usage of patient portals was needed in order to fully understand their role and contribution.

Another observation from the literature review was that most of prior research in the US has focused on primary care or other types of ambulatory care, Veteran's Administration clinics, and disease management programs. Studies pertaining to usage of a patient portals provided by hospitals are lacking. The November 2014 results of compliance with Meaningful Use stage 2 requirements showed that only 17% of the

hospitals were able to engage at least 5% of the patients through the patient portal

(Rappleye, 2015). In an interview for Becker's Hospital Review, Brian Davis, vice

president of Scorpion Healthcare said that despite the millions of dollars spent on

healthcare technology, hospitals' websites were not up to par and that hospitals were

typically making three simple mistakes in regard to encouraging use of patient portals:

they were not showing the portal value to the consumers/patient; the online experience

was not engaging; and the online experience did not inspire confidence in consumers, as

it was not reliable and it did not securely connect patients from one area (such as viewing

lab results) to another (such as paying a bill) (Rappleye, 2015). These statements are

reflected in the research findings presented above, specifically those related to patients

perceptions about the patient portals (Keselman et al., 2007; Nazi, 2013, Schickedanz et

al., 2013; Urovitz et al., 2012; Zarcadoolas (2013). While the hospitals have taken

measures to address some of the security and design aspects, patients' perceptions about

portals may not have changed. Studying the effect of perceived usefulness and perceived

ease of use on the usage of patient portals would shed more light into those aspects.

     Upon completion of the literature review, I raised questions about the specific

contribution of portal's perceived usefulness and perceived ease of use on portal usage.

As of the time of this review, researchers have not quantified the impact those

perceptions have on patient portal usage. This quantitative study would fill in the gap by

measuring two variables: portal perceived usefulness and perceived ease of use, and

determining whether they are significant factors in patient portal usage. Better

understanding of these two variables and their impact on portal usage, would help

healthcare organizations reallocate their patient portal resources, and if needed, place additional efforts in reshaping patients' perceptions.

The research questions and hypotheses for this study were:

RQ1: Is there a relationship between perceived portal usefulness and portal usage?

$H_0$1: There is not a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

H_a1: There is a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

RQ2: Is there a relationship between perceived portal ease of use and portal usage?

$H_0$2: There is not a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

H_a2: There is a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

Summary and Conclusions

Patient portals are a relatively new information technology intended to provide patients with access to their health information and alternate ways of engaging with their

healthcare providers and their own health. Despite the intentions and investments on this technology, use of patient portals by patients remains low. Prior research studies about patient portals reveal certain patterns of portal usage in relation to patients' demographic characteristics, existing health conditions, utilization of healthcare services and health literacy, as well as provider endorsement, portal usability and portal utility. Certain characteristics, such as patients' age, gender, race, income level, education and occupation, as well as health status and health literacy seem to have an impact in the portal access and frequency of use. Provider's engagement and endorsement of portals and portal features related to usability and utility were also found to impact usage of patient portals. Many qualitative studies have brought up various portal usage issues that are related to patients' perceptions of portal usability and ease of use.

Theories on adaption of information technology, TAM, FITT and Diffusion of Innovation support the fact that perceptions about functionality and usability of information technology play an important role in their adaption and use. Further, according to TAM, perception of information technology, particularly, perceived usefulness and perceived ease of use were found to have a positive relationship with the overall adaption and usage of information technology. Current research has not focused on how perceived usefulness and perceived ease of use affect use of patient portals. Hence, this study would fill in the gap by identifying the impact of perceived usefulness and perceived ease of use of patient portals on patient portal usage. Chapter 3 describes the methodology planned for this study.

Chapter 3: Research Method

Introduction

The purpose of this study was to find out the impact of patients' perceived usefulness and perceived ease of use of patient portal have on the frequency and duration of patient portal use by patients. I chose the observational cross-sectional design.

In this chapter, I review the research design, rationale, and methodology. In addition, I include an explanation of the sample population, sample procedures, as well as descriptions of the procedures for participants' recruitment, data collection, and data analysis. This section also outlines the ethical considerations associated with the study.

Research Design and Rationale

To further understand the research design and rationale it is important to restate the research question, hypotheses, and study variables.

Research Question 1: Does perceived portal usefulness affect portal usage significantly?

$H_0 1$: There is not a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

$H_a 1$: There is a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

Research Question 2: Does perceived portal ease of use affect portal usage significantly?

$H_0$2: There is not a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

H_a2: There is a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

The research design plan for this study was solely quantitative. Quantitative analysis is used to examine relationships between variables. Variables in this study are listed below.

Independent variable 1: Perceived usefulness (PU) is the degree to which a person believes that using a patient portal would enhance his or her management of their own health and health information.

Independent variable 2: Perceived Ease of Use (PEU) is the degree to which a person believes that using a patient portal would be free of effort.

Dependent variable: Usage of patient portal is the frequency of using the patient portal provided by the selected healthcare organization (from daily to monthly) and duration of portal use (from less than a minute to more than one hour.)

The independent and dependent variables in this research, lend themselves to the use of quantitative method, specifically, cross-sectional. Literature review revealed a gap in quantitative studies that have measured the impact of PU and PEU on the use of patient portals. No intervention was required for this type of study. The plan was to collect the data during a two-three month period with the participation of Abington Health, Abington, Pennsylvania and Holy Redeemer Hospital and Medical Center,

Meadowbrook, Pennsylvania, respectively located in the north and northeast suburban areas of Philadelphia.

Methodology

The methodology section includes a description of the population used for the study, sampling and sampling procedures, procedures for recruitment, participation and data collection, instrumentation and operationalization of constructs, operationalization, and data analysis plan.

Population

In order to effectively describe the research methodology, it is important to define the target population. According to Frankfort-Nachmias and Nachmias (2008), a population consists of all the cases that conform to a designated set of specifications determined in the study (p. 163). In this study, the potential population of interest included a finite number of all patients in the United States that are provided with access to a patient portal. The target population was the patient population receiving healthcare services from hospitals as inpatients or outpatients. The intended setting for this study was Abington Health located in Abington, Pennsylvania and Holy Redeemer Hospital and Medical Center, located in Meadowbrook, Pennsylvania. Due to lengthy approval process at Holy Redeemer, the final setting for the study was only Abington Health.

Sample size is typically calculated after considering the statistical analysis, and can be determined based on the desired effect size, alpha level, and statistical power (Web Center for Social Research Methods, 2006). The typical alpha level for research in social studies is 0.05 and the typical power level is 80% (Web Center for Social Research

Methods, 2006, para 11). Given the purpose of this study to analyze whether PU and PEU had a statistically significant relationship with portal usage, the Chi-square test of independence and multinomial logistic regression were appropriate for the data analysis (Field, 2013). Multinomial logistic regression is used when the dependent variable is nominal with more than two levels of outcome (Field, 2013). In this study, login frequency was measured with five levels, which were combined into three levels during data analysis, and login duration was measures with 6 levels, which were also combined into three levels during the data analysis process. Based on the G*Power calculator used to compute the appropriate sample size that is needed to achieve 80% power, for alpha = .05 and effect size of 0.5, the sample size was 163 (G*Power Team, 2014).

Sampling and Sampling Procedures

The sampling unit represents a single member of the sampling population (Frankfort-Nachmias & Nachmias, 2008, p. 164). In this study, the sampling unit were patient provided with access to a patient portal by Abington Health, located in Abington, Pennsylvania. Patients could have been of different genders, ages, races, ethnicities, or education levels. The only exclusion criterion was: patient was not provided with portal access. This exclusion criterion would be considered when notifying the patient of a new message in their portal via e-mail.

Procedures for Recruitment, Participation, and Data Collection

Recruitment of participants was planned to be accomplished in collaboration with Abington Health and Holy Redeemer Hospital and Medical Center. Upon IRB approval from Walden, Abington and Holy Redeemer participants would receive an e-mail

invitation to the study. The e-mail would explain the purpose of the study, provide an informed consent to participants, as well as provide the link to the online questionnaire. An invitation to the survey would also be provided when a patient logged into the patient portal. SurveyMonkey was planned to administer the questionnaire online. SurveyMonkey tools make it possible to maintain the anonymity of the participants. There was no need to collect any patient identifying information for this study; however, participants would be asked to report some demographic data such as, gender, age, race, ethnicity, and level of education. For this type of study there was no need for follow up or debriefing upon completion of the questionnaire.

Instrumentation and Operationalization of Constructs

The measuring instrument for the independent variable in this study was Davis' PU and PEU six-item scales. Davis et al. (1989) hypothesized PU and PEU as fundamental determinants of user acceptance of new information technology. The initial PU and PEU scales included 14 items per construct and were designed to measure white collar/employees acceptance of information technology with the purpose of creating better measures for predicting and explaining system use. After testing the 14-item scales, the instrument was revised to include 10 items for measuring PU and 10 items for measuring PEU. Items for measuring PU include quality of work, control over work, work more quickly, critical to my job, increase productivity, job performance, accomplish more work, effectiveness, makes job easier, and useful (Davis, 1989). Items for measuring PEU include cumbersome, ease of learning, frustrating, controllable, rigid and inflexible, ease of remembering, mental effort, understandable, efforts to be skillful,

and ease to use (Davis, 1989). Davis (1989) also validated two abbreviated scales with six-items each, including work more quickly, job performance, increase productivity, effectiveness, makes job easier, and useful to measure PU; and easy to learn, controllable, clear and understandable, flexible, easy to become skillful, and ease to use to measure PEU. Permission to use the PU and PEU scales for this dissertation research was obtained via e-mail from the author, Fred Davis on May 2, 2016.

Multiple researchers have adapted and used PU and PEU scales for their studies. Hyun et al., 2007 used them to measure nurses' perceptions on functionality and usability of an electronic documentation system. Welsh and Houston (2010) used the PU and PEU instrument to measure nurse's perceived usefulness and perceived ease of use of a nursing portal. Ronda, Dijkhorst-Oei, and Rutte (2014) used them to measure perceived barriers to using a web portal in order to optimize its use for patients with diabetes. The main adaptations of the original PU and PEU scales have consisted of including less questions in the questionnaire, adding the name of the actual application in the questions, and using a 5-point or a 7-point Likert Scale.

In terms of psychometric properties of the scales, for the six-item scale, Davis (1989) reported reliability values of 0.98 and .94 respectively for PU and PEU, which demonstrated high convergent, discriminant, and factorial validity. Davis tested the tool by conducting studies on electronic mail, as well as a lab and two graphic systems. Adam, Nelson, and Todd (1992) validated PU and PEU scale as well. They tested the instruments via an electronic and voice mail study as well as Word perfect, Lotus, and Harvard Graphics study, and found comparable reliability levels ranging from 0.91 to

0.95 for PU and .81 and .96 for PEU. Davis et al. (1989) tested the validity of the scales by factor analysis using principal component extraction and oblique rotation. The results indicated that usefulness and ease of use were two distinct factors, which supported construct validity (Davis et al., 1989).

Davis et al. do not describe the initial population they used, however, their study referred to white collar employees. Researchers who have used PU and PEU to measure PU and PEU for various software and information systems in the workplace, have used a particular workforce as their population. However, these two scales have been adapted and used in measuring perceived usefulness and perceived ease of use for other populations, such as patients, students, and non-specific adult populations or web-users. Henderson and Divett (2003) studied general random customers and their perceived usefulness and perceived ease of use of an electronic supermarket. In their study of investigating user communication behavior in computer mediated environments, Chang and Wang (2008) focused on random web-users. Ronda, Dijkhorst-Oei, and Rutte (2014) measured perceived usefulness and perceived ease of use of a patient portal among patients with diabetes. The population that was used for my study was similar to the populations that have already completed PU and PEU surveys in prior studies.

As cited in Davis, Bagozzi and Warshaw (1989), according to Blair and Burton (1987) and Hartley et al. (1977) self-reported portal usage frequency measures may not be precise; however, self-reported frequency is an appropriate relative measure.

Operationalization

  This study involved two independent variables and one dependent variable. All three variables are defined below.

  Independent variable 1: Perceived usefulness is the degree to which a person believes that using a patient portal would enhance his or her management of their own health matters (Davis, 1989).

  Independent variable 2: Perceived Ease of Use of the degree to which a person believes that using a patient portal would be free of effort *(Davis, 1989)*.

  Dependent variable: Usage of patient portal is the frequency of using the patient portal provided by the selected healthcare organization (from daily to monthly) and duration of portal use (from less than a minute to more than one hour.)

  Perceived usefulness and perceived ease of use were planned to be measured by using the six-item scales validated by Davis. Login frequency would be measured by selecting one of the categories: never before, daily, weekly, monthly, and less than once a month. Duration of patient portal use would be measured with the following categories: less than 1 minute, 1-15 minutes, 16-30 minutes, 31-45 minutes, 46-60 minutes, and longer than 60 minutes. Some demographic data questions such as, gender, age, race, ethnicity, and level of education would be included in the survey; however, demographic data were not planned as variables for this study.

  An example of the PU measuring items is:

  10. Overall, I find the patient portal useful in managing my health matters.

  1-strongly disagree

2-moderately disagree

3-slightly disagree

4-neutral

5-sligtly agree

6-moderately agree

7-strongly agree

An example of the PU measuring items is:

11. I find the patient portal ease to use.

1-strongly disagree

2-moderately disagree

3-slightly disagree

4-neutral

5-sligtly agree

6-moderately agree

7-strongly agree

Data Analysis Plan

The data analysis plan included crosstabs and regression analysis with the help of SPSS. As cited by Davis (1989), according to Hauser and Shugan (1980), Larcker and Lessig (1980), and Swanson (1987), "usefulness and ease of use are statistically distinct dimensions" (p. 985). This makes it possible to use regression analysis. Other researchers who have studied the relationship between PU/PEU and the use of an information system (other than patient portals) have used regression analysis, as well. Given the categorical

nature of dependent variables, the plan was to use multinomial regression analysis. This requires entering data into SPSS, recoding the variables (including the set of six questions measuring perceived usefulness and perceived ease of use) and creating new variables as the sum of the scores for perceived usefulness and perceived ease of use. The plan was to use frequencies, crosstabulation tables, and Pearson Chi-square test of independence in order to describe the data and the relationship between independent and dependent variables. Pearson Chi-square and p-values determine whether the null hypotheses were rejected or accepted. Multinomial regression analysis provides answers to the research questions, "Does perceived portal usefulness affect portal usage significantly?" and "Does perceived portal ease of use affect portal usage significantly?" Pearson Chi-square and p-values determine whether perceived usefulness or perceived ease of use have an effect on portal login frequency and duration. Further, expected counts for each cell in the crosstabulation tabs show whether assumptions are violated or not.

Threats to Validity

Threats to validity include control or internal validity and generalizability of external validity. Given the cross-sectional design, the internal validity for this study was projected to suffer. The purpose of the study was to identify the relationship between PU and PEU and portal use, which required that other possible rival explanations of this relationship were ruled out. Specifically, history, maturation, and testing were projected to be problematic for this study. History refers to the events that occur during the time of the study that may affect individuals' responses. Communication from various resources could have mentioned patient portals, impact patients' perceptions about usefulness or

ease of use of patient portals, and thus impact the responses in the questionnaire. Maturation addresses biological, physiological, or social changes occurring during the time of the study. For example, a patient could be diagnosed with a chronic diseases, and under the new situation, perceive the patient portal differently. Testing could also threaten internal validity because the process of going through with the study and completion of the questionnaire could change usefulness and ease of use perceptions.

Given the convenience sampling method selected, the external validity was also projected to suffer because the sample selected may not have been representative of the entire population. Generally, this would make it hard to generalize the results beyond the scope of the study, which was Abington Health and Holy Redeemer patients.

Ethical Procedures

Agreement to gain access to participants was obtained by Walden Institutional Review Board, as well as Abington Health. The IRB approval number provided by Walden University is 01-23-17-0303192. Access to protected health information, such as patient identification information is protected by HIPAA and was not necessary for this study. Patient contacting method was determined in collaboration with Abington Health. One possible contact method was for the hospital to contact patients via e-mail and present them with the link to the questionnaire on my behalf. The other contact method was to share the e-mail list with the researcher; in this case, the researcher would send out the invitations to participate in the study via e-mail. The first alternative was considered more appropriate because there is greater assurance that patients' privacy is not violated when the hospital contacts them. The second alternative required certain agreements

presented by the hospital as well as signing of confidentiality or a business associate agreement (which is typical a procedure when a healthcare organizations is working with external parties). Final course of action and further details were left for discussion and clarification with the participating organizations before starting the data collection.

This study did not require an intervention or sharing of specific health information conditions, procedures, or other sensitive information, factors that typically make patients feel less comfortable to participate in the study. Data collected from questionnaires is managed securely and may only be shared with the Walden Dissertation committee and other approving parties, as well as Abington Health. While the results of the study will be published in the dissertation, raw data will be destructed as instructed by Walden University and Abington Health.

<div align="center">

Summary

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As demonstrated by Davis et al. (1989) as well as other researchers who have focused on identifying contributing factors to use of information technology, Pu and PEU are two important factors that may impact use of the patient portal. Existing research on patient portals lacks quantitative studies pertaining to perceived usefulness and perceived ease of use. In this chapter, I focused on presenting the research methodology, including population, sampling, instrumentation, procedures, operationalization, data analysis plan, and threats to validity. Both 6-item instruments planned to measure perceived usefulness and perceived ease of use of patients toward patient portals have already been validated. Research findings and data analysis are discussed in Chapter 4. Also, statistical reports, tables, and figures that illustrate the results are presented in Chapter 4.

Chapter 4: Results

Introduction

In this study I examined the relationship between patients' perceived usefulness and perceived ease of use of a patient portal and the frequency and duration of patient portal use by patients. The research questions focused on whether perceived portal usefulness and perceived ease of use affect portal usage. The first null hypothesis was: There is not a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients. The second null hypothesis was: There is not a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

The perceived usefulness and perceived ease of use were measured by using Davis' PU and PEU six-item scales. Frequency of portal use was measured by the self-reported frequency of logging into the portal and duration of portal use was measured by the self-reported time spent on the portal. This chapter will provide details on data collection process, sample size and representatives, descriptive statistics, and statistical analysis of the findings.

Data Collection

Data collection was done in collaboration with Abington Health, which is a healthcare organization composed of Abington Health and Abington Physician Network. The initial plan was to also work with Holy Redeemer Hospital and Medical Center; however, those collaboration efforts were not successful. The study and the data

collection process was reviewed and approved by Walden University Institutional

Review Board (IRB), as well as Abington's IRB. The survey was also approved by

Abington's Public Relations Department and the Chief Medical Information Officer.

Upon creating the survey in the SurveyMonkey website, the survey link and the consent

form were shared with Abington's Chief Medical Information Officer and Associate

Chief Medical Information Officer, who posted the information in the patient portal.

Abington's patient portal is a product of eClinicalWorks. A message containing the entire

text from the Consent Form was posted in the patient portal. At the end of the consent

form, the survey link was provided. Patients received a notification via e-mail that a new

message was posted in the portal; this is the normal notification process for any type of

messages posted in the portal, including those for clinical results and clinical care. The

notification did not contain any details from the survey-specific message posted. Patients

who decided to log in and read the message, were presented with the consent form, and

then, invited to take the survey by clicking on the SurveyMonkey link.

　　　The initial plan for recruitment was to e-mail the invitation for participation in the

study to patients, as well as post the message in their patient portal. Upon further

discussion with the Chief Medical Information Officer and the Director of Nursing, it was

decided that e-mailing the patients directly could be considered as intrusion; therefore,

the survey invitation was only shared as a message within the patient portal along with

the routine notification message "You have a new message" via e-mail. The survey

opened on April 19, 2017 and closed on April 27, 2017. Due to eClinicalWorks system

processes, the portal message quit sending (stopped) after it was sent to 27,000 patients.

The software vendor could not decide why the posting stopped at that time. In addition, it was not possible to determine any pattern in relation to how the messages were posted and whether the system followed a certain selection process. The selection of patients who received the message could have been random, alphabetical by patient name, or alphabetical by e-mail address. By the end of the day on April 27, 432 responses were received. This represents a 16% response rate. It should be noted that there was misunderstanding from a few patients who printed the consent form, completed the sample questions within the consent form, and took the paper to their provider. Those responses were not tracked or included in the study. Providers informed the patients that the complete survey could be accessed by clicking on the SurveyMonkey link; however, there was no further follow up or tracking of those patients. Only the surveys collected through SurveyMonkey were used for analysis.

According to the Abington Health team that made data collection possible for this study, the potential population includes over 80,000 Abington patients. This study focused only on Abington patients who have access to the eClinicalWorks patient portal. As described above, the new portal message notification was system generated and was most likely randomly sent to 27,000 patients. The sample of 432 participants was conveniently selected; the survey stopped when the desired number of responses was reached. In the absence of Abington-specific patient demographic statistics, the sample is compared to the population characteristics in Montgomery and Bucks counties, as well as North East Philadelphia, areas which Abington Health primarily serves. According to the United States Census Bureau (2017), the 2016 population estimates for these areas

include an overall population of 1,748,124, with about 17-18% of the population over the age of 65 years old, 51% females, 80% white, 9% black or African American, 6-7% Asian, 2% American Indian, 1% Native Hawaiian or other Pacific Islander, and 5-6% Hispanic. The sample for this study included 45% participants over the age of 65 years old, 60% females, 95% white, 4% black or African American, 1% Asian, and 1% Hispanic. In terms of education, about 37-47% of the population in the selected areas have a Bachelor's degree or higher; in this study, about 70% of the participants reported a Bachelor's degree or higher. Based on these comparisons, the sample is over-representative of the female population, white population, and the population with a Bachelor's degree or higher. The sample is also over-representative of the elderly population; however, this is most-likely better aligned with the typical patient population. The sample is under-representative of the other races, Hispanics, and the population with less than a Bachelor's degree education. These findings are consistent with prior studies who have found that women, white, non-Hispanic, and better educated populations are more likely to use a patient portal (Ancker at al., 2011; Roblin, 2009; Schickendaz at al., 2013; Weingart, Rind, Tofias, & Sands, 2006), and thus, more likely to participate in a patient portal survey.

Results

About 65% of the patients who completed the survey were between 55 and 74 years old. About 25% were between 25 and 54 years old, and about 10% were above 75 years old. About 60% of the respondents were female and 40% were males. More than 95% of the respondents were white, about 4% were black or African American, and less

than 1% were Asian. Other races were not represented. In regard to ethnicity, about 99%
were non-Hispanic and about 1% were Hispanic. About 77% of the respondents reported
to have completed some college, a Bachelor's degree or a Master's degree. About 10% of
the respondents had high school, a high school equivalent, or vocational school
education, and about 10% had a doctoral or a professional degree. There were only a few
missing values for age, gender, race, ethnicity, and level of education completed. A
summary of the sample demographics is shown in Table 1 below.

Table 1

Reported Values for the Demographic Characteristics of the Sample Size

Characteristic	Reported Values	Missing values
Age	430	2
Gender	429	3
Race	426	6
Ethnicity	424	8
Education	431	1

Figures 4 and 5 provided below show the distribution of the age and gender for
the participants who responded.
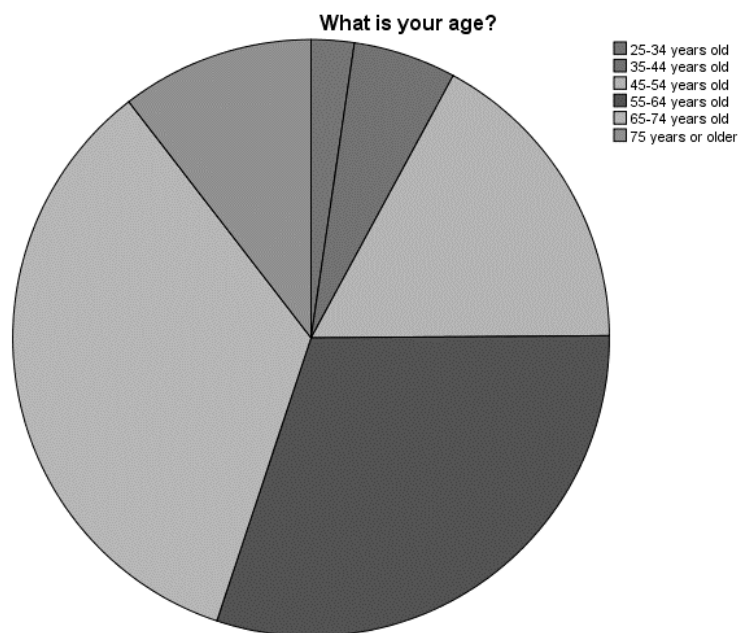
Figure 1. Pie chart for the age of the participants.
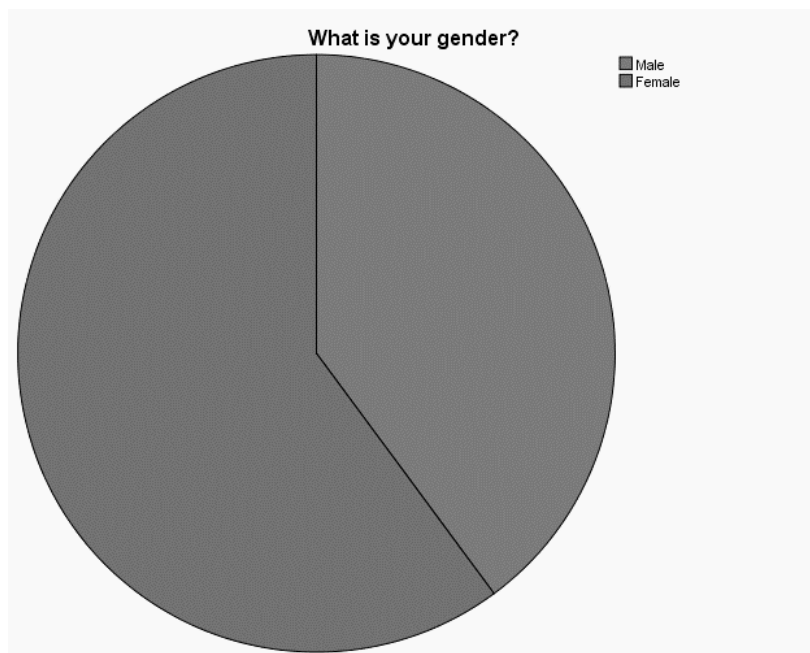
Figure 2. Pie chart for the gender of the participants.

All 432 participants responded to the questions pertaining to perceived usefulness, perceived ease of use, frequency of logging in, and time spent on the portal. In terms of perceived usefulness, most participants agreed (at various levels) that the patient portal was useful. Frequency distributions for all six items measuring perceived usefulness are shown in Table 2 in the next page. There were no missing cases.

Table 2

Frequencies for the Perceived Usefulness (PU) Questions

PU Question	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
The patient portal enables me to manage my health matters more quickly.	29	18	9	38	46	145	147
The patient portal improves my performance in managing my health matters.	30	22	11	65	61	126	117
The patient portal increases my productivity in managing my health matters.	31	27	12	58	60	127	117
The patient portal increases my effectiveness in managing my health matters.	31	26	11	59	63	118	124
The patient portal makes it easier to manage my health matters.	32	23	8	43	63	119	144
Overall, I find the patient portal useful in managing my health matters.	35	20	11	28	64	117	157

The majority of participants in this study, also agreed (at various levels) that the patient portal was easy to use. Frequency distributions for all six items measuring perceived ease use are shown in Table 3. There were no missing cases.

Table 3

Frequencies for the Perceived Ease of Use (PEU) Questions

PU Question	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
I find the patient portal easy to learn.	27	14	23	28	37	132	171
I find the patient portal controllable.	27	21	24	65	49	121	125
I find the patient portal clear and understandable.	26	19	23	27	46	135	156
I find the patient portal flexible.	28	23	32	116	49	103	81
I find the patient portal easy to become skillful at.	26	12	23	60	53	127	131
I find the patient portal easy to use.	25	16	24	35	54	127	151

A Cronbach's alpha analysis was conducted to test the reliability of the PU and PEU scales. As shown in Table 4, perceived usefulness scale had high reliability,

Cronbach's *a* = .978. The perceived ease of use scale also had high reliability,

Cronbach's *a* = .966.

Table 4

Reliability Statistics

Scale	*Cronbach's Alpha*	*Cronbach's Alpha* Based on Standardized Items	N of Items
Perceived Usefulness	.978	.978	6
Perceived Ease of Use	.966	.966	6

Individual PU and PEU scores for each participant were added and new variables

PUTotal and PEUTotal were computed. This type of computing and creation of new

variables can be done in SPSS and is common when calculating data collected from

Likert-scale questionnaires. The minimum scores for each scale was 6 (for individuals

who strongly disagreed with all items) and the maximum score for each scale was 42 (for

individuals who strongly agreed with all items). The two computed variables were

recoded into new categorical variables. For PU, the first category (35.6% of the values)

included total scores 6-30, the second category (31.1 % of the values) included total

scores 31-37, and the third category (33.3%) included total scores 38-42. This recoded

variable was named PUTotal_R3. R symbolizes recoding and 3 symbolizes the split of

the data into three almost equal parts. For PEU, the first category (32.4% of the values)

included total scores 6-30, the second category (33.3 % of the values) included total

scores 31-37, and the third category (34.3%) included total scores 38-42. This recoded

variable was named PEUTotal_R3.

In terms of the frequency of logging into the patient portal, the majority of the responses were "weekly" and "monthly". There was no log-in limit set for the patients. These were self-reported data reflecting the patient's frequency of logging into the patient portal. Table 5 shows the frequency distribution for this dependent variable.

Table 5

Frequencies for the "On average, how frequently do you log into your patient portal".

Category	Coded as	Frequency	Percent
Never before	1	2	.5
Less than once a month	2	28	6.5
Monthly	3	119	27.5
Weekly	4	272	63
Daily	5	11	2.5
Total		432	100

In order to obtain statistically significant results, the "never before" category was merged with "less than once a month" category. In addition, the "daily" category was merged with the "weekly" category. The distribution of frequencies after merging of categories is shown in Figure 6 in the next page.
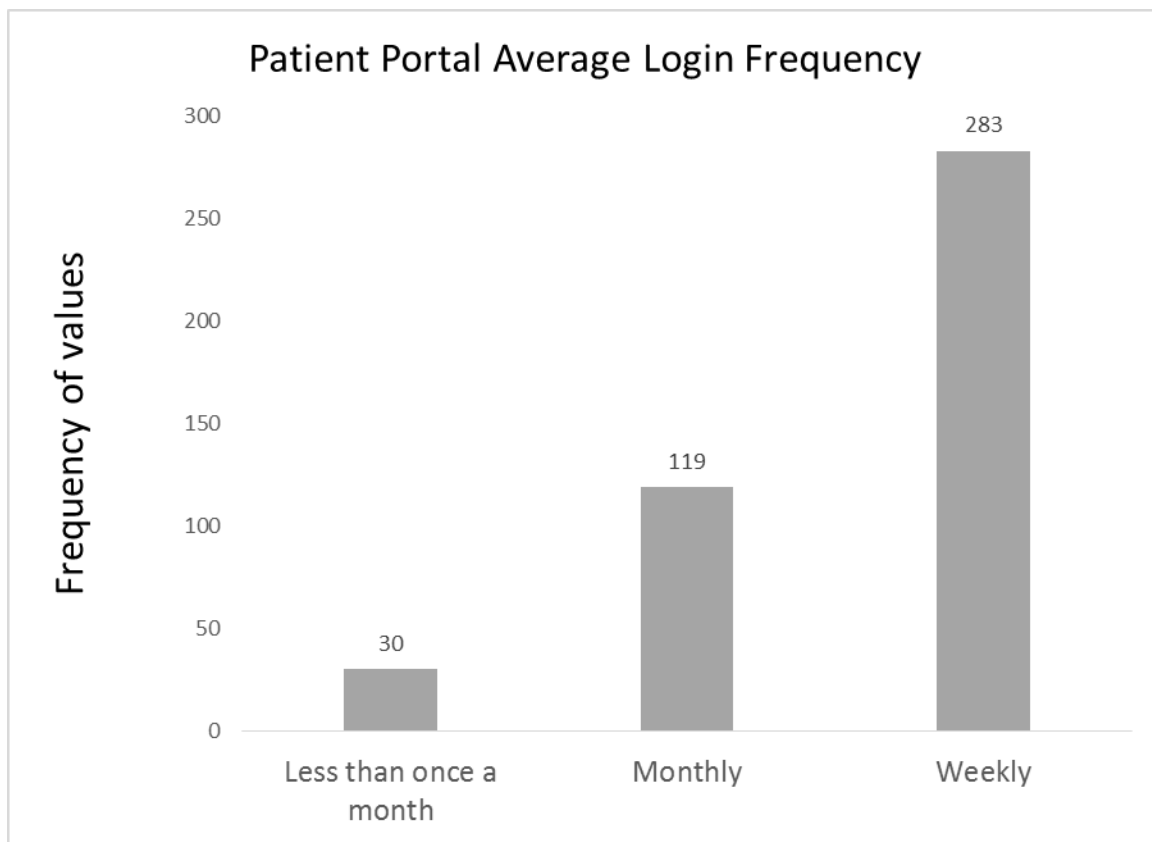
Figure 6. Graph for the frequency of logging into the patient portal.

In terms of the duration of the patient portal use, the majority of the responses were between 1 and 15 minutes. Table 6 presented in the next page shows the frequency distribution for this dependent variable.

Table 6

Frequencies for the "On average, how much time do you spend in your patient portal when you log in".

Category	Coded as	Frequency	Percent
Less than a minute	1	18	4.2
1-15 minutes	2	356	82.4
16-30 minutes	3	53	12.3
31-45 minutes	4	2	.5
46-60 minutes	5	2	.5
More than 60 minutes	6	1	.2
Total		432	100

As in the case of login frequency, in order to obtain statistically significant results, the last three categories "31-45 minutes", "46-60 minutes", and "more than 60 minutes" were merged with the "16-30 minute" category. The distribution of frequencies after merging of categories is shown in Figure 7 in the following page.
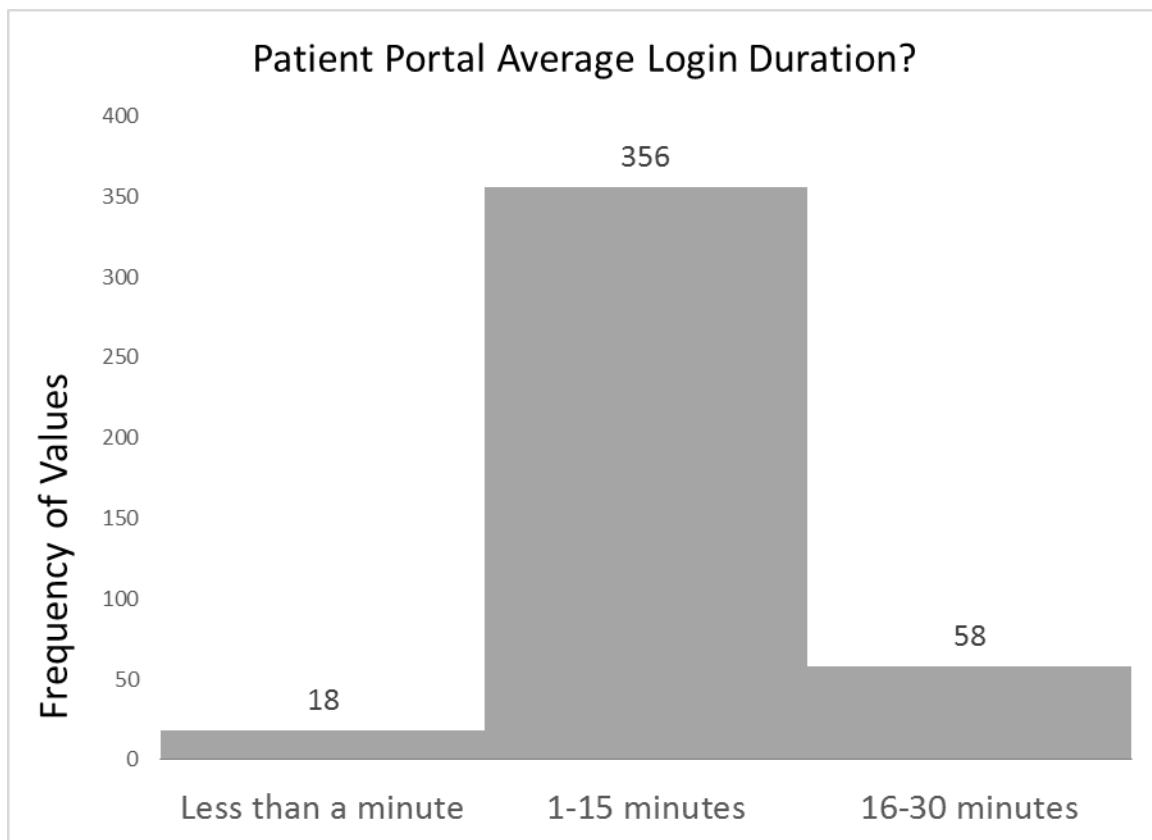
Figure 7. Graph for the time spent on the patient portal.

Upon coding of data and merging of the categories as described above, crosstabs and multinomial logistic regression analyses were conducted in SPSS. Crosstabs procedure is appropriate for calculating the Chi-square test of independence which is used to examine independence between variables (Green & Salkind, 2011). In addition, multinomial logistic regression is appropriate to investigate whether a perceived usefulness or perceived ease of use affect frequency and duration of portal use (Field, 2013).

Statistical Analysis

The following sections detail the analysis. Results are broken down by hypotheses and research questions.

Research Question and Hypothesis 1.

The first research question is "Does perceived portal usefulness affect portal usage significantly?" The first null hypothesis assumes independence between PU and frequency of logging in as well as independence between PU and the duration of portal usage per login.

A Chi-square test of independence was performed to examine the relationship between perceived usefulness of the patient portal and frequency of logging in to the patient portal. A significant relationship was found, X^2 (4) = 26.489, $p<.001$. This value is highly significant and it shows that there is a statistically significant relationship between perceived usefulness and frequency of logging into the patient portal. A Chi-square test of independence was also performed to examine the relationship between perceived usefulness of the patient portal and the time patients spent on the portal once they logged in. This value is also significant and it shows that there is a statistically significant relationship between perceived usefulness and duration of patient portal usage by patients. The first null hypothesis, $H_0 1$ is rejected, and the alternative hypothesis $H_a 1$ is accepted. Table 7 presented in the following page shows Chi-square, degrees of freedom, and significance levels for the first hypothesis.

Table 7

Chi-square Tests for H_01 (Perceived Usefulness)

Test	Value	df	Significance	DV
Pearson Chi-square	26.489	4	.000	Login Frequency
Pearson Chi-square	9.724	4	.045	Login Duration

To further explore whether perceived portal usefulness affects frequency of

logging into the patient portal, a multinomial regression analysis was conducted. Results

are shown in Table 8. All figures in the table are rounded to two decimal points.

Table 8

Multinomial Logistic Regression Parameter Estimates for PUTotal_R3 and Frequency

	B(SE)	95% CI for	Odds Ratio	
		Lower	Odds Ratio	Upper
Monthly vs. less than once a month				
Intercept	1.56 (0.32)**			
PUTotal_R3=1	-0.33 (0.53)	0.25	0.72	2.06
PUTotal_R3=2	-0.32 (0.47)	0.29	0.73	1.82
Weekly vs. less than once a month				
Intercept	1.83 (0.31)**			
PUTotal_R3=1	1.03 (0.50)*	1.06	2.81	7.46
PUTotal_R3=2	0.21 (0.45)	0.52	1.24	2.97

Note. R^2 = .06 (Cox & Snell), .08 (Nagelkerke). Model X^2 (4) = 27.20, $p < .001$.
* $p < .05$, ** $p < .001$

a. The reference category is: less than once a month.

As seen in the results table above, there is a relatively high standard error, leading to low levels of significance for all but one category. The relative log odds of logging in the portal weekly versus less than once a month will increase by 1.03 if the total PU score moves from the highest scoring category to the lowest scoring category. Based on this data, there is a very limited effect that perceived usefulness has on the frequency of patient portal usage.

A multinomial regression analysis was also conducted to explore whether perceived usefulness affects the time spent on the portal or login duration. Results are shown in Table 9.

Table 9

Multinomial Logistic Regression Parameter Estimates for PUTotal_R3 and Duration

	$B(SE)$	95% *CI* for Lower	Odds Ratio Odds Ratio	Upper
1-15 minutes vs. less than a minute				
Intercept	3.38 (0.51)**			
PUTotal_R3=1	-1.03 (0.59)	0.11	0.36	1.14
PUTotal_R3=2	.66 (0.88)	0.35	1.93	10.75
16-30 minutes vs. less than a minute				
Intercept	1.75 (0.54)**			
PUTotal_R3=1	-1.46 (0.66)*	0.06	0.23	0.85
PUTotal_R3=2	0.21 (0.45)	0.27	1.65	10.02

Note. R^2 = .02 (Cox & Snell), .03 (Nagelkerke). Model X^2 (4) = 9.62, $p < .05$.
* $p < .05$, ** $p < .001$

a. The reference category is: less than a minute.

As seen in the results table above, there is a relatively high standard error, leading to low levels of significance for all but one category. The relative log odds of using the portal for 16-30 minutes versus less than a minute will decrease by 1.46 if the total PU score moves from the highest scoring category (Group 3) to the lowest scoring category (Group 1). The same cannot be said when the PU score moves from Group 3 to Group 2. Based on this data, there is limited effect that perceived usefulness has on the duration of patient portal usage.

Research Question 2.

The second research question is "Does perceived portal ease of use affect portal usage significantly?" The second null hypothesis assumes independence between PEU and frequency of logging in as well as independence between PEU and the duration of portal usage per login.

A Chi-square test of independence was performed to examine the relationship between perceived ease of use of the patient portal and frequency of logging in to the patient portal. A significant relationship was not found, X^2 (4) = 3.334, $p>.05$. Perceived ease of use and frequency of logging in are independent variables. A Chi-square test of independence was also performed to examine the relationship between perceived ease of use of the patient portal and the time patients spend on the portal once they log in. In this case, a significant relationship was found, X^2 (4) = 11.116, $p<.05$. This second value is significant and it shows that there is a relationship between perceived ease of use and duration of portal usage. Given that patient portal usage is measured by both, frequency of logging in and duration of portal use, the null hypothesis, $H_0 2$ is not rejected, and the

alternative hypothesis H_a2 is not accepted. Table 10 shows Chi-square, degrees of

freedom, and significance levels for the second hypothesis.

Table 10

Chi-square Tests for H_02 (Perceived Ease of Use)

Test	Value	*df*	Significance	*DV*
Pearson Chi-square	5.335	4	.255	Login Frequency
Pearson Chi-square	11.116	4	.024	Login Duration

A multinomial regression analysis was conducted to further investigate the effect

of perceived usefulness on login frequency. Results are shown in Table 11.

Table 11

Multinomial Logistic Regression Parameter Estimates for PEUTotal_R3 and Frequency

	B(SE)	95% *CI* for Odds Ratio	Odds Ratio	
		Lower	Odds Ratio	Upper
Monthly vs. less than once a month				
Intercept	1.57 (0.35)**			
PEUTotal_R3=1	-0.60 (0.50)	0.21	0.55	1.45
PEUTotal_R3=2	-0.03 (0.51)	0.36	0.97	2.62
Weekly vs. less than once a month				
Intercept	2.20 (0.33)**			
PEUTotal_R3=1	0.01 (0.46)	0.41	1.01	2.49
PEUTotal_R3=2	0.14 (0.48)	0.45	1.15	2.96

Note. $R^2 = .01$ (Cox & Snell), .02 (Nagelkerke). Model X^2 (4) = 5.47, $p > .05$. ** $p < .001$
a. The reference category is: less than once a month.

B values presented above are not statistically significant. Portal ease of use does not affect frequency of logging into the patient portal.

The multinomial regression analysis conducted to explore whether perceived usefulness affects the duration the duration of portal usage is shown in Table 12.

Table 12

Multinomial Logistic Regression Parameter Estimates for PEUTotal_R3 and Duration

	B(SE)	95% CI for	Odds Ratio	
		Lower	Odds Ratio	Upper
1-15 minutes vs. less than a minute				
Intercept	3.41 (0.51)**			
PEUTotal_R3=1	-1.19 (0.59)*	0.10	0.31	0.98
PEUTotal_R3=2	.72 (0.88)	0.37	2.05	11.40
16-30 minutes vs. less than a minute				
Intercept	1.75 (0.54)**			
PEUTotal_R3=1	-1.40 (0.66)*	0.07	0.25	0.90
PEUTotal_R3=2	0.45 (0.92)	0.26	1.57	9.53

Note. R^2 = .02 (Cox & Snell), .04 (Nagelkerke). Model X^2 (4) = 10.61, $p < .05$.
* $p < .05$, ** $p < .001$

a. The reference category is: less than a minute.

The relative log odds of using the portal for 1-15 minutes versus less than a minute will decrease by 1.19 if the total PEU score moves from the highest scoring category (Group 3) to the lowest scoring category (Group 1). In addition, the relative log

odds of using the portal for 16-30 minutes versus less than a minute will decrease by 1.40 if the total PEU score moves from the highest scoring category (Group 3) to the lowest scoring category (Group 1). The same cannot be said when the PEU score moves from Group 3 to Group 2. Based on this data, there is a limited effect that perceived ease of use has on the duration of patient portal usage.

Summary

The purpose of this study was to investigate the relationship between patients' perceived usefulness and perceived ease of use when it comes to the patient portal and patient portal usage measured by login frequency and duration. Abington Health patient population and their patient portal eClinicalWorks was used to measure perceived usefulness, perceived ease of use, login frequency and login duration. A total of 432 patients participated in the survey and all surveys were complete and valid for inclusion in the data analysis. There were only few missing demographic data. Upon completion of data analysis, it was found that a statistically significant relationship exists between perceived usefulness and portal usage; however, the effect of perceived usefulness on portal usage was not significant and/or consistent with changes in perceptions moving from high levels of agreement to lower levels of agreement. In addition, it was found that perceived ease of use is not significantly related to patient portal usage and the effect of perceived ease of use on patient portal usage is not significant.

These findings provide limited confirmation of the Technology Acceptance Model as it applies to patient portals. Study results create an opportunity to discuss the overall perceptions on perceived usefulness and perceived ease of use of patient portals,

patient portal usage, and patient experience with portals. Results will be further discussed

and interpreted in in Chapter 5. Chapter 5 will also describe limitations to the study,

recommendations for further research, and practical implications.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This study focused on examining the relationship between PU and PEU on one side and the login frequency and duration of the portal usage on the other. The main purpose of the study was to answer two questions: (1) Does PU significantly affect portal usage as measured by login frequency and duration; and (2) Does PEU significantly affect portal usage as measured by login frequency and duration? The two hypotheses from this study were:

$H_0$1: There is not a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

H_a1: There is a statistically significant relationship between perceived portal usefulness and portal usage (measured by frequency and duration of portal use) by patients.

$H_0$2: There is not a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

H_a2: There is a statistically significant relationship between perceived portal ease of use and portal usage (measured by frequency and duration of portal use) by patients.

The study was cross-sectional, with two independent variables (PU and PEU) and two dependent variables (login frequency and login duration). Data analysis of 432 completed surveys revealed that a significant relationship exists between PU and login

frequency ($p < .001$), PU and login duration ($p < .05$), and PEU and login duration ($p <$ .05); however, a significant relationship does not exist between PEU and login frequency ($p > .05$). Basically, perceived usefulness seemed to be significantly related to portal usage and perceived usefulness was not. Perceived usefulness and perceived ease of use did not significantly affect portal usage.

Interpretation of the Findings

Patient portal knowledge collected from prior research reveals that patient portals are widely implemented among hospital and physicians' offices and despite any government requirements for usage, they may soon become a standard part of healthcare (Sarkar & Bates, 2014). Prior research identified many issues related to patient portals, including usability and ease of use as barriers to using the patient portal (Haun et al., 2014; Schickedanz et al., 2013; Urovitz et al., 2012; Zarcadolas et al., 2013). As presented in Tables 2 and 3, in Chapter 4, this study found that over two thirds of the patients who participated in the survey agreed at various levels (by selecting "strongly agree", "moderately agree", or "slightly agree") that the patient portal was useful and easy to use. The overall positive perceptions about portal usefulness and ease of use may be a reflection of the progress made during the last five years. Prior studies have found that younger, non-black, more educated patients are more likely to use the patient portal (Ancker et al., 2011; Roblin, 2009; Schickendaz et al., 2013; Weingart, Rind, Tofias, & Sands, 2006). This study showed that about 75% of the participants were over the age of 55 years old, less than four percent of the participants were black, and about 89% of the participants had at least some college degree with the majority holding a bachelor's or a

master's degree. These figures characterize the sample of this study (patients who read the notification message and chose to take the survey) and do not represent portal usage rates for the all patient of Abington Health; however, they can serve as a helpful reference in creating an idea about the demographic patterns of portal usage. It is possible that non-black and more educated patients are still the ones to use patient portals the most. In regard to age, it is possible, that more older people than younger people are using the patient portal. It should be noted that prior studies took place anywhere between four and eleven years prior to this study and age brackets are not defined the same.

Prior studies have compared perceived usefulness between patient portal users, non-users, and early quitters, and have found significant differences in the perception of portal usefulness between users and non-users. This study did not include non-users, although, there were two participants that were new to the patient portal (they logged in to the patient portal for the first time when they took the survey). As presented in Chapter 4, there was a statistically significant relationship between perceived usefulness and login frequency. This means that patients who perceive the portal more useful may take the time to log in, check for any new information, and stay in the portal more than those who perceive the portal less useful. It could also be that as a result of more frequent and longer login, patient's perceptions toward the patient portal are positive. Given that perceived usefulness and perceived ease of use did not significantly affect login frequency and login duration, results from the study do not confirm that patients log in the portal or stay longer as a result of their perceptions.

When it comes to ease of use, there are no prior studies that have focused on the relationship between perceived ease of use and portal usage. This study explored the potential that ease of use might affect portal usage; however, findings showed that perceived ease of use is not related to how frequently patients log into the portal. Results showed some relationship between perceived ease of use and login duration, however, it should be noted that the majority of the participants (about 82%) spent only 1-15 minutes on the portal. Login duration may be related to other factors, such as number of documents posted on the portal, internet speed, speed or process of reading, distractions while logged in, or actual patient navigation speed from page to page. What matters is that patients take the time they need to read and understand the health information shared in the portal and that perceived ease of use does not become a barrier in that process. Overall, these findings showed that perceived usefulness is more significantly related to login frequency (p=.024) than login duration (p=.255). This is an interesting finding given that logging in is first step to using the portal. This study did not find that perceptions had a significant effect on portal usage; however, it expanded the existing knowledge about the relationship between perceived usefulness and perceived ease of use and portal usage.

This study was based on the Technology Acceptance Model (TAM) by Davis, Bagozzi, and Warshaw, which is built on the premise that perceived usefulness (PU) and perceived ease of use (PEU) of a system affect attitude toward using the system and behavior intention to use the system, which leads to actual use of the system (1989). While a relationship between PU and log in frequency and duration and PEU and

duration was found, a causal relationship between PU/PEU and overall portal usage was not found. These results do not show confirmation of the TAM theory in the case of patient portal usage for Abington patients.

Limitations of the Study

Limitations discussed in this section include control, generalizability, and construct validity. This study has limitations from internal validity. The cross-sectional design lacks the time component (Frankfort-Nachmias & Nachmias, 2008), meaning participants in the study were not provided with an opportunity to first create a perception about the patient portal, and then, use the patient portal based on that perception. They came with already formulated perceptions about the patient portal before they received the survey invitation. This makes it hard to determine whether a causal relationship exists between the variables being studied. Also, there were no control techniques or other manipulations that were used. No one of the variables was controlled. Participants in this study could have created perceptions on portal usefulness and ease of use based on any patient portal they used; not just the eClinicalWorks portal, which was the focus of the study. In fact, based on a few participants' comments noted in Chapter 4, a certain level of frustration with portals seems to exist given that patients see physicians that are part of different health systems and use different portal applications (each requiring user names and passwords and offering different views and types of information).

External validity is concerned with the representativeness of the sample and generalizability of the results (Frankfort-Nachmias & Nachmias, 2008). As described in Chapter 4, the sample of 432 patients has some similarities to the population Abington

Health serves but it is was not randomly chosen and it is not fully representative of the patient population. In addition, this sample was asked to refer to the patient portal provided by Abington Health, eClinicalWorks. In reality, patients across the United States are provided with access to multiple types of patient portals, designed by various health information vendors. Those portals are different in terms of their functionality and design, they may provide different types of information in different formats, and may even provide a wide range of administrative services. The deficiency in sample representatives in terms of demographics and the type of patient portal they have been exposed to and referred to create an issue with the generalizability. Results of this study may not be generalized beyond Abington Health patient population.

Construct validity in this study is not a concern. As per results shared in Chapter 4, Cronbach's alpha values for both six-item scales measuring perceived usefulness and perceived ease of use were respectively, 0.978 and 0.966. As per Field (2013), depending on the type of survey and the number of items in the scale, an acceptable Cronbach's alpha can be .8, .7, or even .5. Given that the Cronbach's alpha values were much higher than the suggested values, a high reliability of the scales exist in this study.

Recommendations

This study can be conducted in other healthcare organizations that utilize different patient portal applications. Expanding the study to capture more applications would address some of the issues pertaining to the generalization of the results. One recommendation is to look at the interactions between perceived usefulness and perceived ease of use and examine this combined effect on portal usage. Another

recommendation is to change the measurement of frequency and duration from self-reported categorical data to system-monitored and system-generated actual scale data. This would increase the accuracy of measurement for the dependent variables (login frequency and duration) and make it possible to see any potential correlations between PU/PEU and the number of times and number of minutes patients stay logged in. In addition, login duration could be broken down by document, such as the number of minutes a patient spends in reading a new message, a radiology study, a lab report, or a visit summary. For portals that provide the ability to schedule an appointment with the provider or other types of services, those measurements could be added as well. It should be noted that studies with actual usage measurements would require certain system capabilities and greater efforts and collaboration from hospitals' IT departments. The additional efforts may prove valuable, especially if the studies help identify portal functions that improve or worsen patient experience (which is related to perceptions and perhaps future use of the portal). Similarly, the study could be conducted by expanding the patient population that uses the same portal application. This would require collaboration with the vendor who provides the portal application, as well as the hospitals who use it. Such a study could reveal differences in the portal perceived usefulness and ease of use as well as portal usage among different hospitals or health systems. With the portal application being the same, the analysis could drill down into the documentation that is shared with patients in the patient portal by various organizations. The content and quantity of information shared could be playing a role in the usage of the patient portal.

Data collected on this study was quantitative; however, as explained in Chapter 4, a few qualitative comments were collected. Those comments show that patients do not mind spending some additional time to provide feedback on what they consider important. This clues could be capitalized upon by conducting a qualitative study. There are a number of qualitative studies on patient portals that have focused on better understanding patient perceptions on usability, discoverability, format, and organization of information, as well as barriers to portal usage (Irizarry, DeVito, & Curran, 2015; Schnipper et al., 2008; Wald, Weingart, Rind, Tofias, & Sands, 2006; Zarcadolas et al., 2013). While there has been progress in terms of making the portals more user-friendly and secure, patients still experience with lost usernames and passwords and with keeping track of multiple usernames and passwords. Such a concern was identified by some of the patient comments in this study. Patients may also be interested in personalizing the information in the portal and the way they receive notifications. Some comment from this study indicated that e-mail blasts were not preferred and that some individuals do not like reminders provided in the patient portals. Yet, other individuals may want notifications and reminders. Preferences may include customization of the content, as well. For example, rather than seeing the typical format of laboratory results, patients may want see a version that is more "lay person friendly". The concept of reimagined lab test results to make them "lay person friendly" has been recommended as a best practice for patient portals by the Health Information Management Systems Society (HIMSS) (HIMSS, 2014). Being able to personalize the portal may affect the overall experience and perceptions about the patient portal. Based on these observations, future qualitative

studies could focus on exploring questions, such as: What triggers a patient to look at the messages posted in the portal? What are the patient preferences for personalized and generalized messages? What is the level of understanding when it comes to the health record content? What type of support or reliable resources would patients need to help them better understand the information shared in the portal and take action towards improving their health?

Implications

The proposition of this study was to identify the relationship between perceived usefulness and perceived ease of use on one side and the login frequency and duration of the patient portal by patients on the other. The intent was to measure the role of perceived usefulness and perceived ease of use on portal usage. Having such knowledge could help in allocating organizational resources in ways that help improve patient perceptions about patient portals and also improve portal usage. Improvements in portal usage can improve patient engagement and patient engagement can help improve health outcomes (Ammenwerth et al., 2012; DelBanco et al., 2012) and lower healthcare costs (James, 2013; Landi, 2016). The findings from this study showed that a significant relationship does exist between perceived usefulness and portal login frequency and duration but the effect of perceived usefulness on login frequency and duration is very limited. Observation of the relationship between these variables does not provide enough evidence to support reallocation of resources in the direction of improving patient perceptions about the portal; however, it highlights the intertwining nature of perceived usefulness and portal usage.

In addition, the study found that a significant relationship between perceived ease of use and portal login frequency does not exist. Considering the improvements in user interface and patient's increasing comfort level with using computer applications, this means that patients may not use a system more just because it is easy to use. They need to see the value in it. For Abington, this means greater focus more on the usefulness of the patient portal. Currently, the system provides a visit summary, laboratory, or other test results that can be viewed in a few minutes, as well as the opportunity to e-mail the provider and request an appointment. As supported by the 82.4% of the participants in this study who reported using the portal for 1-15 minutes, activities available to accomplish in the portal do not require a long time to complete. From a practical standpoint, staying in the patient portal for 15 more minutes may not mean much; unless patients are provided with additional health and wellness resources or other relevant engagement tools. The data from this study shows that over 80% of the patients agree that the portal is useful, which is an indication that they realize it is important to stay informed on their own health matters. The next step for Abington is to capitalize on those positive perceptions and provide patients with more health resources within the patient portal. The ultimate goal should be to not only improve patient experience with the portal and boosting engagement but also strive to improve patient outcomes.

This study is among the first ones to focus on the effect of perceived usefulness and perceived ease of use on portal usage. As such it contributed to the body of knowledge and filled in some of the gap in studying potential factors to patient portal usage. The study can be replicated (or modified with minor changes in the measurements

of login frequency and duration) among other health systems or portal vendors who provide the same product to multiple providers. The fact that a significant relationship was found between perceived usefulness and portal usage may increase the interest in expanding research to greater and more diverse samples, as well as other portal applications. Those efforts will help gain better understanding of the impact of perceived usefulness and perceived ease of use on patient portal usage.

Conclusions

This study was focused on the relationship between perceived usefulness and perceived ease of use of the patient portal and portal usage by patients. The Technology Acceptance Theory framework led to the assumption that perceived usefulness and perceived ease of use would affect the portal usage. Portal usage was measured by self-reported login frequency and duration. The study showed that there is a significant relationship between perceived usefulness and portal usage but there is no significant relationship between perceived ease of use and portal usage. Most importantly, the study did not find that perceived usefulness or perceived ease of use affect portal usage. Despite the limitations of the study, it was valuable to measure patients' perceptions on the patient portal usefulness and ease of use, and it was important to identify the connection between perceived usefulness and portal usage. This knowledge can serve as a baseline for Abington Health in the process of improving the patient portal usefulness and overall patient experience and outcomes. This study can also serve as a baseline for further patient portal studies in the US.

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Appendix A: Survey Questions

1. Are you 18 years of age or older?
   o   Yes, Proceed with the survey
   o   No, Do not proceed with the survey

2. The patient portal enables me to manage my health matters more quickly.
   o   strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

3. The patient portal improves my performance in managing my health matters.
strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

4. The patient portal increases my productivity in managing my health matters.
   o   strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

5. The patient portal increases my effectiveness in managing my health matters.
   o   strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

6. The patient portal makes it easier to manage my health matters.
   o   strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

7. Overall, I find the patient portal useful in managing my health matters.
   o   strongly disagree
   o   moderately disagree
   o   slightly disagree
   o   neutral
   o   slightly agree
   o   moderately agree
   o   strongly agree

8. I find the patient portal easy to learn.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

9. I find the patient portal controllable.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

10. I find the patient portal clear and understandable.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

11. I find the patient portal flexible.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

12. I find the patient portal easy to become skillful at.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

13. I find the patient portal ease to use.
- o strongly disagree
- o moderately disagree
- o slightly disagree
- o neutral
- o slightly agree
- o moderately agree
- o strongly agree

14. On average, how frequently do you log into your patient portal?
- o Daily
- o Weekly
- o Monthly
- o Less than once a month
- o Never before

15. On average, how much time do you spend in your patient portal when you log in?
   o Less than a minute
   o 1-15 minutes
   o 16-30 minutes
   o 31-45 minutes
   o 46-60 minutes
   o more than 60 minutes

16. What is your age?
   o 18-24 years of age
   o 24-34 years of age
   o 35-44 years of age
   o 45-54 years of age
   o 55-64 years of age
   o 65-74 years of age
   o 75 years of older

17. What is your gender?
   o Male
   o Female

18. What is your race?
   o White
   o Black or African American
   o American Indian or Alaskan Native
   o Asian
   o Native Hawaiian or Other Pacific Islander

19. What is your ethnicity?
   o Hispanic
   o Non Hispanic

20. What is the highest level of education you have completed?
   o Grammar school
   o High school or equivalent
   o Vocational/technical school (2 year)
   o Some college
   o Bachelor's degree
   o Master's degree
   o Doctoral degree
   o Professional degree (MD, JD, Etc.)
                    o   Other (please specify) _____

Appendix B: Consent Form

CONSENT FORM

You are invited to take part in a research study about your perceptions and usage of patient portals. The researcher is inviting all adults who have been provided with access to a patient portal by their healthcare provider to be in the study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Dasantila Sherifi who is a doctoral student at Walden University.

Background Information:
The purpose of this study is to measure how perceived usefulness and perceived ease of use affect the actual use of patient portals

Procedures:
If you agree to be in this study, you will be asked to:
- Answer a qualifying question, confirming that you are 18 years of older.
- Answer 13 survey questions.
- Answer 5 general demographics questions.
- Completion of the questionnaire is estimated to take no more than 10 minutes of your time.

Here are some sample questions:

The patient portal makes it easier to manage my health matters.
    1-strongly disagree
    2-moderately disagree
    3-slightly disagree
    4-neutral
    5-sligtly agree
    6-moderately agree
    7-strongly agree

I find the patient portal ease to use
    1-strongly disagree
    2-moderately disagree
    3-slightly disagree
    4-neutral
    5-sligtly agree
    6-moderately agree
    7-strongly agree

On average, how frequently to you log in to your patient portal?
    ____ Daily   ____ number of times

_____ Weekly   _____ number of times
_____ Monthly   _____ number of times
_____ Less than once a month
_____ Never before

Voluntary Nature of the Study:
This study is voluntary. You are free to accept or turn down the invitation. No one at Abington Memorial Hospital will treat you differently if you decide not to be in the study. If you decide to be in the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves minimal risk of the minor discomforts that can be encountered in daily life, such as such as fatigue, stress or becoming upset. Being in this study would not pose risk to your safety or wellbeing.

The study may benefit patients in the future as it may lead to improvements in patient portal usefulness and ease of use, as well as improved patient perceptions.

Payment:
No payment will be provided for participation in this study.

Privacy:
Reports coming out of this study will not share the identities of individual participants. Details that might identify participants, such as the location of the study, also will not be shared. Even the researcher will not know who you are. The researcher will not use your personal information for any purpose outside of this research project. No personal identifiers will be used in this study. Data will be kept secure by using codes in place of names and password protection. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via email at Dasantila.sherifi@waldenu.edu . If you want to talk privately about your rights as a participant, you can call the Research Participant Advocate at my university at 612-312-1210. Walden University's approval number for this study is 01-23-17-0303192 and it expires on January 22, 2018.

Please print or save this consent form for your records.

Obtaining Your Consent

If you feel you understand the study well enough to make a decision about it, please indicate your consent by clicking the link below.

URL to survey link (https://www.surveymonkey.com/r/P5LMX7V)