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Facilitators and Barriers to Electronic Personal Health Record Use in the Older Adult Population

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FACILITATORS AND BARRIERS TO PATIENT PORTAL USE IN THE OLDER ADULT POPULATION

by

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ABSTRACT

FACILITATORS AND BARRIERS TO ELECTRONIC PERSONAL HEALTH RECORD USE IN THE OLDER ADULT

by

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Technology is rapidly being implemented into healthcare. The electronic personal health record (ePHR) has been implemented to improve health outcomes, patient engagement, self-management of chronic disease, and decrease cost of healthcare. Research has examined the impact on older adult's ePHR use, and which characteristics influence an older adult's willingness to use the ePHR. However, there is little evidence to describe facilitators and barriers, and the hypothesized consequences. A correlational design with a convenience sample of older adults (n = 210). Measures included a self-reported survey, adapted U.S.A.B.I.L.I.T.Y. survey, Geriatric Depression Scale: Short Form, UCLA Loneliness Scale, and an observation checklist. Descriptive statistics, frequency distributions, Pearson r and standard multiple regression used for data analysis. Multiple regression analysis for the dependent variable of intent to use indicates the overall model explains 70.3% of the total variance in older adults' intent to use ePHR (F (7, 200) = 67.6, p <.001). User experience (β = .50, p <.001) and perceived control (β = .367, p <.001) were statistically significant predictors on older adult's intent to use ePHRs. Multiple regression analysis for the dependent variable of performance indicates the overall model explains 26.3% of the total variance in older adult's performance with ePHR (F (7, 49) = 2.5, p <.028). The measure of depression was statistically significant in predicting older

adults' performance with ePHRs ($\beta = .32$, $p < .037$). This study identified several facilitators and barriers to older adults' intent to use and performance with electronic personal health records (ePHRs). Understanding facilitators and barriers to ePHR use could inform healthcare progress. Further research is needed to identify the influence of depression and loneliness on older adults' intent to use and performance with ePHRs.

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Chapter 1

Introduction

Technology use has become an important aspect of life, influencing the workplace, academic settings, and healthcare (Czaja et al., 2006). In healthcare, technology provides delivery services, in-home monitoring and communication, transmission of health-related information and data, and support groups (Czaja et al., 2006). One type of healthcare technology, the electronic personal health record (ePHR), is increasingly being used across healthcare settings (Chaudhry et al., 2006). Due to advancements in healthcare technology, patients and caregivers are encouraged to utilize interventions such as electronic personal health records to understand and manage their health conditions (Czaja, 2015).

Healthcare technology affects all patients and caregivers, and can interfere with patient autonomy and management of health conditions (Thompson et al., 2011). One aspect of health care technology, the ePHR, is intended to improve access and quality of care for patients (Wildenbos, Peute, & Jaspers, 2017). Electronic personal health records are web-based programs that help patients to perform several tasks, such as communicating with providers and monitoring health records (Zettel-Watson & Tsukerman, 2014). One perceived benefit of ePHRs is the ability to improve health outcomes, particularly for persons with chronic illnesses and older adults (Wildenbos et al., 2017). In addition, recent legislation promotes ePHR implementation across healthcare settings (Scheck McAlearney et al., 2016). While research exists on the benefits of ePHRs, it is unclear what factors contribute to the older adult's enrollment and usage (Wildenbos et al., 2017).

Background and Significance

Chronic disease significantly affects health care costs for both older adult patients and healthcare systems. Estimates show that treatment and monitoring of chronic diseases can be as much as 75% of healthcare expenditures in the United States (Davis, Bender, Smith, & Broad, 2015). The Centers for Disease Control and Prevention (CDC, 2017) states that chronic and mental health conditions account for 86% of the nation's $2.7 trillion in spending. The aging population has important implications for spending due to the higher incidence of chronic disease and healthcare expenditures (Neuman & Cubanski, 2015). According to Moore (2014), one of the groups that had the highest hospital costs in 2012 were patients aged 65 to 84 years. To reduce the cost of health spending related to chronic disease management, engagement of the patient is necessary (Sands & Wald, 2014). Research indicates that self-management and collaboration with providers leads to better health outcomes in patients with chronic conditions (Nolte & Osborne, 2013). One solution to improving engagement and self-management of the older adult is the implementation of electronic personal health records.

Historically, patients with chronic conditions and older adults sought primary providers face-to-face to provide direct care and manage co-morbidities (Scheck McAlearney et al., 2016). Electronic personal health records allow providers to deliver individualized patient education and provide health coaching electronically in between appointments (Kruse, Argueta, Lopez, & Nair, 2015). In 2009, the Health Information Technology for Economic and Clinical Health (HITECH) Act was created to encourage development of health information systems (HealthIT.gov, 2016). The HITECH Act provides organizations opportunities to establish programs to improve health care quality, safety, and efficiency using health information systems (HealthIT.gov, 2016). Organizations have since implemented electronic health records, provided decision support

interventions, and started remote monitoring of older adults (Bowles, Dykes, & Demiris, 2015). In addition, legislative incentives to implement electronic personal health records have shifted the role of providers from director to facilitator of disease self-management (Scheck McAlearney et al., 2016).

The legislation and incentives for organizations to utilize health information technology and the cost of chronic conditions fuels a collision within the older adult population. Factors including computer self-efficacy and digital disengagement challenge health systems to find effective solutions to overcome barriers to using ePHRs (Price-Haywood, Harden-Barrios, Ulep, & Luo, 2017). Online health management systems such as ePHRs are already utilized and will continue to increase in popularity and use (Zettel-Watson & Tsukerman, 2016). Therefore, it is critical to understand factors that influence older adult patient enrollment and usage of ePHRs in order to best facilitate engagement.

According to the Administration on Aging (2020), there is an estimated number of 54.1 million older adults aged 65 years or older. The number of older adults is projected to increase by an estimated 30 to 40 million people by the year 2050 (Administration on Aging, 2013). The older adult population is adapting to technological advancements, but at a much slower rate than younger generations (Pew Research Center, 2014). The percentage of older adults who used the internet increased between 2008 and 2012, yet remained 27% below the percentage of all U.S. adults (Pew Research Center, 2014). The University of Washington (UW) Soaring project is a program designed to identify how older adults manage personal health information (Orthopaedic Healthcare Solutions, 2017). From the initial results of the UW Soaring project, one in five older adults reported using an ePHR to access online medical records and information (Orthopaedic Healthcare Solutions, 2017). Other research indicated that 80% of the older adult population

enrolled in an ePHR, but utilization varied between 10% and 30% (Arcury et al., 2017; Gordon & Hornbrook, 2016). Despite the correlation of electronic personal health record use and favorable health outcomes, adoption of ePHRs in the older adult population is still low (Wildenbos et al., 2017).

Research indicates that factors such as health literacy level and socioeconomic status affect older adult's use of ePHRs (Wildenbos et al., 2017). Research has also been conducted on the effect of biological, psychological, and social aging processes in relation to older adult's ePHR use (Wildenbos et al., 2017). Physical limitations such as impaired range of motion have been researched, whereas sensoriperceptual deficits have not been studied (Chaffin & Harlow, 2005). In addition, older adult's cognition and memory impairment research is prevalent (Patomella, Kottorp, Malinowsky, & Nygård, 2011; Rosenberg, Kottorp, Winblad, & Nygård, 2009), but evidence of depression as a factor to ePHR use is absent. Mental health conditions, such as depression (Finlay & Kobayashi, 2018), as well as socioeconomic status (Cotterell, Buffel, & Phllipson, 2018) have been linked to another factor, loneliness. Research on loneliness has indicated that individuals who are lonely have a greater risk for developing chronic conditions (Cotterell et al., 2018). However, there is a lack of evidence on the effect of loneliness on older adults' intent to use and performance with ePHRs. Initial research suggests that perceived control and user experience with ePHRs impact older adult's intent to use, but further research is needed (Caboral-Stevens, 2015).

While the use of ePHRs is linked to health care benefits, lack of utilization could negatively affect older adult health outcomes (Depatie & Bigbee, 2015). If chronically ill older adults continue to have low ePHR adoption, they may not experience all of the services offered (Wildenbos et al., 2017). Evaluation of older adult's experiences and preferences for ePHR use

can lead to increased adoption rates (Wildenbos et al., 2017). Therefore, it is essential to identify and understand facilitators and barriers to electronic personal health record use in the older adult.

Purpose

The purpose is to examine the relationship between individual factors of older adults and their use of electronic personal health records (ePHRs).

Table 1

Independent and Dependent Variables

Independent Variables	Dependent Variables
Depression	Intent to use
Perceived control	Performance
User experience	
Sensoriperceptual deficits	
Loneliness	

Research Questions

1. What is the older adult's degree of depression?
2. What is the older adult's degree of loneliness?
3. What is the older adult's perceived control of electronic personal health records?
4. What is the older adult's user experience with electronic personal health records?

5. What is the relationship between sensoriperceptual deficits and intent to use electronic personal health records in the older adult?
6. What is the relationship between performance and intent to use electronic personal health records in the older adult?
7. What is the relationship between the independent variables and intent to use electronic personal health records in the older adult?
8. What is the relationship between the independent variables and performance with electronic personal health records in the older adult?

Research Hypotheses

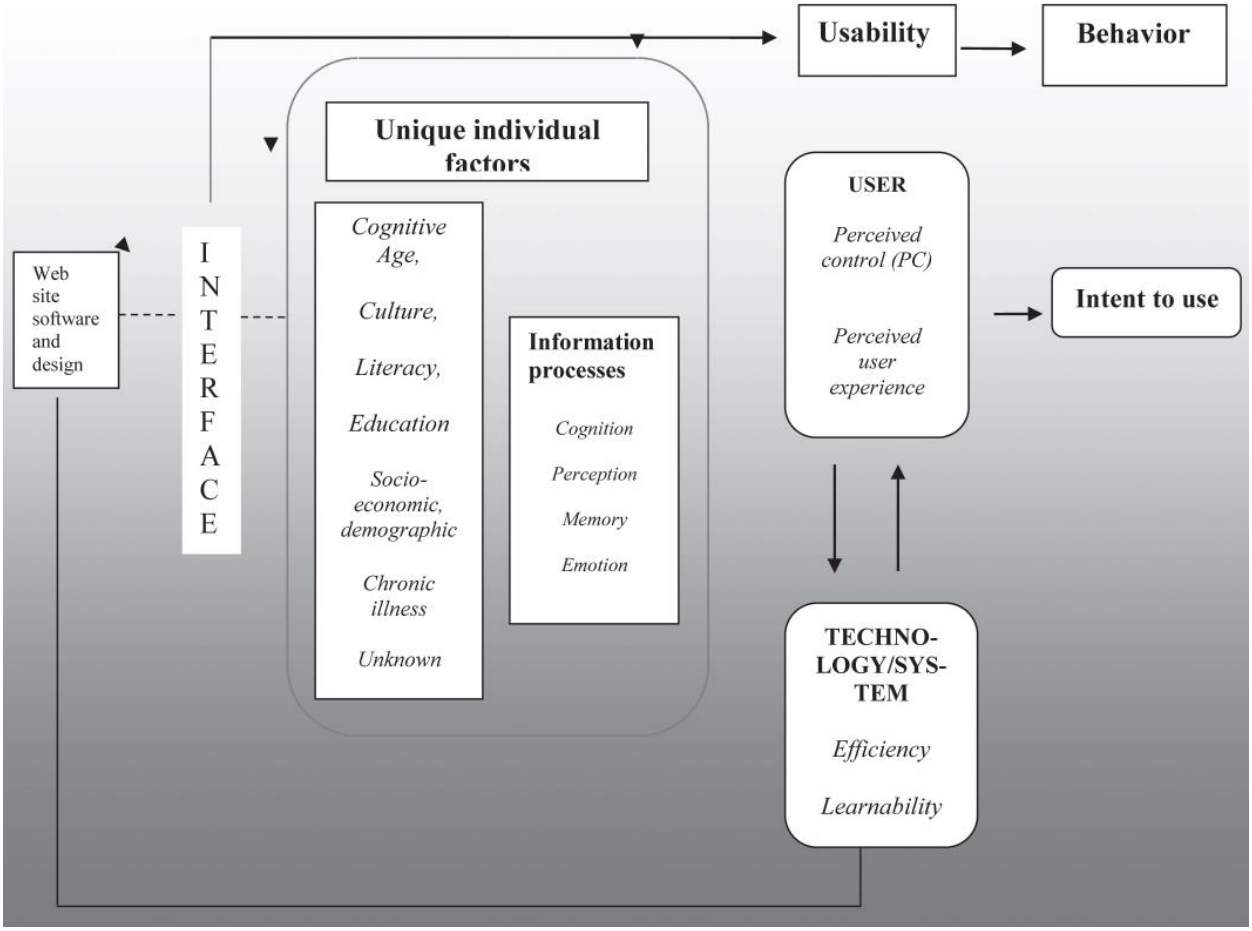
1. Controlling for older adult's sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with intention to use electronic personal health records.
2. Controlling for older adult's sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with performance with electronic personal health records.

Theory Incorporation

The Use of Technology for Adaptation by Older Adults and/or Those With Limited Literacy (U.S.A.B.I.L.I.T.Y.) Framework for Older Adults (Figure 1) was selected for study guidance and support (Caboral-Stevens et al., 2015). The purpose of the U.S.A.B.I.L.I.T.Y. Framework is to utilize theories and concepts that explain or predict intent to use electronic personal health records by the older adult (Caboral-Stevens et al., 2015). The U.S.A.B.I.L.I.T.Y. Framework is appropriate as it identifies facilitators and barriers to using health information

technology, such as ePHRs (Caboral-Stevens et al., 2015). The framework consists of developed concepts, propositions, assumptions, and outcomes that directly relate to the older adult (Caboral-Stevens et al., 2015). The framework incorporates internal and external variables that predict an older adult's intent to use ePHRs. The following section will explain the major tenants of each premise of the framework and describe the significance to nursing.

Figure 1. Pictorial representation of the derived Use of Technology for Adaptation by Older Adults and/or Those With Limited Literacy Model© (Caboral-Stevens et al., 2015, p. 7)



U.S.A.B.I.L.I.T.Y. Framework for Older Adults

The U.S.A.B.I.L.I.T.Y. Framework for Older Adults (Caboral-Stevens et al., 2015) is a newer conceptual model. It was developed to explain or predict the potential intent to use a

health website by older adults. It was derived from three theoretical frameworks: the Roy Adaptation Model, the Technology Acceptance Model, and the Theory of Planned Behavior (Caboral-Stevens et al., 2015). The framework bases its tenets on the assumption that older adults utilize technology and online resources based on perceived usability (Caboral-Stevens et al., 2015).

The U.S.A.B.I.L.I.T.Y. Framework incorporates the constructs of efficiency, learnability, perceived user experience, and perceived control to measure intent to use technology (Caboral-Stevens et al., 2015). Two determinants are categorized as user components: perceived user experience and perceived control (Caboral-Stevens et al., 2015). Learnability and efficiency are categorized as computer system components (Caboral-Stevens et al., 2015).

Efficiency

The construct of efficiency is based on two determinants: perceived usefulness and perceived ease of use (Caboral-Stevens et al., 2015). Davis (1989) describes perceived usefulness as the degree in which a person believes a system would improve performance. Perceived ease of use is the degree in which someone believes the system would be free from difficulty (Davis, 1989). In the U.S.A.B.I.L.I.T.Y. Framework, efficiency is defined as the amount of effort required to use the system and how well the system meets the user's needs (Caboral-Stevens et al., 2015). In this study, data on perceived ease of use from an adapted version of the U.S.A.B.I.L.I.T.Y. Survey© was analyzed as a factor influencing electronic personal health record use in older adults.

Learnability

The second computer system component is learnability, which historically has been difficult to define. In the U.S.A.B.I.L.I.T.Y. Framework, learnability encompasses the ability of an individual with no previous technology experience to both perform well and achieve optimal performance (Caboral-Stevens et al., 2015). Learnability addresses two categories: initial learnability and extended learnability. Initial learnability identifies the initial performance with a technology system (Caboral-Stevens et al., 2015). Extended learnability describes the change in performance over time (Grossman, Fitzmaurice, & Attar, 2009). Learnability will be measured through the variable of performance in this study. Performance was measured through observation and questions adapted from the U.S.A.B.I.L.I.T.Y. Survey©.

Perceived User Experience

The first user component is perceived user experience, which is the level of satisfaction in using the system and design (Caboral-Stevens et al., 2015). Perceived user experience is the holistic experience of the individual's interaction with a system (Caboral-Stevens et al., 2015). Perceived user experience focuses on the characteristics of the product as well as the user's internal state (Caboral-Stevens et al., 2015). In addition, the construct emphasizes the interrelatedness of the system, the user, and the context within which the encounter occurs (Caboral-Stevens et al., 2015). In this study, perceived user experience, as measured by the adapted version of the U.S.A.B.I.L.I.T.Y. Survey©, was analyzed to determine influence on electronic personal health record use in older adult.

Perceived Control

Perceived control is the second user component, and is defined as the amount of control users have to choose a path to proceed (Caboral-Stevens et al., 2015). Perceived control is composed of three facets: cognitive, decisional, and behavioral control (Caboral-Stevens et al., 2015). Cognitive control describes how an individual interprets an event based on the ability to gather and appraise information (Caboral-Stevens et al., 2015). Decisional control is the ability to choose from different opportunities of action (Caboral-Stevens et al., 2015). Behavioral control is an individual using direct means to influence an event (Caboral-Stevens et al., 2015). In this study, perceived control is an independent variable that was measured using the adapted version of the U.S.A.B.I.L.I.T.Y. Survey©.

Incorporation of Variables Within Framework

The U.S.A.B.I.L.I.T.Y. Framework provides structure for incorporation of other variables that affect ePHR use in older adults. The independent variables of perceived control and perceived user experience define the characteristics of the user (Caboral-Stevens, 2015). This study sought to identify the relationship between user variables and intent to use and performance with electronic personal health records. The user in this study is the older adult. The older adult interacted with the technology/system component, which measured perceived ease of use and performance. An electronic personal health record test account was used during the data collection phase for the primary researcher to observe performance. The interface in the study was the ePHR. Finally, measured unique individual factors included sensoriperceptual deficits, presence of depression, and loneliness, along with demographic information and presence of chronic illness. The components of usability and behavior were not directly measured. However, the results of the study may be able to predict or explain improved self-management of chronic

conditions in older adults (Caboral-Stevens et al., 2015). Identifying factors that influence ePHR use in older adults may lead to improved health outcomes as a result of behavior changes.

Strengths and Limitations of the U.S.A.B.I.L.I.T.Y. Framework

One of the critical features of the U.S.A.B.I.L.I.T.Y Framework is that it is specifically geared toward the older adult population. The aim of the framework seeks to address a lack of evidence related to the use and acceptance of informational technology in the older adult (Caboral-Stevens, 2015). The U.S.A.B.I.L.I.T.Y. Framework also addresses cognitive and functional changes, motivations, and intent to use ePHRs (Caboral-Stevens et al., 2015). One assumed limitation of the U.S.A.B.I.L.I.T.Y. Framework is that it is situation-specific, limiting the scope and focus (Meleis, 2012). With the focus on a specific population, generalization to other populations may be challenging (Meleis, 2012). However, since the target population of the study is the older adult, the U.S.A.B.I.L.I.T.Y. Framework is an appropriate choice. Another limitation is the lack of utilization in the literature. Because the U.S.A.B.I.L.I.T.Y. Framework is new and emerging, there is little evidence that references and applies the framework in nursing research. Initial studies have indicated relevant and significant findings toward intent to use electronic personal health records in the older adult population (Caboral-Stevens, 2015). However further research is needed on the assumptions, reliability, and adaptability of the conceptual model (Caboral-Stevens, 2015). One aim of the study was to seek to validate the framework as a guiding principle for older adults and ePHR use.

Theory Relevance and Significance to Nursing

Implementing technology interventions such as ePHRs can be a complex issue as older adults learn to navigate the system (Caboral-Stevens et al., 2015). If the older adult is unable to

perform or lacks intent to use ePHRs, implementation of ePHR use could be ineffective (Thompson et al., 2011). By understanding barriers that lead to inadequate performance or lack of intent to use ePHRs, nurses may be proactive in the decision-making processes (Machado, Lima, Cavalcante, de Araujo, & Vieira, 2014). As more issues in older adult utilization of ePHRs are raised, nurses may be more involved in management of chronic conditions (Thompson et al., 2011).

Theoretical and Operational Definitions

The following definitions are provided to the reader as a means of ensuring consistency.

Older Adult

According to the World Health Organization (WHO) (2015), an older adult is any individual who has reached the chronological age of 65 years. The United Nations designates any person over the age of 60 categorically an older adult (WHO, 2015). For consistency, the operational definition of an older adult is identified as any individual who is 65 years in age or older.

Sensoriperceptual Deficits

Age related changes can limit the older adult's ability to accurately and efficiently perform computer skills necessary to navigate electronic personal health records (Chaffin & Harlow, 2005). Visual changes can lead to blurred vision and increased glare, or loss of field of vision (Chaffin & Harlow, 2005). Hearing changes can lead to misinterpretation of sounds or cues emitted from computers (Chaffin & Harlow, 2005). While there are other sensory or physical limitations that can occur, sensoriperceptual deficits for this study are limited to hearing

and vision deficits. The operational definition of sensoriperceptual deficits is self-identification by the older adult of hearing and/or vision impairment.

Presence of Depression

Depression may be known as major depressive disorder or clinical depression. Individuals who experience depression have persistent feelings of sadness or hopelessness, and often lose interest in things they once enjoyed (Shelton, 2018). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) lists several criterion for a diagnosis of depression, and requires an individual to experience at least five symptoms during a two-week period (Shelton, 2018). The conceptual definition for depression is the presence of distressed mood, accompanied by somatic and cognitive changes that affect the individual's ability to function (Shelton, 2018). The operational definition of depression is identified through use of the Geriatric Depression Scale: Short Form and indicated by a score of greater than ten (Sheikh & Yesavage, 1986).

Perceived Control

According to Morris and Marshall (2004), there are three facets of perceived control: cognitive, decisional, and behavioral. Cognitive control relates to interpretation of an event through information gathering and appraisal (Averill, 1973). Decisional control addresses the chance and ability to choose from different courses of action (Averill, 1973). Behavioral control is when an individual uses decision authority to influence an event (Averill, 1973). The definition used for perceived control is the degree to which an individual feels they can affect outcomes via voluntary actions (Averill, 1973). The operational definition for perceived control was measured via the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015).

User Experience

User experience is multifactorial and complex. It consists of the user's internal state, the characteristics of the system, and the context or environment (Hassenzahl & Tractinsky, 2006). User experience is a holistic experience that combines elements of the system and the emotions, the situation, and usability of the individual (Hassenzahl & Tractinsky, 2006). The conceptual definition for user experience is the attitude toward the overall experience, characteristics of the system, and the context in which the interaction occurred (Hassenzahl & Tractinsky, 2006). The operational definition for user experience was measured using the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015).

Loneliness

Loneliness is described as a perceived discrepancy between an individual's desired and actual level of social interaction (Ong, Uchino, & Wethington, 2016). Social isolation and loneliness are often closely linked, but in fact are different concepts (Chipps, Jarvis, & Ramlall, 2017). Social isolation is an objective measure of an individual's lack of contact with social networks (Cotterell et al., 2018). Loneliness, however, is a subjective perception and experience of lack of interaction (Poscia et al., 2017). The conceptual definition for loneliness is the subjective perception of less than desirable contact with an individual's social network (Kemperman, van den Berg, Weijs-Perrée, & Uijtdewillegen, 2019). The operational definition for loneliness was measured by the UCLA Loneliness Scale Version 3 (Russell, 1996). Loneliness was measured on a continuous scale, with higher numbers indicating more loneliness (Russell, 1996).

Intent to Use

Intent to use stems from factors that drive or influence a particular behavior (Ajzen, 1991). Intent to use is an indicator of system use and is directly impacted by perceived ease of use and perceived usefulness (Punnoose, 2012). The conceptual definition for intent to use is the cognitive representation of an individual's willingness and readiness to perform a task or behavior (Punnoose, 2012). The operational definition for intent to use was measured through the adapted version of the U.S.A.B.I.L.I.T.Y. Survey©.

Performance

The term performance comes from the concept of usability. Usability is concerned with the relationship between computers systems and the user, and measures effectiveness and efficiency (Caboral-Stevens et al., 2015). Usability can describe both the effectiveness of using a product as well as the quality of the user experience (Caboral-Stevens et al., 2015). The conceptual definition of performance is the ability and ease with which an individual achieves specific tasks within a system (Benbunan-Fich, 2001). The operational definition of performance is the ability to complete specified tasks in an electronic personal health record test account.

Electronic Personal Health Record

Electronic personal health records are an application in which an individual can maintain and manage personal health information (HealthIT.gov, 2016). Electronic personal health records provide a secure website where patients can access medical data and communicate with providers (Turner et al., 2015). Electronic personal health records differ from electronic medical records and electronic health records in regards to end users (HealthIT.gov, 2016). Electronic medical records (EMRs) are considered digital versions of a paper chart, and have clinicians as

the end user (HealthIT.gov, 2016). Similarly, electronic health records (EHRs) have clinicians as end users, but include all clinicians involved in patient care (HealthIT.gov, 2016). Electronic personal health records (ePHRs) are designed with the patient as the end user (HealthIT.gov, 2016). The definition for electronic personal health record is a secure online website where patients access personal health information from anywhere with an internet connection (HealthIT.gov, 2016). An electronic personal health record test account was provided by Twin Cities Physicians.

Chapter Summary

In this chapter, the background and theoretical framework are proposed for a dissertation study to examine the relationship between individual factors of older adults and their use of electronic personal health records. The dissertation addresses the problems of legislative requirements to use ePHRs and lack of utilization in the older adult. The dissertation is composed of five chapters and three articles prepared for publication. Chapter One is an introduction to the problem and the dissertation. Chapter Two is a critical review of the literature along with a manuscript of a synthesis of the literature. Chapter Three details the methodology utilized for the study. Chapter Four presents the results of the study along with two manuscripts explaining the results for each dependent variable. Finally, Chapter Five concludes the dissertation presenting a synthesis of the study and future implications.

Chapter 2

State of the Science

Introduction

This chapter provides a review of the current state of the science surrounding technology use and the older adult population. The purpose of the study is to examine the relationship between individual factors of older adults and their use of electronic personal health records. Included in this chapter is a published manuscript. The prepared manuscript is a systematic review of the literature on the facilitators and barriers to electronic personal health record use in the older adult population.

Background

Technology adoption has become a critical skill needed for individuals to function in society (Rikard et al., 2018). Society is becoming more reliant on technology innovations in all aspects of everyday life (Rikard et al., 2018). The term technology can have various meanings, for example, it can be the application of scientific knowledge to energy, construction, and communications, among others (Britannica, n.d.). Because of a broad range of definitions of technology, for this study, technology is limited to information and communications technology (ICT) (Ramsden Marston et al., 2019). ICT is defined as any technological tool and/or resource used for creating, sharing and exchanging information (UNESCO, 2021). ICT focuses primarily on communication technologies, such as internet, cellphones, and wireless networks.

While ICT is utilized by people of all ages, it has specific benefits to the older adult population. Increased use of ICT has the potential to positively impact health and health care systems (Rikard et al., 2018) and positively influence well-being, degree of loneliness, and social

support (Knapova et al., 2020). However, the older adult (aged 65 and older) may not experience positive health outcomes due to the digital divide, (Rikard et al., 2018) which refers to the gap in adoption of ICT between younger and older adults (Bixter et al., 2019). Although the adoption rate of ICTs is growing fast in the older adult population, it is still much lower than the younger generations (Abdelrahman et al., 2021). This chapter seeks to identify characteristics of older adults who utilize ICT. Factors impacting general ICT use in the older adult will also be compared to ePHR use in the older adult. A systematic review on facilitators and barriers to electronic personal health records, a specific type of ICT, is included.

The Older Adult Population

The older adult population (aged 65 and older) is the fastest growing portion of the population (Knapova, 2020). The Administration on Aging (AoA) publishes reports on the American population age 65 and older, and in 2019 the older adult was estimated to be 54.1 million, representing approximately 16% of the U.S. population (AoA, 2020). The percentage of older Americans is projected to grow to 21.6% of the population by the year 2040 (AoA, 2020). Older adults have been more resistant to adopting technology compared to younger generations (Aggarwal et al., 2020). However, there are a growing number of older adults utilizing information and communication technologies (Aggarwal et al., 2020).

The use of information and communication technologies is largely affected by sociodemographic factors (Hülür & Macdonald, 2020). Research has shown that sociodemographic factors affect the older adult population similarly compared to the general population (Hülür & Macdonald, 2020). Lower rates of usage of ICT in older adults is correlated to older age who are less affluent, minority, and less educated (Hülür & Macdonald, 2020). In

addition, nonusers tend to have a disability or chronic condition, live alone or are single or widowed (Knapova et al. 2020).

Characteristics of Older Adult ICT Users

While older adults are classified as aged 65 and older, there is variability within this age group. The AoA (2020) identifies three groups: the young-old (65-74 years), the middle-old (75-84 years), and the old-old (85 years and older). The number of older adults in the young-old subgroup remains the highest (31.5 million) compared to those 85 and older (6.6 million) (AoA, 2020). The young-old are almost twice as likely as those in the old-old category to use the internet (82% vs. 44%) as well as have smartphones (59% vs. 17%) (Anderson & Perrin, 2017). The difference in usage between age groups is also seen in electronic personal health record (ePHR) use in the older adult. Portz et al. (2019) states that older adults, particularly in the old-old group, have a decrease in ePHR adoption. Likewise, the percentage of older adults setting up an ePHR decreased with age (National Poll on Healthy Aging, 2018).

The digital divide is evident across racial and ethnic composition as well. In 2019, 24% of older adults aged 65 or older identified as racial or ethnic minority (AoA, 2020). Research on ICT found that non-Hispanic whites were more likely to be users than members of racial and ethnic minority populations (Lee et al., 2020). In particular, older African Americans and Hispanics have decreased usage of many different digital technology (Yoon et al., 2020). Similarly, Walker et al. (2020) identified that African Americans have one of the lowest growth rate of ePHRs nationally. Although research suggests racial disparities in ICT use, the extent is unclear (Mitchell et al., 2019). Current research on ICT use on racial/ethnic groups is limited to specific geographic areas or technology, without national representation (Mitchell et al., 2019).

Therefore, it is hypothesized that the gap in ICT usage among racial/ethnic groups is higher than reported (Mitchell et al., 2019).

In addition to age and race, differences exist in ICT use in relation to income. The median income of older individuals reported in 2019 was approximately $27,000, with men having an income about $16,000 higher than women (AoA, 2020). In general, Americans with higher household incomes were more likely to have multiple devices (63% with $100,000 or more) compared to 23% of lower income households (Vogels, 2021). Internet and ICT usage tends to be lower in less affluent populations, in part due to lack of access (Hülür & Macdonald, 2020). Vogels (2021) found that 13% of the population making less than $30,000 per year did not have access to technology. In comparison, only 1% of the population with an annual income over $100,000 did not have access to technology (Vogels, 2021). Electronic personal health record use also had a higher percentage of patients with higher household income (59% for $\geq$ $60,000 vs. 42% for < $60,000) (National Poll on Healthy Aging, 2018).

Older adults with some college or higher education levels were more likely to engage with ICT than those who completed lower education levels (Hülür & Macdonald, 2020). The Pew Research Center (2017) found that older adults who were college graduates adopted technology at higher rates than older adults with lower levels of education. Fang et al. (2019) implied that education is the primary predictive sociodemographic variable towards ICT use. Higher education levels are often linked to social factors including income and occupation, further creating variation across the older adult population (Fang et al., 2019). The National Poll on Healthy Aging (2018) also found that adults with more education were more likely than others to set up and use an ePHR.

Adoption and use of ICT in the older adult was negatively correlated with the presence of a disability or a chronic health problem (Knapova et al., 2020). Nineteen percent of adults aged 65 or older had reported no function or significant difficulty in at least one functioning domain (AoA, 2020). Disabilities with the highest percentages included impairment in vision, hearing, mobility, communication, cognition, and self-care (AoA, 2020). Leading chronic conditions in the older adult are arthritis, coronary heart disease, myocardial infarction, cancer, breathing disorders, stroke and diabetes (AoA, 2020). Cognitive and functional decline have been shown to factor into usage of ICT in older adults (Izadi-Avanji et al., 2021). Declines in the older adult can limit the use of ICT, such as a reduced physical or cognitive ability to interact with the device (Izadi-Avanji et al., 2021).

Marital status and living arrangements are associated with ICT use and adoption at the individual level (Knapova et al., 2020). Nationally, a larger percentage of older men (70%) were married in comparison to older women (48%) (AoA, 2020). Approximately 30% of all older women were widows, which significantly outnumbers the percentage of widowers (AoA, 2020). Due to the high number of widows, there are more older women who live alone (33% vs. 20%), and the proportion increases with age (AoA, 2020). Research summarizes that nonusers of ICT have a tendency to live alone, be single, or widowed (Knapova et al., 2020).

Types of Technology Use

Technology knowledge and usage are becoming increasingly necessary for older adults to interact within their living environment (Lee & Maher, 2021). In order to address changes within the older adult population and facilitate adoption of ICT, it is critical to know what types of technology are currently used by the older adult (Lee & Maher, 2021). ICT, particularly health related technologies, can address challenges in the older adult and provide support in their

communities (Jaana & Paré, 2020). According to the Pew Research Center (2017), the main types of technology utilized by the older adult include the internet, smartphones, tablets, and social media.

Internet Use

Approximately 67% of older adults across the U.S. state that they use the internet, although this percentage decreases as they age (Pew Research Center, 2017). Lee et al. (2020) found that the primary reasons for an older adult to use the internet are for e-mail, searches, and communication with friends and family. Likewise, Aggarwal et al. (2020) identified education, social connectedness, and access to services as additional reasons for older adults to utilize the internet. Older adults are able to remain socially connected to others and build social support networks (Aggarwal et al., 2020) and access information such as banking, shopping, leisure activities and health-related updates (Aggarwal et al., 2020).

One advantage to using the internet for health-related concerns is the ability to access telehealth, which allows patients of any age to visit with a provider through video platforms (National Poll on Healthy Aging, 2019). While there are an increasing number of virtual visits, only 4% of older adults reported having a telehealth visit within the previous year (National Poll on Healthy Aging, 2019). Electronic personal health records are another benefit to internet use, as it allows individuals to communicate with a provider and exchange health information (National Poll on Healthy Aging, 2018). However, older adults stated they were not comfortable with technology (47%) and did not like communicating via computer (62%) (National Poll on Healthy Aging, 2018).

Smartphone Use

The number of older adults who own a smartphone has increased 24% since 2013 (Pew Research Center, 2017). At least 80% of the older population owned a cellphone, with 42% owning a smartphone (Pew Research Center, 2017). Jaana and Paré (2020) found that a significantly smaller number of older adults used a smartphone compared to the general adult population (49.8% vs. 84.2%). Older adults not only use smartphones to communicate with others, but to organize and collect information such as calendars and news (Abdelrahman et al., 2021).

Tablet Use

One-third (32%) of older adults stated they owned tablet computers, with 19% owning an e-reader (Pew Research Center, 2017). While ownership of tablets is increasing in the older adult population, it still lags behind the adult population (Jaana & Paré, 2020). Unlike other forms of technology, there has been a sharp increase in tablet use in the 75 and older population (Vaportzis et al., 2018). One thought is that older adults prefer tablets over traditional computers due to portability and usability (Vaportzis et al., 2018). For example, older adults have an easier ability to adjust font sizes and icons on a tablet, which is more useful for those with motor and visual impairments (Vaportzis et al., 2018).

Social Media Use

Older adults utilize social media for activities such as finding news and information as well as connecting with friends and family (Pew Research Center, 2017). Thirty-four percent of older adults have used a social networking site, which has increased 7% since 2013 (Pew Research Center, 2017). Adults in the young-old age range are more likely to utilize social media

(45%) than those 75 years and older (20%) (Pew Research Center, 2017). Although older adults use social networking sites less frequently than other age groups, the number is expected to grow (Hülür & Macdonald, 2020). Older adults who use internet are more likely to use social media sites to remain connected and meet new people (Hülür & Macdonald, 2020).

Depression in the Older Adult

Information and communication technologies (ICT) can influence older adults and improve psychological well-being (Berg et al., 2017). Mental health and well-being are important aspects of care to consider in the older adult population. Worldwide, depression occurs in 7% of the older adult population, though the rates may not reflect the actual numbers affected, as mental health is often overlooked and untreated (WHO, 2017). According to the CDC (2021), estimates of older adults with depression in community environments (< 5%) is less than those requiring homecare (13.5%) or hospitalization (11.5%). However, as older adults with depression can have less ability to function, it can increase their expenses as they access more health care services (WHO, 2017). Strategies to promote health in the older adult include providing social support and implementing health and social programs related to mental illness (WHO, 2017). Information and communication technologies have been developed to facilitate interventions to improve the mental health of older adults (Haase et al., 2021).

The potential for ICT to support older adult's mental health, including depression, is increasingly evident in research (Andrews et al., 2019). Older adults have increased usage of technology for recreational activities and communication (Andrews et al., 2019). For example, the use of social networks may be able to increase older adult's engagement with others, which can lower their degree of depression (Domènech-Abella et al., 2017). Likewise, Izadi-Avanji et al. (2022) found that older adults who use ICT, such as social media, were more likely to

experience fewer mental health symptoms. However, little research has been done on the use of ICT for mental health support (Andrews et al., 2019). Recently, virtual visits and telehealth have been utilized for older adults' mental health concerns (National Poll on Healthy Aging, 2019). However, less than third (28%) of older adults who responded, stated they would consider a telehealth visit for addressing their mental health concerns (National Poll on Healthy Aging, 2019).

Loneliness in the Older Adult

Loneliness amongst older adults is associated with physical and mental health problems, such as depression (Byrne et al. 2021). Loneliness is described as a perceived deficit between the social contact a person desires and the actual level achieved (Rodrigues, 2021). A recent report indicated that 43% of older adults experience feelings of loneliness (Byrne et al., 2021). Loneliness is associated with a 26% increase in older adult mortality and can lead to a rapid decline in their physical functioning (Byrne et al., 2021). For example, individuals who have higher levels of loneliness have increased risks for dementia, cardiovascular disease, stroke, loss of physical mobility, and mental health conditions which can exacerbate symptoms of depression (Finlay & Kobayashi, 2018). Technology, particularly social technology such as ICT, increases older adults' engagement with others, which can mitigate the effects of loneliness and potentially improve health outcomes and can positively impact psychosocial health on individuals (Byrne et al., 2021). Although there is a correlation between social technology and decreased loneliness in older adults, the relationship to ePHR use is unclear (Byrne et al., 2021).

Manuscript One: "Facilitators and Barriers to Patient Portal Use in the Older Adult: A Systematic Review of the Literature"

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Abstract

A systematic review was conducted to examine relationships between individual factors of older adults and the usage of patient portals. Facilitators included improved communication, support, and training. Barriers include lack of experience, anxiety, privacy concerns, health limitations, and lack of interaction.

Key Words: older adults, patient portals, facilitators, barriers, usage

Facilitators and Barriers to Patient Portal Use in Older Adults: A Systematic Review of the Literature

Healthcare is experiencing an information and technology boom. The new technology provides information and tools to help patients self-manage chronic health conditions (Czaja, 2015). Increases in technology use assume patients and caregivers have the knowledge to use technology to regulate and manage chronic health conditions (Thompson et al., 2011). Estimates indicate that over 37 million older adults will be managing at least one chronic condition by the year 2030 (Zettel-Watson & Tsukerman, 2016). The National Council of Aging (2021) reports that 80% of older adults have at least one chronic condition, and 77% have at least two. Organizations are developing prevention strategies for chronic conditions including self-care management interventions to address, in part, rising healthcare costs (Nahm et al., 2018). Legislation encourages organizations to utilize health information technology (HIT) such as patient portals (PPs) to improve patient outcomes (Nahm et al., 2018). Patient portals enhance coordinated care to improve and maintain patient outcomes (Sockolow et al., 2011).

The Health Information Technology for Economic and Clinical Health (HITECH) Act was created in 2009. The HITECH Act authorized incentive payments to organizations that utilized electronic health records (EHRs) with meaningful use (Nahm et al., 2018). To meet the requirements set by the HITECH Act, many organizations implemented patient portals (Nahm et al., 2018). Patient portals (PPs) are systems that can be accessed by electronic devices that provide patients access to health information and communication with providers (Griffin et al., 2016). PPs have shown to improve communication, decrease medical costs, and improve the quality of healthcare (Arcury et al., 2017). However, the number of patients utilizing PPs decreases by age (Arcury et al., 2017). While older adults' enrollment in patient portals (PPs) has

increased, the adoption of PPs remains low (Wildenbos et al., 2017). An older adult is identified by the World Health Organization (WHO) as any individual who has reached the chronological age of 65 years (2015). Factors have been suggested as contributors to low adoption rates in the older adult population, including limited technology and internet access (Wildenbos et al., 2017). However, extensive research has not been done (Wildenbos et al., 2017). Therefore, a literature review was conducted to identify factors influencing older adults' usage of patient portals.

Objective

This article aims to examine the relationship between individual factors of older adults and their use of patient portals. Increasing patient engagement in PPs to improve health outcomes requires a greater understanding of factors that impact older adults' usage. Three questions were formulated to guide the systematic review of literature.

1) What are the older adult adoption and usage rates with patient portals?

2) What facilitates older adults' adoption and usage of patient portals?

3) What are the barriers impacting older adults' adoption and use of patient portals?

Methods

Due to limited research on facilitators and barriers to patient portal use in older adults, a systematic review was conducted to identify gaps in research. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). Article searches were conducted through CINAHL, PubMed, Medline, and Cochrane Database of Systematic Reviews. Articles describing patient portals, older adults' intent to use patient portals, and facilitators and barriers to using patient portals were identified for the review.

Study Inclusion and Exclusion Criteria

The inclusion criteria were as follows: a) full text was available; b) identification of patient portals or internet use; c) included older adults over the age of 65; d) printed in English; e) published in scholarly peer-reviewed journals. Both qualitative and quantitative articles were selected. Reviews and expert opinions were included to obtain different approaches and methodologies. Articles with incomplete data were excluded, or those that did not mention patient portals, internet use, or older adults.

Data Collection Process

An initial search using terms *aged, elderly, geriatric, older adult, internet use, personal health record use, patient portal use* and *health* was conducted. The initial search yielded 1113 publications (see Figure 1). Refinement of the search of articles containing keywords *aged, elderly, geriatric older adult, patient portal,* and *patient electronic health record* yielded 590 results. Adding in the search term *health* yielded 431 results. Finally, adding in *access* or *use* yielded 354 results. Duplicates were eliminated and abstracts were reviewed, bringing the query down to 61 articles. Articles were then read for content, and reference lists were reviewed to identify other relevant studies. After review of reference lists, 16 additional publications were included, bringing the total to 77. Inclusion and exclusion criteria were followed and articles were further reviewed for content. Twenty articles were included in the final review. Data was extracted from the articles and compiled in evidence tables based on type of research (see Tables 1 and 2).

Extracted data included research design, research location, and research question or hypothesis. Measures, analyses, and data collection strategies used in the articles were also extracted. Last, the findings, strengths, and limitations were extracted. All data was organized in

qualitative and quantitative evidence tables (Tables 1 and 2). Expert opinions and systematic reviews were limited and are included in the qualitative evidence table. A matrix was created to identify facilitators and barriers to patient portal use in the selected articles (Table 3). Article content was reviewed in detail, and facilitators and barriers were identified as presented in the matrix.

Bias and Quality Assessment

Potential bias could have occurred through publication bias, in which positive findings are more likely to be published (Gray et al., 2017). Quality assessments for each article were done using the Evidence Appraisal Tool (Dang et al., 2018). A quality rating of an "A" indicates the research contains characteristics of experimental or quasi-experimental studies (Dang et al., 2018). Research characterized as a "B" or a "C" suggests non-experimental studies and expert opinion (Dang et al., 2018). Quality assessment ratings were identified for each article in the corresponding evidence tables.

Results

Facilitators and barriers to patient portal use were identified (see Table 3). Of the twenty studies included in the final review, twelve used quantitative methods and eight used qualitative methods. Eighteen studies were conducted in the United States, one in the United Kingdom, and one in Australia. Three perceived facilitators of patient portal use were identified: improved communication, support, and training. Five perceived barriers of patient portal use were identified. Barriers included lack of experience using patient portals, anxiety, privacy and security concerns, physical and mental health limitations, and lack of personal interaction.

Adoption and Usage Rates

Patient portals have been available since the 1990s (Irizarry et al., 2015). However, estimates indicate less than 10% of US consumers utilize PPs for communication and self-management (Casey, 2016). Low adoption and usage rates may be attributed to bias in who receives access codes. Ancker et al. (2011) identified that 16% of subjects received an access code, and 60% of those users activated their account. Access codes were significantly more likely to be issued to patients who were female, younger patients, Caucasian, and English speakers (Ancker et al., 2011; Peacock et al., 2017). Disparities in issuing of access codes can be attributed to self-selection or selection by providers, but the relationship is largely unexplored (Ancker et al., 2011; Peacock et al., 2017).

Another factor leading to low adoption and usage rates is access to the internet. Economically disadvantaged, less educated, and older adults that live in rural or low-income urban areas are less likely to be online (Cresci et al., 2010). Cresci et al (2010) indicated that individuals who did not utilize internet-based programs were older (*Mean age = 74.27, SD = 8.10*), compared to those using internet-based programs. In addition to a lack of access to the internet, older adults appear to be less likely to use internet-based programs. Compared to younger adults, the percentage of older adults utilizing information technology is drastically lower (Cresci et al., 2010). Between 2008 and 2012, the percentage of older adults using the internet increased by six percentage points (Pew Research Center, 2014). However, the overall rate of older adults using the internet (27%) remains below the percentage of all U.S. adults who go online (Pew Research Center, 2014). One in five older adults participating in the University of Washington Soaring Project use a PP to access online medical records and information

(Orthopaedic Healthcare Solutions, 2017). Low PP adoption rates have led to an increased research to examine factors that influence PP use in older adults (Pew Research Center, 2014).

Perceived Facilitators

Improved Communication

Patient portals have been shown to improve communication and satisfaction with care (Griffin et al., 2016; Kruse et al., 2015). Patients, including older adults, recognize that computer technology such as PPs is useful for communication (Chaffin & Harlow, 2005). After utilizing PPs, 92% of older adults surveyed shared information with the primary care provider (Kim et al., 2009). In addition, older adults identified that having updated health information led to improved communication with providers and influenced the use of PPs (Casey, 2016; Kim et al., 2009). O'Donnell et al. (2011) found in their study that eighty-eight percent of older adults indicated PPs would improve communication between providers and patients. Likewise, a comparison between a control and intervention group examined by Casey (2016) indicated a statistically higher communication rate when using PPs. Additionally, older adults identified a positive correlation between communicating through PPs and face-to-face communication with providers (Kim et al., 2009).

Patient portals not only increase communication between provider and patient but open discussion topics that may be difficult or awkward (Latulipe et al., 2015). Older adults highlighted questions about issues that were prompted through PPs that they might not have thought to ask their provider (Snyder et al., 2009). Topic prompts in a patient portal may encourage further face-to-face discussion about issues with a provider. Tieu et al. (2015) suggested that the ability to send secure messages with a provider improved subsequent face-to-

face visits Additionally, patients hypothesized that communication mediated through a PP may provide a neutral method to begin discussion. (Latulipe et al., 2015).

Benefits of Improved Communication. The coordination and communication between patients and providers can lead to improved self-management of chronic conditions (Tieu et al., 2015). Older adult participants stated that after using patient portals for communication, self-management of care had increased (Kim et al., 2009; O'Donnell et al., 2011). Similarly, Kruse et al. (2018) found that 37% of articles found an increase in disease outcomes using a patient portal. Thirty-three percent of articles showed that older adults attributed greater self-management of chronic conditions due to educational resources present within a patient portal (Kruse et al., 2018). Another aspect of self-management includes retrieval of medical history data. Archiving of data and information can aid self-management of chronic conditions in the older adult (Latulipe et al., 2015). The ability to review stored information helps older adults remember details about health conditions, thus improving self-management (Latulipe et al., 2015).

Support

The second identified facilitator of patient portal use was support. Older adults tend to be more willing to use technology such as PPs if encouraged and supported (Adams et al., 2005; Chaffin & Harlow, 2005). Often support is provided by friends, families, and peers (Chaffin & Harlow, 2005). However, support in other settings was provided from non-relatives including graduate students and providers (Casey, 2016; Kim et al., 2009). Older adults identified that support of any kind, including verbal support, was critical to learning skills needed to navigate patient portals (Ng, 2008). Due to the support and encouragement, older adults were more likely to utilize PPs (Casey, 2016; Kim et al., 2009; Logue & Effken, 2012).

Training

A third facilitator of patient portal use in older adults is having training tutorials and programs (Kruse et al., 2015). In structured settings, helping others learn and collaborate with formal support assisted learning in older adults (Ng, 2008). Adams et al. (2005) suggested that most internet users are self-taught. Older adults rely heavily on formal training or informal support from family and friends (Adams et al., 2005). In another survey, 66% of older adults indicated help from another person would be required to use internet-based websites (Gordon & Hornbrook, 2016). Technology training programs can reduce anxiety in older adults and increase efficiency (Adams et al., 2005; Ng, 2008). After an educational intervention, participants had a statistically higher comfort level with patient portals (Casey, 2016). When staff or healthcare providers explained features of PPs, the likelihood that patients would use PPs increased (Casey, 2016).

Perceived Barriers

Lack of Experience

Patient portals are often created by technology inclined individuals (Gordon & Hornbrook, 2016). However, older adults, especially those over the age of 75, often have limited experience with computer use (Gordon & Hornbrook, 2016; Huber & Watson, 2014). As PPs are internet-based, difficulty in using the internet impacts older adults' willingness to adopt new skill sets (Adams et al., 2005). Older adult's perceived ease of use appears to be linked to previous experience with skill sets needed to navigate computer systems (Adams et al., 2005). For example, Tieu et al., 2017 indicated that older adults with limited experience using computers were more hesitant to utilize PPs. Lack of experience can contribute to difficulties using digital technologies such as PPs (Czaja, 2016; Gordon & Hornbrook, 2016; Price-Haywood et al.,

2017). Users with little to no experience with computers identified programs as complex and difficult to use (Adams et al., 2005). In addition to challenges with navigating PPs, older adults expressed difficulty with basic computer skills, such as creating and remembering passwords (Tieu et al., 2015). To address patient concerns, it is important for healthcare organizations to identify technology proficiency before implementing patient portals (Tieu et al., 2015).

Anxiety

Anxiety and worry are other perceived barriers related to PP use in the older adult. Chaffin and Harlow (2005) identified that learning a new skill, such as navigating PPs, was linked to higher anxiety levels in older adults. Likewise, Ng (2008) indicated that the lack of knowledge necessary was a source of worry in older adults. Several other patients mentioned that learning how to use a PP would take up too much time and would be difficult to learn (Latulipe et al., 2015). Anxiety associated with lack of experience with PP use may lead to decreased self-management of chronic conditions. In one study, as the participant's age increased, their self-efficacy scores decreased (Hall et al., 2015). Self-efficacy is described as the individual's perception or confidence level when performing a task (Hall et al., 2015). Similarly, Logue and Effken (2012) identified that older adults were less likely to know how to use internet based PPs and were less confident in self-management.

Privacy and Security Concerns

Privacy and security concerns about patient portals were another perceived barrier. Older adults expressed concern about health information being online, a lack of confidentiality and potential hacking threats (Price-Haywood et al., 2017; Tieu et al., 2015). Older adults in another study were concerned with the amount of information online (Turner et al., 2015). Snyder et al. (2009) found that older adults were concerned about PP websites and who would be able to

access the information. Although older adults identified benefits to PPs, 41% of reviewed articles suggested that portal design had insufficient security protections (Kruse et al., 2015). Older adults understood password protected systems and security measures within patient portals (Latulipe et al., 2015). However, the risk that information could be used for identity theft or for insurance denials was expressed (Latulipe et al., 2015). In a follow-up study to PP use, 7.5% of participants indicated no intention of future use due to privacy and security concerns (Casey, 2016).

Physical and Mental Health Limitations

Physical limitations involving vision, hearing, and range of motion were identified as barriers to using technology (Chaffin & Harlow, 2005). Physical limitations, cognition, mental health disorders, and the presence of chronic diseases were found to impact PP use. Cresci et al. (2010) found that older adults in internet-based programs had a higher number of chronic diseases than those not utilizing internet-based programs. Ancker et al. (2011) identified three diagnoses highly associated with gaining PP access, but not necessarily usage of PPs: hyperlipidemia, asthma, and depression. In another study, a small number of seniors (7.9%) identified a physical problem as a barrier to using a computer (Gordon & Hornbrook, 2016). In addition to physical limitations, mental health disorders can also impact PP use. Casey (2016) found that older adults' depression scores were negatively correlated with PP use. Hällgren et al. (2014) suggested that individuals with a more significant cognitive impairment considered tech-based interventions less relevant. Loss of interest, fatigue, and cognitive impairment can inhibit older adults' engagement with a PP, leading to poor patient outcomes (Casey, 2016).

Lack of Personal Interaction

Last, fear of losing personal interactions with providers were a perceived barrier to using patient portals (Gordon & Hornbrook, 2016; Tieu et al., 2015). Face-to-face interactions with providers are often identified as a preferred mode of communication (Latulipe et al., 2015). Older adults expressed fears that patient portals would replace face-to-face interactions with providers (Latulipe et al., 2015). Older adults emphasized the value in face-to-face visits and communication and expressed concern over technology replacing personal interactions (Tieu et al., 2015). In addition, the reliance on internet-based communication may lead to the loss of self-management of healthcare related tasks (Gordon & Hornbrook, 2016). With a shift towards portal-based communications, older adults may find it more difficult to access information and communicate with providers (Gordon & Hornbrook, 2016).

Discussion

Analysis of the research identified several factors that influence patient portal use in the older adult. Facilitators of portal use include improved communication, support, and training. Barriers of portal use include lack of experience, anxiety, security concerns, health limitations and concern for the loss of personal interactions.

Improved Communication

Patient portals provide patients with access to personal health information and facilitate improved communication with providers (Kruse et al., 2015). However, the challenges associated with the installation of PPs such as cost and learning a new technology can be frustrating (Kruse et al., 2015). One suggestion to improve PP use and increase acceptance is to standardize PP design with the user in mind (Kruse et al., 2015). The current design of portals is variable, and educational resources may or may not be present (Kruse et al., 2015). The design of

PPs can include functions that address the needs of older adult users. Design features such as adding audio dictionaries and health care references can aid in the self-management of diseases (Latulipe et al., 2015). Another improvement suggested is to address concerns on health literacy. Communication appears to be correlated to health literacy, which is the individual's ability to use information to make healthcare decisions (Kim et al., 2009; Snyder et al., 2009; Tieu et al., 2017). Although PPs may provide information, older adults may not understand what the information means (Kruse et al., 2018). By addressing literacy limitations, the benefit of improved communication with providers and improved self-management can be marketed (Kim et al., 2009; Snyder et al., 2009; Tieu et al., 2015).

Support

Older adults are more willing to use portals if encouraged and supported by their friends, families, and peers (Adams et al., 2005; Chaffin & Harlow, 2005). Support and encouragement provide a sense of belonging and accomplishment, as well as a feeling of shared experiences (Ng, 2008). One suggestion to develop support for older adults is to include community resources and accommodations (Chaffin & Harlow, 2005). Examples of community resources may include educational programs, adaptive computer equipment, and formal and informal technology support (Chaffin & Harlow, 2005). Another recommended resource is to use age-specific training programs and manuals, which can increase ease of use in the older adult (Adams et al., 2005). By providing a structured environment, the older adult can develop a sense of trust that promotes a supportive atmosphere (Casey, 2016).

Education

Older adults often seek help and advice to navigate technology from friends and family, or they are self-taught (Adams et al., 2005). By introducing and implementing computer

education courses, an increased number of older adults utilized technology (Casey, 2016; Ng, 2008). Programs that emphasize new skills found using portals appear to be the focus of many courses offered (Cresci et al., 2010). Educational programs are recommended as it may encourage patient portal engagement by older adults (Hall et al., 2015). As many older adults identify the need for assistance with portals, educating older adults to use them is critical (Price-Haywood et al., 2017).

Lack of Experience

Lack of experience was correlated to the willingness to adopt PP use into their skillset (Adams et al., 2005; Czaja, 2015; Gordon & Hornbrook, 2016; Price-Haywood et al., 2017). While a lack of experience impacts the widespread adoption of portals, it is particularly true with the older adult population. However, researchers demonstrated that learning these skills can have a positive impact on older adults, specifically with problem-solving and improved patient outcomes (Chaffin & Harlow, 2005). In order to make portals easier to use for the older adult, it is recommended to adapt a learner-centered approach. Having materials such as user manuals and instructions written with the older adult in mind can make it simpler and easier to understand (Adams et al., 2005; Czaja, 2015). Providing a variety of information delivery formats that address the needs of a more diverse population is also being considered (Chaffin & Harlow, 2005; Latulipe, 2015). Examples of alternative formats include visual aids, written instructions, and discussion (Chaffin & Harlow, 2005; Latulipe, 2015). Not only can training remove a barrier to portal use, it can have a positive effect on older adults' attitudes toward using portals (Latlipe et al., 2015; Ng, 2008).

Anxiety

The thought of learning a new technology was identified as a source of anxiety for older adults, which may hinder acceptance of portal use (Chaffin & Harlow, 2005; Ng, 2008). Training has been found to reduce anxiety when it comes to navigating new technology as well as increase efficacy (Adams et al., 2005; Ng, 2008). For example, drill and practice techniques have been found to be appropriate to familiarize older adults with the equipment (Chaffin & Harlow, 2005). Decreasing older adults anxiety around computer and the internet requires providing them with emotional support (Kim et al., 2009). Additionally, Kim et al. found that to reduce anxiety in older adults, it is important to ensure the availability of resources for understanding health information (Kim et al., 2009).

Security Concerns

Many older adults fear invasion of privacy, theft, or fraud as potential risks to using technology, especially web-based technology (Cresci et al., 2010; Kruse et al., 2015). Patients needing to use open-access computers or public computers expressed a greater concern over security (Tieu et al., 2015). Older adults expressed more willingness to adopt new technologies if there was a guarantee that information would be protected and backed up (Price et al., 2013). Strategies such as encryption and secure networks have the potential to ease the barrier of mistrust (Latulipe et al., 2015). Patient portal developers could also consider implementing online security measures for public computer users (Tieu et al., 2015).

Health Limitations

Some of the most common physical limitations reported in the literature include vision, hearing, and range of motion (Chaffin & Harlow, 2005; Cresci et al., 2010). Health limitations not only affect the ability to utilize equipment but limit the time spent with the technology

(Chaffin & Harlow, 2005). Visual disorders with older adults may make it more difficult to view the technology (Latulipe et al., 2015). In addition, many internet-based interventions include peripheral elements, which may be harder for older adults with decreased vision to identify (Latulipe et al., 2015). Other physical limitations that commonly occur in the older adult are hearing impairments and hearing loss (Chaffin & Harlow, 2005). Depending on the type of technology used, a decrease in hearing may impact the ability to access and utilize that information (Chaffin & Harlow, 2005). For example, sounds and cues from video, audio dictionaries, or error messages, may be confusing or misheard (Chaffin & Harlow, 2005). A third limitation is decreased mobility and range of motion (Chaffin & Harlow, 2005). Multiple components of portals require manipulation of equipment, which could be difficult if the person has a mobility issue (Chaffin & Harlow, 2005). As a result of health limitations, many interventions have been specifically modified to enhance mobility and quality of life (Czaja, 2015; Latulipe et al., 2015). Initial research on the impact of physical health limitations has been conducted. However, there is little evidence on the impact of mental health illnesses such as depression on PP use. This is an area identified for future research.

Loss of Personal Interactions

Older adults expressed concern that using patient portals would lead to a loss of interactions with providers (Gordon & Hornbrook, 2016). Marketing emphasizing care coordination with providers and PPs is a recommended approach to overcome the fear of losing personal interactions (Latulipe et al., 2015). When promoting PPs, it is important for health care organizations to emphasize that the system is not a replacement for face-to-face visits (Latulipe et al., 2015). Including information about the benefits of patient portals, such as improving patient health and well-being, can also encourage portal use (Arcury et al., 2017). Ensuring

patients understand how portals are implemented can improve communication and outcomes without the losing personal interactions (Griffin et al., 2016). Last, patient portal designers could consider language barriers and assess potential effects of replacing face-to-face communication in the older adult population (Tieu et al., 2015).

Methodological Challenges

Assessment of the literature identified limited high quality quantitative research. A suggestion is to increase quantitative research to compare to the current body of qualitative research. One challenge to obtaining high quality research is difficulty in the ability to conduct randomized clinical trials (Bowles et al., 2015). In addition, previous research utilized multiple variables, making it difficult to determine which factors impacted behavior (Bowles et al., 2015). Another challenge is the feasibility of convenience samples, leading to less general representation of larger populations (Polit & Beck, 2017). Smaller sample sizes, which are more common than larger samples, impacted the statistical power of results (Hällgren et al., 2014). Last, research often utilizes self-reported data, which can lead to misrepresentation of actual behavior and ambiguity in responses (Polit & Beck, 2017).

Gaps in Literature

Initial research on PP use in older adults has been conducted. However, there is little evidence examining the contribution of motivation and various physical limitations common in older adults. Even though there is research on individual factors, there is little evidence to describe the relationship between facilitators and barriers and the hypothesized consequences. Proposed consequences include an inability to make informed decisions, decreased quality of life, and an inability to manage chronic health conditions. Further research can build on the knowledge gained by identifying barriers to performance and portal use when implementing

interventions (Arcury et al., 2017). Also, developing and incorporating standardized assessment tools could help better accommodate or recommend specific interventions for older adults (Gardner & Amoroso, 2004). Although intervention strategies show potential, more research is needed on physical limitations and potential solutions to overcome barriers. Additionally, no standardized measurement tools exist for measuring perceived barriers, so further research can be done to develop a tool. Last, evaluation of measurement tools can be performed to determine which instruments are the most beneficial for older adults (Blažun et al., 2014).

Conclusion

The analysis of the literature has identified prominent facilitators and barriers to patient portal use in the older adult. Perceived facilitators include improved communication, support, and training. Perceived barriers include experience and skills, anxiety, privacy and security concerns, physical and mental health limitations, and lack of personal interaction. Methodological challenges identified in the research include small sample sizes, convenience sampling, and a lack of standardized assessment and measurement tools. Future research can be focused on utilizing the knowledge gained by identifying barriers when implementing portal use. Research can also be conducted on developing and incorporating standardized assessment tools.

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Table 1.
Quantitative Studies

						Evidence Rating	
Study #	Author and Date	Study Design	Sample Size	Findings	Limitations	Level	Quality
1	Adams (2005)	Quasi-experimental	*n* = 23	▪ Perceived usefulness of the internet (p = 0.068). ▪ Perceived usefulness of e-mail and positive effect on Internet usage (p = 0.019). ▪ Users perception of usefulness of Internet regardless of experience (p = 0.027). ▪ Effect of computer experience on perceived use of the Internet (p = 0.005).	Lack of universal terminology; purposive sampling used	II	B
2	Ancker (2010)	Retrospective analysis of data from portal and electronic health records	*n* = 74,368	▪ Hypertension (11,699) and hyperlipidemia (8764) most prevalent chronic conditions. ▪ Access codes more likely to be issued to women (adjusted OR 1.06, 95% CI = 1.01 to 1.11), younger patients (adjusted OR 0.97, 95% CI = 0.96 to 0.99), whites (adjusted OR 1.60, 95% CI = 1.50 to 1.71), speakers of English (adjusted OR 2.80, 95% CI = 2.45 to 3.20), those with insurance (adjusted OR 4.10, 95% CI = 3.84 to 4.37), more	Significance levels not clearly indicated in tables or discussion of results. Patient-provider relationship not studied as confounding variable.	III	B

				clinical visits (adjusted OR 1.042, 95% CI = 1.038 to 1.044), and more chronic illnesses (adjusted OR 1.15, 95% CI = 1.13 to 1.18). ▪ Activation more likely among older patients (adjusted OR 1.05, 95% CI = 1.01 to 1.08), non-blacks (adjusted OR 1.69, 95% CI = 1.50 to 1.90), speakers of English (adjusted OR 1.71, 95% CI = 1.23 to 2.40), privately insured (adjusted OR 1.71, 95% CI = 1.51 to 1.94), and those with more clinical visits (adjusted OR 1.012, 95% CI = 1.007 to 1.018). ▪ Frequency of portal use correlated to number of clinical visits (r = 0.31, p < 0.001), number of diagnoses (r = 0.18, p < 0.001), and age (r = 0.08, p < 0.001).			
3	Casey (2016)	Quasi-experimental	*n* = 50	▪ Participants with higher CES-D scores used the PHR less and participants (r = -2.86, p ¸0.05). ▪ Computer use comfort level was statistically higher four weeks after the PHR educational intervention (Z = -1.1668, p ¸0.005). ▪ Amount of PHR use differed in the participant group receiving the educational intervention (M = 1.08)	Small sample size. Single geographic region. Lack of diversity in sample.	II	B

				compared to the matched control group (M = 0.16, U = 735.5, p = 0.001).			
4	Cresci (2010)	Non-experimental	*n* = 1410	▪ Age correlated to interest in use of Internet (p = 0.0001). ▪ Differences found between No-Nets and Pro-Nets on education (p = <0.001). ▪ No-Nets were 2.280 times less likely to take classes/like to learn new things, 1.581 times less likely to have membership in community organizations, and 1.807 times less likely to do volunteer work.	Lack of description of validity and reliability indicators for measures. Inadequate description of initial study to compare findings	III	B
5	Gordon (2016)	Descriptive correlational study	*n* = 4980	▪ Older adults less likely to have registered for a patient portal, signed into patient portal, or used the patient portal. ▪ Access to digital technology decreased with increasing age. ▪ Black, Latino, and Filipino seniors were less likely to have digital devices.	Did not take into account social determinants to patient preferences. Response rate among black, Latino and Filipino seniors was limited. Did not use validated	III	B

					measures of health literacy. Did not directly state statistics to demonstrate significance.		
6	Hall (2015)	Quasi-experimental	*n* = 225	▪ Computer self-efficacy scores were lower between nonusers and users across all age groups.	Findings not generalizable to all. Limited to respondents with landline telephones. Data was self-reported. May be influenced by bias and interpretation of the questions by the participant	II	B
7	Kim (2009)	Univariate descriptive	*n* = 70	▪ 100% of participants felt they were able to provide more health information to their health care provider with using the system (95% CI = 78.4 to 100). ▪ 90.9% of participants indicated the face-to-face meeting time with their	Questionnaire not indicated as reliable or valid. Design or sampling	III	B

				health care provider was used more efficiently with the system (95% CI = 51.2 to 96.0). ▪ 81.8% of participants indicated that the system improved the quality of overall health care they received (95% CI = 65.6 to 100).	methods not clearly stated. Analysis of data not explicit.		
8	Logue (2012)	Descriptive survey methodology	*n* = 38	▪ Older seniors reported less confidence in their ability to use internet-based PHRs (*t* = 2.04, p = 0.01). ▪ Older seniors did not perceive that they had the resources in place to use PHRs (*t* = -2.80, p = 0.01).	Population variance between two settings. Variations in age and ethnicity. Small sample size. Non-probability sampling procedure. Selection bias. Self-reported data. Difficult to connect statistical data to narrative.	III	B

9	O'Donnell (2011)	Cross-sectional telephone survey	*n* = 170	▪ Supporters of physician health information exchange were more likely to be caregivers for chronically ill individuals (adjusted OR 4.6, 95% CI = 1.06 to 19.6). ▪ Respondents interested in using personal health information exchange were more likely to be frequent Internet-users (adjusted OR 3.3, 95% CI = 1.03 to 10.6). ▪ Respondents interested in using personal health information exchange feel communication among their physicians was inadequate (adjusted OR 5.7, 95% CI = 1.7 to 25.3). ▪ Respondents believe health information exchange would improve communication with physicians (adjusted OR 4.7, 95% CI = 1.7 to 12.8).	Did not separate results by age. Difficult to generalize results.	III	B
10	Peacock (2016)	Prevalence study	*n* = 3677	▪ Respondents who accessed their own personal health information online were more likely to report being offered access by their health care provider ($p < 0.001$). ▪ Older, non-white, Hispanic, less educated, and lower income participants reported being offered portal access less often ($p < 0.05$).	Low response rate. Respondents may not be representative of the entire US population.	III	B

				▪ Individuals 75 years and older were less likely to access online personal health information than younger respondents (OR 0.41).	Did not take into account differences across healthcare settings.		
11	Price-Haywood (2017)	Cross-sectional survey	*n* = 101,019	▪ e-HEALS scores positively associated with higher education (estimate 5.9, SE = 1.1) and negatively associated with age (estimate -0.32, SE = 0.009).	Single institution. Limited scope on chronic diseases. Survey response bias.	III	B

Table 2.

Qualitative Studies, Expert Opinions, and Systematic Reviews

						Evidence Rating	
Study #	Author and Date	Study Design	Sample Size	Findings	Limitations	Level	Quality
1	Chaffin (2005)	Expert opinion	N/A	▪ Four barriers to learning identified: motivation, skills, biological architecture, and lack of a supportive environment. ▪ A teaching and learning process was described to accommodate older adult learners. ▪ Strategies presented that could increase an older adult's ability to learn computer skills.	No description of the design of the study. No sample size was identified or described.	V	C
2	Czaja (2015)	Expert opinion	N/A	▪ Barriers that prevent older adults from not fully utilizing technology applications include cost, accessibility, usability, training and technical support, and issues around privacy and data management. ▪ Program design should be focused on the users. ▪ An interaction between the designer and user needs to occur.	No description or identification of a study. No sample size	V	C
3	Kruse (2015)	Systematic literature review	*n* = 27	▪ 11 out of 27 articles (41%) reported an improvement of patient-provider communication from using a patient portal.	Exclusion criteria not	III	B

				▪ 11 out of 27 articles (41%) stated patient portals were not user-friendly and had a lack of patient technical support, education or access to the Internet.	explicitly stated. Only two databases searched. Key words limited during search process.		
4	Latulipe (2015)	Interviews	*n* = 52	▪ Lack of technological experience and lack of access to technology are major factors contributing to lack of interest. ▪ Income may be a factor to usage of internet. ▪ Trust issues appeared to be a barrier to using patient portals. ▪ Patients fear that patient portals will replace face-to-face communication with providers.	Interview questions not identified or explained. Patients who have not utilized patient portals gave feedback on benefits without having experience.	III	B
5	Ng (2008)	Interviews	*n* = 10	▪ Five broad categories emerged: problems and difficulties, evolving motivation, learning supports, collaboration, and benefits.	Small sample size. Recruitment occurred through one program.	III	B

					Limited by ethnic and cultural aspects – all members were of one population group.		
6	Snyder (2009)	Interviews	*n* = 10	▪ Patients expressed concern over security of the website and who would be able to access information. ▪ Patients liked that questions asked were about issues they either didn't think of or might not normally talk about with their physician.	Small sample size. No description of the interview questions. Patients were recruited from a single setting.	III	B
7	Tieu (2017)	Interviews	*n* = 25	▪ Participants with limited health literacy were more likely to require assistance and took longer to complete tasks. ▪ Participants experienced barriers in basic computer (n = 12), routine computer (n = 13), reading and writing (n = 8), and medical content (n = 5).	Measure of health literacy was brief. Findings may be affected by task ordering effects. May not be generalizable to larger health systems or	III	B

					integrated care settings. Approach may have affected task performance.		
8	Tieu (2018)	Interviews	*n* = 16	▪ Barriers and facilitators of portal use included computer or internet access, technological skills and interest, security and privacy of information, patient-provider relationship, and chronic illness self-management.	Limited to English speakers. Did not provide guided interview questions.	III	B
9	Turner (2015)	Semi-structured interviews	*n* = 74	▪ Facilitators of portal use included easy access to health information, direct communication with provider, and ability to make online appointments. ▪ Barriers to portal use included problems logging in, cost of maintaining internet access, aversion to using computers, and security concerns.	May not be generalizable. Results may differ based on living situations.	III	B

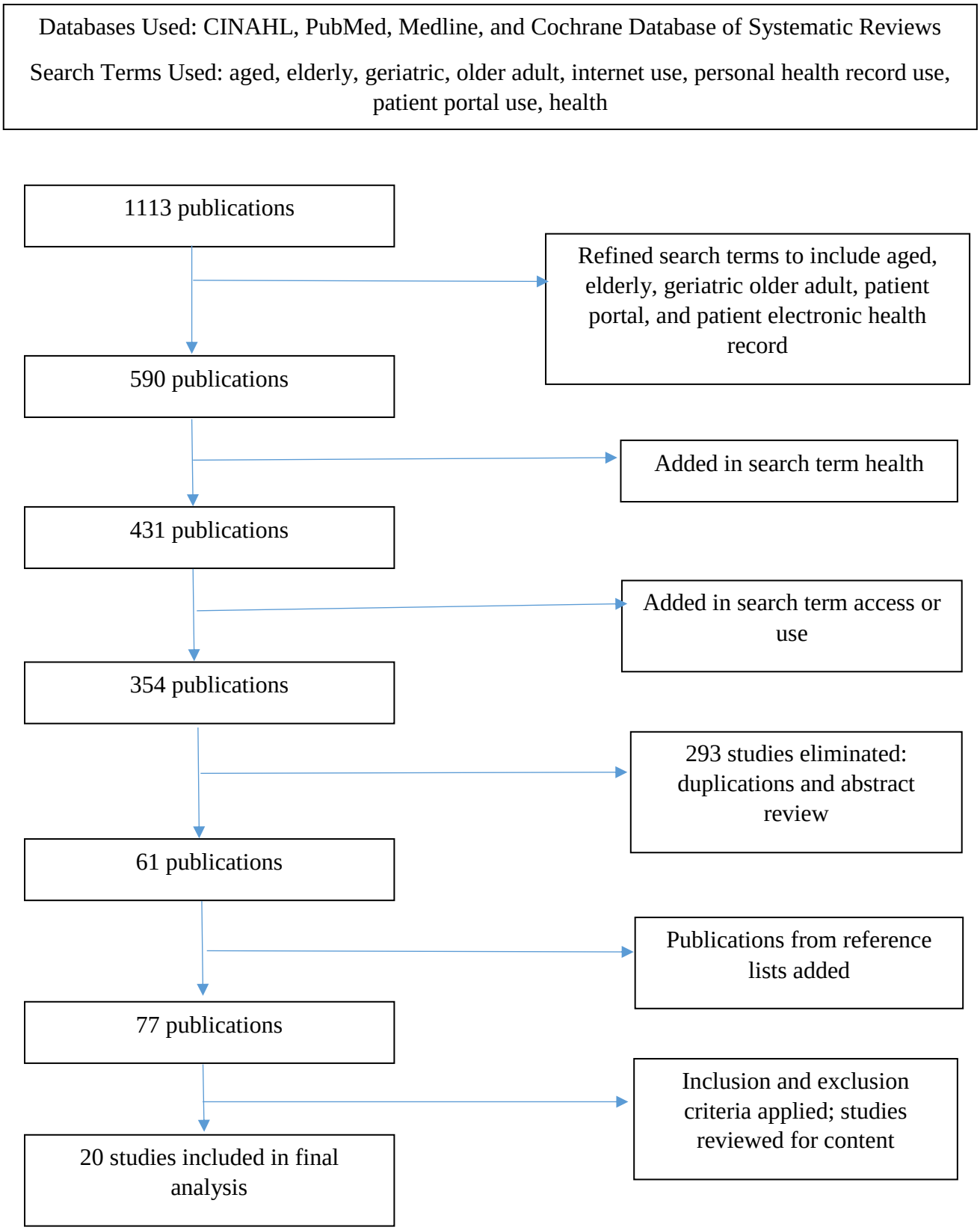
Table 3.

Facilitators and Barriers to Patient Portal Use in Older Adults

Author Date	**Type of Research**	**Access or Activation**	**Improved Communication**	**Support**	**Training**	**Experience and Skills**	**Anxiety**	**Privacy and Security Concerns**	**Physical and Mental Health Limitations**	**Lack of Personal Interaction**
Adams 2005	Quantitative	x		x	x	x	x			
Ancker 2010	Quantitative	x	x							
Casey 2016	Quantitative		x	x	x				x	
Chaffin 2005	Expert opinion	x	x	x	x	x	x		x	
Cresci 2010	Quantitative	x			x			x	x	
Czaja 2015	Expert opinion	x	x			x		x		
Gordon 2016	Quantitative	x	x			x			x	x
Hall 2015	Quantitative	x			x					
Kim 2009	Quantitative	x	x	x			x		x	

Kruse 2015	Systematic review		x					x		
Latulipe 2015	Qualitative		x			x		x		x
Logue 2012	Quantitative		x	x		x				
Ng 2008	Qualitative			x	x					
O'Donnell 2011	Quantitative		x	x				x		
Peacock 2016	Quantitative	x	x							
Price-Haywood 2017	Quantitative	x		x	x	x		x		
Snyder 2009	Qualitative		x					x		
Tieu 2017	Qualitative					x				x
Tieu 2015	Qualitative	x	x			x		x		x
Turner 2015	Qualitative		x			x		x		

Figure 1. Literature Review Search Figure



Chapter Summary

This chapter presented the current state of the science on information and communication technologies and electronic personal health record use in the older adult. The chapter began with an overview of general characteristics of the older adult as well as ICT use in this population. Factors impacting ICT use were then compared to older adults' usage with ePHRs. Depression and loneliness were described in relation to ICT and ePHR use, and gaps were identified in the literature. As a result, a systematic review of the literature manuscript was presented at the end of the chapter. The manuscript provides a more in-depth analysis of facilitators and barriers to ePHR use in the older adult population.

Chapter 3

Methods

Introduction

The purpose of the study was to examine the relationship between individual factors of older adults and their use of electronic personal health records (ePHRs). This chapter provides an in-depth discussion of the methodology utilized in the study. An explanation of the sample population, setting, procedures and data analysis are included. In addition, the chapter includes a detailed discussion of the measurements used in the study. Ethical considerations and limitations associated with the study are outlined.

Research Design

The study was a correlational design. Descriptive statistics and a description of relationships (Gray et al., 2017) were used. The study was aimed at determining the relationship or association between variables.

Research Questions

1. What is the older adult's degree of depression?
2. What is the older adult's degree of loneliness?
3. What is the older adult's perceived control of electronic personal health records?
4. What is the older adult's user experience with electronic personal health records?
5. What is the relationship between sensoriperceptual deficits and intent to use electronic personal health records in the older adult?

6. What is the relationship between performance and intent to use electronic personal health records in the older adult?
7. What is the relationship between the independent variables and intent to use electronic personal health records in the older adult?
8. What is the relationship between the independent variables and performance with electronic personal health records in the older adult?

Research Hypotheses

1. Controlling for older adult's sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with intention to use electronic personal health records.
2. Controlling for older adult's sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with performance with electronic personal health records.

Assumptions of Study

- Participants will answer all questions truthfully, honestly, and to the best of their ability.
- Participants are cognitively able to participate in the study.
- Participants will actively participate in observed portion of study.

Sample/Subjects

Participants for this investigation were older adults. Inclusion criteria was that the participant was aged 65 or older, and that they could speak and read English. Setting the age at 65 years or older was based on the classification of an older adult identified by the World Health Organization (WHO, 2015). The ability to speak and read English was required based on the

available resources for the study. The primary researcher conducted data collection and had a primary language of English. Subjects were recruited through convenience and snowball sampling.

The sample size was determined through power analysis to estimate the sample size needed to achieve statistical conclusive validity. Conducting a power analysis allowed for detection of differences or relationships that were present within the chosen population (Gray et al., 2017). In order to determine power, effect size was identified. The study determined sample size by obtaining at least 30 subjects for each study variable measured (Gray et al., 2017). Using the recommended average correlation, a total of 210 participants was needed for the study. A 10%-15% attrition rate was also calculated. The calculated total number of participants needed for the study was between 231-242 subjects in order to ensure the final sample size equals 210.

Setting

Subject recruitment consisted of face-to-face recruitment, advertisements, letters and emails. Creative strategies were considered, such as recruiting through pie or dessert socials at data collection sites (Gray et al., 2017). Subjects were invited to participate at independent senior housing facilities, senior centers, and local churches. Clinical partners with assisted living and senior communities were contacted. In addition, churches and senior groups at sites such as Bethlehem Baptist, Swanville Bible, and Harbor Church were contacted. Selection of facilities was determined by using sites where potential participants lived and the primary researcher had access to the location. In addition, accessing a community group led to further recruitment through word of mouth or snowball sampling (Gray et al., 2017).

Measures

Demographic information was collected on each participant (see Appendix A). Data included age, gender, race or ethnicity, education level, and income. Participants indicated if they have a chronic condition, specified the type of condition, and how many chronic conditions were present. Demographic information included whether the participant owned a computer, had experience with computers, and number of hours of computer use per day. Data was collected on whether the participant had an electronic personal health record account, if they used their electronic personal health records (ePHR), and what tasks they performed within the ePHR.

Sensoriperceptual deficits were limited to hearing and visual deficits. Sensoriperceptual deficits were identified with a participant self-report measure involving a simple questionnaire to determine if the participant had hearing and/or visual impairment. The questionnaire consisted of closed-ended items, with alternatives including a simple yes or no response. The questionnaire also identified if the participant used corrective lenses, hearing aids, or other assistive devices.

Perceived control and intent to use electronic personal health records (ePHRs) were measured using an adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). An adapted U.S.A.B.I.L.I.T.Y. Survey© was created using selected items pertaining to the independent and dependent variables (see Appendix B). For all items on the adapted version, permission to change wording and instructions to reflect ePHRs was granted by the survey developer (see Appendix C). In addition, permission to use the subscales instead of the entire survey was also granted by the survey developer (see Appendix B).

The original U.S.A.B.I.L.I.T.Y. Survey© is a 5-point Likert scale consisting of 25 items, ranging from 1 (strongly disagree) to 5 (strongly agree) (Caboral-Stevens, 2015). Items from the

original U.S.A.B.I.L.I.T.Y. Survey© subscales were included as separate items on the adapted version (see Appendix D). The concept of perceived control includes the attributes of cognitive, decisional, and behavioral control (Caboral-Stevens, 2015). On the original U.S.A.B.I.L.T.Y. Survey©, six of the items (Nos. 20-25) address the overall concept of perceived control (Caboral-Stevens, 2015). Perceived control was then sub-divided into items on the original U.S.A.B.I.L.I.T.Y. Survey© measuring attitudinal control and items measuring cognitive control (Caboral-Stevens, 2015). On the original U.S.A.B.I.L.I.T.Y. Survey©, items 23, 24 and 25 addressed cognitive control, and items 20, 21 and 22 measured attitudinal control (Caboral-Stevens, 2015). The concepts of attitudinal and cognitive control were included in the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© as measures of perceived control and intent to use. Items 10-12 on the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© measured the subscale of perceived control, and items 7-9 on the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© measured intent to use ePHRs.

A Cronbach's alpha coefficient was conducted to determine internal consistency on the sub-scale items of perceived control (Caboral-Stevens, 2015). The Cronbach's alpha coefficient for perceived control in the U.S.A.B.I.L.I.T.Y. Survey© is 0.64 (Caboral-Stevens, 2015). Gray et al. (2017) states that coefficients with a value greater than 0.80 are considered strong. However, newer instruments may only show limited to moderate reliability as indicated by coefficients of 0.70-0.79. In addition, subscales of newer instruments may only indicate internal reliability of 0.60-0.69, which is an acceptable value. Therefore, a Cronbach's alpha coefficient of 0.64 is expected since the U.S.A.B.I.L.I.T.Y. Survey© is a newer subscale of the instrument (Gray et al., 2017).

User experience was measured using the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). Items 14-19 on the original U.S.A.B.I.L.I.T.Y. Survey© measured user experience (Caboral-Stevens, 2015), correlating to items 1-6 on the adapted version. Cronbach's alpha coefficient for user experience is 0.89, suggesting a strong reliability (Caboral-Stevens, 2015). The U.S.A.B.I.L.I.T.Y. Survey© was selected because it is specifically designed for older adults and their intent to use technology. The items in the U.S.A.B.I.L.I.T.Y. Survey© measured the participants perceived control with ePHRs (Caboral-Stevens, 2015). Therefore, items specifically measuring perceived control and intent to use were selected for inclusion in the adapted version of the U.S.A.B.I.L.I.T.Y. Survey©. In addition, the questions for user experience included in the adapted of the U.S.A.B.I.L.I.T.Y. Survey© came from the original U.S.A.B.I.L.I.T.Y. Survey®, which had scales with established psychometrics, including baseline reliability and validity (Caboral-Stevens, 2015).

The original U.S.A.B.I.L.I.T.Y. Survey© was tested for reliability and validity, including content validity and internal consistency (Caboral-Stevens et al., 2015). Face validity was conducted by using experts who reviewed the instrument (Caboral-Stevens, 2015). Using feedback by experts, revisions were made based on suggestions (Caboral-Stevens, 2015). A panel of experts was utilized to determine content validity of the survey (Caboral-Stevens, 2015). The content validity index for items (I-CVI) as well as for scales (S-CVI) were calculated (Caboral-Stevens, 2015). The calculated I-CVI for the U.S.A.B.I.L.I.T.Y. Survey© was 0.97, indicating that the items on the survey were highly relevant, as an acceptable I-CVI is 0.80 (Caboral-Stevens, 2015). The S-CVI/Ave for the original U.S.A.B.I.L.I.T.Y. Survey© was calculated at 0.97, which meets the standard criterion of 0.90 (Caboral-Stevens, 2015). Internal consistency was used to determine reliability of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-

Stevens, 2015). The total item correlation coefficient was 0.96, with all determinants except perceived control exceeding the Cronbach alpha of 0.80 (Caboral-Stevens, 2015). Based on the initial subscale tests for reliability and validity, the adapted U.S.A.B.I.L.I.T.Y. Survey© is an appropriate instrument to use for the study.

Depression was identified through use of the Geriatric Depression Scale: Short Form and indicated by a score of greater than ten (Sheikh & Yesavage, 1986). The GDS: Short Form (Sheikh & Yesavage, 1986) was developed to cut down on the time requirement of completing lengthy scales (See Appendix E). Fifteen items from the Geriatric Depression Screen were selected according to the highest correlation to depressive symptoms (Sheikh & Yesavage, 1986). The items were arranged in a yes-no format, similar to the original form (Sheikh & Yesavage, 1986). Ten of the selected items indicate depression when the participant answered "yes" (Sheikh & Yesavage, 1986). The remaining five items indicate depression when the participant answered "no" (Sheikh & Yesavage, 1986). A validation study was conducted, comparing both versions of the Geriatric Depression Screen (Sheikh & Yesavage, 1986). The Geriatric Depression Screen: Short Form (Sheikh & Yesavage, 1986) was able to differentiate depressed from non-depressed participants ($r = .84$, $p < .001$).

Loneliness was measured using the UCLA Loneliness Scale Version 3 (UCLA V3), a version of the scale updated to improve readability to increase participant's comprehension of the items (Russell, 1996). The UCLA V3 scale consists of 20 items that measure participants' subjective feelings of loneliness (Russell, 1996). Participants rated each item of the UCLA V3 on a 4-point Likert scale, ranging from 1 (Never) to 4 (Often) (Russell, 1996). Participants rated each item on the UCLA V3 indicating how often each statement reflects their perspective on loneliness (Russell, 1996). Several items on the UCLA V3 are reverse scored (Russell, 1996),

For example, the primary researcher would change the ranking of 4 to equal a score of 1 (see Appendix F). Individual item scores for the UCLA V3 were tallied and a total sum was reported (Russell, 1996). Higher total scores on the UCLA V3 indicated a higher degree of loneliness, whereas lower total scores indicated lower degrees of loneliness, ranging from 20-80 (Russell, 1996). A total score less than 28 indicated no/low loneliness, scores 29-42 suggest moderate loneliness, and scores greater than 43 indicated high degrees of loneliness (Cacioppo & Patrick, 2008). Version 3 of the UCLA scale appears reliable with Cronbach alpha ranges from .89-.94 across all samples (Russell, 1996). Convergent validity for the UCLA V3 was identified by significant correlations with other measures of loneliness, including the Differential Loneliness Scale (r = .72) (Russell, 1996).

Performance of ePHR tasks was measured through observation of the participant completing basic tasks in an electronic personal health record. The primary researcher obtained consent for a sample ePHR account with Twin Cities Physicians (see Appendix G). The sample ePHR account did not contain any actual patient information and was used only to observe the participant's ability to perform ePHR tasks. Each participant performed specific ePHR tasks within the sample account. The observation items were developed using the format of the original U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). The items on the observation checklist were developed as a combination of numerical data and narrative information about the type of ePHR assistance needed by the participant (see Appendix H) (Caboral-Stevens, 2015). The ePHR tasks were identified through the literature, and focused on the basic functions of ePHRs. Items were modified into a checklist in which the observer had specific behaviors and numerical values to choose from.

Procedures

Prior to data collection, construction of the adapted U.S.A.B.I.L.I.T.Y. Survey© using subscale measures was completed. The developer of the U.S.A.B.I.L.I.T.Y. Survey© was contacted to obtain permission to use the survey, which was granted. Permission was also granted to modify the layout of the survey and alter the wording of the instructions and items to reflect electronic personal health records (ePHRs).

The primary researcher collected data for the dissertation study. The primary researcher was trained during practicum experiences and coursework to conduct quantitative research. Organizations were contacted through face-to-face interactions as well as telephone calls and emails. Healthcare organizations were identified based on existing clinical partnerships with the primary researcher and through personal contacts. Permission was obtained from each organization to collect data. The primary researcher was familiar with collecting informed consent from participants. Part of the informed consent process was to indicate that participation was voluntary and included explanation of risks and benefits of the study.

Participant recruitment involved identifying eligible candidates and encouraging them to participate in the study. A brief interview identifying inclusion and exclusion criteria was conducted to determine eligibility. The primary researcher included information about the benefits and risks of participating in the study. Explanation of how results will be shared, details of the study, and any assurances about confidentiality of information was disclosed to convey a nonthreatening and worthwhile experience for the participants.

Eligible participants were informed about the research study and had the option to consent or decline participation. The purpose of informed consent was to ensure that participants

had information about the research. Elements included in the informed consent included participant status, study goals, type of data, procedures, and the nature of the commitment. Finally, participants were informed that their consent was voluntary, and they had the right to withdraw at any time (see Appendix I). Basic contact information was collected using simple language to ensure participants comprehended the information. Written consent form statements were evaluated for consistency prior to distribution to participants. A request to waive documentation of informed consent was completed and approved by the University of Wisconsin – Milwaukee IRB. Consent was assumed when the participant partook in responding to the data collection surveys. The primary researcher ensured the data that was collected was de-identified to keep data confidential and private. Surveys were identified by assigning a number to each submitted response.

Once consent was obtained, the researcher collected the participants' demographic information. The initial questionnaire, the demographic data sheet, asked participants to self-identify if they have any current or past hearing or visual impairments. Data collection on sensoriperceptual deficits was important to gather accurate data collection, interpret results and understand the population. The demographic questionnaire was administered by the primary researcher, who asked the participant each item and recorded the answer electronically on a Microsoft Word document.

Each participant was screened for depression using the Geriatric Depression Scale: Short Form (GDS:SF) (Sheikh & Yesavage, 1986). Participants were instructed that the GDS:SF was a screen for depression, not a definitive diagnoses from a provider. The survey was administered by the primary researcher who asked the participant each item and recorded the answer on an electronic Microsoft Word document. The screening took approximately 5 minutes to administer.

Each bolded answer was assigned one point by the researcher, indicating the presence of depression. If the participant answered "no" to identified items (Nos. 1, 5, 7, 11, 13), one point was assigned for each item. One point was assigned if the participant answered "yes" to any of the remaining ten items. The points were calculated for a total score that ranged from 0-15. A score of 0-5 was considered normal. A score over 5 was suggestive of depression, whereas a score of $\geq$ 10 was highly indicative of depression. If a participant scored higher than 5, they could continue with the study, however, the primary researcher recommended a follow-up assessment with a provider. In addition, all participants were offered a list of resources for services addressing depression.

Each participant completed the UCLA Loneliness Scale Version 3 (Russell, 1996). The survey was administered by the primary researcher who asked each question to the participant and electronically recorded their answer on a Microsoft Word document. The survey took approximately 10 minutes to administer. Identified questions (Nos. 1, 5, 6, 9, 10, 15, 16, 19, 20) were reverse scored (Russell, 1996). The researcher calculated a total score, which ranged from 20-80, with higher numbers associated with higher degrees of loneliness.

The adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015) collected data from participants regarding perceived control, user experience, and intent to use ePHRs (see Appendix J). The survey used Likert-type scales (Caboral-Stevens, 2015). The researcher asked the participants each question on the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© and recorded participant's answers into an electronic Microsoft Word document. The survey took between 10 to 20 minutes to complete.

Once the adapted version of the U.S.A.B.I.L.I.T.Y. Survey© was completed, participants who indicated that they were able to (n = 63), completed the sample ePHR account basic tasks.

The ePHR sample account was provided by Twin Cities Physicians, and the researcher had written permission to access the account. Participants received verbal instructions to accomplish the tasks, and were informed they could ask for further verbal instruction or clarification prior to performing the tasks. The primary investigator utilized structured observation as the participants performed the tasks using a checklist to evaluate their performance of the tasks. The checklist was identified using corresponding survey numbers to ensure de-identification of personal information. Tasks the participants were asked to perform included: (a) logging into the ePHR, (b) sending and reading messages, and (c) finding lab value information. Other observed tasks for the participants entailed reviewing medications, health history, and logging out of the system. The researcher timed how long it took individual participants to complete each task within the sample ePHR account. Task completion took the participants approximately 10-15 minutes. Following task completion, participants were thanked and the primary investigator responded to any of the participants remaining questions or comments.

The participant's data was compiled, coded, and entered into a data file using an SPSS statistical package. The coding transformed the data into numerical values to perform the statistical analysis. After the data was entered into the SPSS program, the data was cleaned and outliers were identified. A code book was created to keep a record of the coding and variable naming, as well as basic information.

Data Analysis

Data analysis was conducted using version 28 of the SPSS software. Before hypotheses were tested, pre-analytic activities were conducted. The first step that was taken was to identify missing data by inserting 999 to account for data that was not completed on the surveys. Examining frequency distributions of each variable identified missing values. The distributions

of each outcome variable were analyzed using descriptive statistics, including frequencies, means, and standard deviations.

Variables with severely skewed distributions were transformed or analyzed with non-parametric tests to arrange data as close to a normal curve as possible (Gray et al., 2017). As multiple survey items were used to measure certain variables, a sum score was calculated within SPSS. A Pearson *r* correlation was conducted to determine if there were any relationships between the independent (depression, loneliness, perceived control, and user experience) and dependent (performance and intent to use ePHRs) variables. A scatter plot was created to provide a visual representation of the correlations. Scatter plots were used to provide preliminary information about the nature of the relationship and to identify nonlinear relationships (Gray et al., 2017).

Standard multiple regression was conducted, with all independent variables entered into the regression model simultaneously (Pallant, 2016). Each independent variable was evaluated for predictive power compared to other independent variables. Standard multiple regression was utilized to determine how much variance the independent variables were able to explain on the dependent variables as a group or block.

The primary researcher implemented data management in consultation with a doctorally prepared expert in statistics and Major Professor. All forms were kept in locked file cabinets. The primary researcher entered the data into a password protected database to ensure security and confidentiality. To ensure data accuracy, the primary researcher and another PhD prepared researcher entered, cleaned, and verified the de-identified data and corrected any entry errors prior to conducting the analysis. As an additional safeguard, frequency distributions of all variables were checked by the principal investigator and a PhD prepared researcher before

proceeding with the analysis, including looking for anomalies, skewness, or the presence of ceiling or floor effects, which can reduce variability (Pallant, 2016).

The assumptions for hierarchical multiple regression are that there are linear relationships between independent and dependent variables, requires a normal distribution, data must be symmetrically dispersed and the independent variables are not correlated with each other (Gray et al., 2017). After 25% of the data was collected, the primary researcher and a PhD prepared researcher with expertise in statistics reviewed the data to ensure that assumptions for the analysis could be met. No problems with the data were identified, and the assumptions were met.

Ethical Considerations

To ensure participant rights were protected, the Institutional Review Board (IRB) at University of Wisconsin - Milwaukee was consulted prior to initiation of the study. Participants were informed that they could choose or decline to participate in the study without persuasion or repercussion. Participants were also provided verbal instructions regarding the details of the research study, and informed that they could withdraw from the study at any time. Investigators involved with the research had current CITI training certificates on file with the IRB, to ensure the protection of human subjects (CITI Program, n. d.). In addition, permissions for use of instruments was obtained from the developer and permission to use the sample ePHR account came from the Twin Cities Physicians group prior to data collection.

Limitations

One limitation was the non-experimental design of the study, as it constrains the ability to support causal inferences in comparison to experimental or quasi-experimental studies. Participants were not randomized, but were self-selected volunteers, which can create sample

bias, and the findings cannot be generalized to a broader population. The use of questionnaires was that the respondent could leave an item unanswered, leading to missing data. By using self-reported instruments, there is a risk of response bias. Due to the COVID-19 pandemic, data collection was required to be conducted online, and 70% of the participants had limited technology access to complete the task performances in the sample ePHR account. For the remainder of the participants (30%) who performed the task performance in the sample ePHR account, the data collection process could have impacted the participant's concentration by having the primary researcher observe them, or the brief 10-15 minute process may have been fatiguing. Finally, there is always concern regarding the potential for observer bias, though a category checklist was created to minimize bias.

Summary

The relationship between older adults and individual factors and their ePHR usability and behavior was examined using a quantitative approach. The correlational design enabled the identification of relationships between the independent and dependent variables. The target population was defined for this investigation as the older adult aged 65 years or older who could read and write in English. A convenience sample of participants was selected after determining the number needed to achieve the power required to effectively analyze the data. Recruitment of participants included word of mouth, flyers, and communication with healthcare organizations. Measures included demographic questions, the Geriatric Depression Scale: Short Form, the UCLA Loneliness Scale Version 3, an adapted U.S.A.B.I.L.I.T.Y. Survey©, and when possible, structured observation. The primary researcher followed a strict IRB approved protocol to ensure compliance and accuracy with data collection. Consultation with the Major Professor and a PhD prepared researcher with an expertise in statistics was conducted as needed. Data analysis

consisted of conducting frequencies, correlational statistical tests, and hierarchical regression analysis.

Chapter 4

Results

Introduction

The purpose of this dissertation is to identify facilitators and barriers to electronic personal health record (ePHR) use in the older adult population. This study examined the impact of individual factors on intent to use and performance with ePHRs. Independent variables for the study included depression, loneliness, perceived control, and user experience. Dependent variables were intent to use ePHRs and performance with ePHRs. Because two dependent variables were identified in the study, two separate manuscripts were prepared to present the results. The first manuscript details the results of facilitators and barriers of older adults' intent to use ePHRs. The second manuscript describes factors influencing older adults' performance with ePHRs.

Manuscript Two: "Factors Affecting Older Adults' Intent to Use Electronic Personal Health Records (ePHRs)"

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Manuscript in Process

Abstract

Background: Technology continues to be implemented into healthcare and can enrich the lives of older adults. While older adults are utilizing technology for health management, they continue to have lower usage rates than younger adults. Electronic personal health records (ePHRs) have the potential to benefit older adult's health, yet factors influencing low ePHR access rates in this population have not been extensively researched.

Methods: A correlational design with a convenience sample of older adults (n = 210). Measures included a self-reported survey, adapted U.S.A.B.I.L.I.T.Y. Survey, Geriatric Depression Scale: Short Form and the UCLA Loneliness Scale. Descriptive statistics, frequency distributions, Pearson r and standard multiple regression were used for data analysis.

Results: Multiple regression analysis for intent to use indicates the overall model explains 70.3% of the total variance in older adults' intent to use ePHR (F (7, 200) = 67.6, p, <.001). User experience (β = .50, p <.001) and perceived control (β = .367, p <.001) were statistically significant predictors on older adult's intent to use ePHRs.

Conclusions: This study identified several facilitators and barriers to older adults' intent to use electronic personal health records (ePHRs). Results from this study emphasize the need for user-

friendly designs implementing older adult feedback in the development and implementation of ePHRs.

Key words: older adult, technology, electronic personal health record, ePHR, facilitators, barriers, usage

Introduction

Older adults aged 65 and older are the fastest growing subset of the general population (Knapova et al., 2020) expected to increase by 21.6% by the year 2040 (AoA, 2020). Technological advances in healthcare enrich the lives of older adults and improve their quality of life (Abdelrahman et al., 2021). The Health Information Technology for Economic and Clinical Health (HITECH) Act has led to organizations creating and implementing technology into healthcare systems (Nahm et al., 2020). Implementing technology into healthcare can increase communication and enable self-management, and lead to positive health outcomes (Portz et al., 2019).

Technology interventions have demonstrated the potential to promote and maintain health, though not everyone receives the benefits of digital health information (Tappen et al., 2020). While older adults are increasingly using technology for health management, they continue to have lower technology usage rates than younger adults (Knapova et al., 2020). One viable solution healthcare organizations are using to increase older adults' access to healthcare knowledge is the use of telehealth platforms, which can improve individuals' health outcomes (Oh et al., 2021). Telehealth platforms also allow older adults access to their medical information to better manage their healthcare (Reed et al., 2019).

Prior research has demonstrated the benefits of individuals accessing their electronic personal health records (ePHRs) (Hoogenbosch et al., 2018), which are secure websites that allow patients to view their records linked to their provider's electronic health record system (Portz et al., 2019). However, only half (49%) of older adults even have access to an ePHR (National Poll on Aging, 2018). Although older adults have expressed interest in electronic

personal health record use, factors influencing older adults' low ePHR access rates have not been extensively studied (Portz et al., 2019).

Limited research in the literature has focused older adults' facilitators and barriers to use ePHRs in their intent to use. Perceived usefulness and ease of use influences the older adult's intention to use technology (Hoogenbosch et al., 2019). The U.S.A.B.I.L.I.T.Y. Framework for Older Adults guided this investigation (Caboral-Stevens et al., 2015). According to the U.S.A.B.I.L.I.T.Y. Framework, older adults' perceived control and perceived experience influences their intent to use ePHRs (Caboral-Stevens et al., 2015). For this study, older adults' intent to use ePHRs is the cognitive representation of the individual's willingness and readiness to perform a task or behavior (Punnoose, 2012). The purpose of the U.S.A.B.I.L.I.T.Y. Framework is to explain or predict older adults' intent to use electronic personal health records (Caboral-Stevens et al., 2015).

Purpose

The purpose of this study was to examine the relationship between individual factors of older adults and their intent to use electronic personal health records (ePHR). Seven research questions are associated with this study:

1. What is the older adult's degree of depression?
2. What is the older adult's degree of loneliness?
3. What is the older adult's perceived control of electronic personal health records?
4. What is the older adult's user experience with electronic personal health records?
5. What is the relationship between sensoriperceptual deficits and intent to use electronic personal health records in the older adult?

6. What is the relationship between performance and intent to use electronic personal health records in the older adult?
7. What is the relationship between the independent variables and intent to use electronic personal health records in the older adult?

Hypothesis

The hypothesis for this investigation:

1. Controlling for older adult's sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with intention to use electronic personal health records.

Methods

Research Design

A correlational design guided this project. Descriptive statistics and a description of relationships between independent and dependent variables in this investigation (see Table 1) were identified. Participants completed a 24-item demographic survey that included questions about computer and ePHR use. Participants who indicated they were able to (n = 63) performed basic tasks within a sample ePHR account. The University of Wisconsin-Milwaukee Institutional Review Board approved the study.

Table 2

Independent and Dependent Variables

Independent Variables	Dependent Variable
Depression	Intent to use
Perceived control	
User experience	
Sensoriperceptual deficits	
Loneliness	

Sample/Subjects

Participants for the study (N = 210) were 65 years or older, able to speak and read in English, and have telephone access at a minimum for ability to communicate. Convenience and snowball sampling facilitated recruitment of participants. In response to the power analysis requirements, 30 or more subjects were measured for each variable.

Setting

This study was conducted virtually through video conferencing; over the telephone; and at senior housing facilities and local churches. Older adults received invitations to participate through face-to-face recruitment, advertisements, flyers, letters, and emails. Virtual meetings took place over a video conference platform. Environmental settings ensured participant privacy and confidentiality prior to the survey administration. Telephone meetings began with the assurance that the participant's speaker phone was disabled and the participant was alone. In-person meetings were held in empty rooms or isolated spaces.

Measurement

The six variables in the study were measured using 4 measures.

1. A demographic survey collected data on age, gender, race/ethnicity, education level, and income. In addition, information on chronic conditions, computer and ePHR ownership and usage was gathered. Identification of hearing and visual deficits was also included on the demographic survey. All survey items for the measure were multiple-choice questions or select all that apply, with the exception of age.
2. The degree of depression was measured through the Geriatric Depression Scale: Short Form (Sheikh & Yesavage, 1986). The GDS: Short Form consists of 15 yes/no questions. Ten items indicate the presence of depression when the participant answers "yes." Five items indicate depression when the participant answers "no." Total scores over 5 were suggestive of depression and a score of 10 or greater was highly indicative of depression.
3. The degree of loneliness was measured with the UCLA Loneliness Scale Version 3 (Russell, 1996). The scale contains 20 items that measure subjective feelings of loneliness (Russell, 1996). Each item is a 4-point Likert scale, ranging from 1 (Never) to 4 (Often). A total score less than 28 indicated no/low loneliness, scores 29-43 suggest moderate loneliness, and scores greater than 43 indicate high degrees of loneliness (Cacioppo & Patrick, 2008).
4. Perceived control was measured with an adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). Three items are measures of perceived control. Items are written as a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

5. User experience was measured with an adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). Six items measured user experience. Items were written as a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).
6. Intent to use was measured with an adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015). Three items are measures of intent to use. Items are written as a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Procedures

Participant's interviews included an informed consent explanation for eligibility. Due to health practices surrounding COVID-19 and social distancing, a waiver to obtain written consent was received from the IRB. Consent for the study was assumed by participants as voluntary participation in the study. Once eligibility was determined, a random participant number was assigned to each participant. All items on each measure were verbally read to the participant by the researcher. Answers were verified by the researcher who verbally read back all of the responses to the participants, and then the investigator electronically recorded the participants' responses on a Microsoft Word document.

The researcher administered the demographic survey to the participant, which included data collection on hearing and visual deficits. Following the demographic survey, the Geriatric Depression Scale: Short Form (Sheikh & Yesavage, 1986) was administered. Upon completion of the 15 items, the researcher calculated assigned points for a total score. Participants that scored a 5 or higher were allowed to continue with the study, however a follow-up assessment with a provider was recommended. In addition, as a precaution measure, all participants were offered a resource list for mental health services. The third step in the study was to administer the UCLA Loneliness Scale: Version 3. After the participant answered all 20 items, the researcher

calculated assigned points for a total score. Finally, participants were administered the adapted U.S.A.B.I.L.I.T.Y. Survey© to gather data on perceived control, intent to use, and user experience. Participants answered 12 items and the researcher electronically recorded the responses on a Microsoft Word document.

Results

Data analysis was conducted using SPSS software version 28. Missing data were identified and the value 999 was imputed to reflect missing data. Descriptive statistics were analyzed to describe the demographic information of the participants.

Participant Characteristics

Participants in this investigation were all older adults (N= 210) (see Table 2). Half of the participants were between the ages of 65 and 74 years. Approximately one-third (32%) were between the ages of 75 and 84, and 17% were 85 years or older. Participants were equivalent in representation by gender, with 49% being male and 51% being female. The majority of participants were White (98.6%), followed by Hispanic or Latino (1.4%) and most (56%) had some college or higher level of education. The most frequent chronic illness reported by the participants was high blood pressure (59%), followed by high cholesterol (42.9%), arthritis (40.5%), and diabetes (20.5%). The majority of participants had some degree of visual impairment (71%) and used glasses for vision (85.2%). Forty percent of the older adults in this study had a hearing impairment, with 25.2% of them using hearing aids.

When participants were asked if they owned a computer, the majority responded affirmatively, with ownership greater than 5 years (73.3%). Similarly, participants (74.3%) described having used a computer for greater than 5 years. Approximately one-third of

participants reported their level of computer usage as beginner (32.9%), with the remaining participants reporting intermediate or higher computer usage (67.1%). Participants were asked about their knowledge of and usage of electronic personal health record (ePHR) use. Over half (54%) of participants knew about, understood, and used an ePHR for health management. Participants reported having learned about ePHRs primarily from healthcare providers (52.9%), followed by medical staff (13.8%) and nurses (11.0%). Most participants had never received any help to learn how to use or navigate an ePHR (60.5%), and those that did often received help from family or friends (13.8%). One-fourth of participants did not utilize an ePHR (25.7%), with another 94 (44.8%) having utilized one for greater than 5 years. The most common features participants used within an ePHR were reviewing lab values (53.8%), communicating with providers (51.4%), and reviewing medications and health history (41%).

Data Analysis

Four variables were transformed to produce a sum score: intent to use, user experience, sensoriperceptual deficits, and perceived control. A Pearson *r* correlation was conducted to determine any relationships between the independent and dependent variables. Standard multiple regression was conducted to evaluate correlations instead of hierarchical multiple regression due to the sample size.

Measures

The association of participants' age in relation to computer ownership, computer experience, level of experience, and knowledge, ownership, and experience with ePHRs was analyzed. A Pearson correlation coefficient was computed to examine the relationship between the variables. A weak negative correlation that was statistically significant, was found between

the participants' age and the variables of computer ownership, computer experience, level of experience, and knowledge, ownership, and experience with ePHRs (see Table 3).

A Pearson correlation coefficient was computed to assess the relationship between participant's education level and their experience with computers (see Table 4). A statistically significant correlation was found between the participant's education level and their ownership of computers ($r(208) = .35$, $p < .01$). A moderate positive correlation was found between participant's education level and their experience with computers ($r(208) = .36$, $p < .01$).

Another Pearson correlation coefficient was computed to assess the relationship between participant's household income and six demographic items (see Table 5). A statistically significant correlation was found between participant's household income and their computer ownership ($r(208) = .31$, $p < .01$). Additionally, a moderate positive correlation was found between participant's household income and their level of experience with computers ($r(208) = .33$, $p < .01$).

Frequency distributions were calculated to determine the older adults' *degree of depression* (see Table 6) and *degree of loneliness* (see Table 7). Of the 210 participants, 12.8% had a score of 5 or greater on the Geriatric Depression Screening Short Form, indicating that the participants had some depressive symptoms. Approximately 3% of the participants ($n = 6$), scored 10 or greater on the Geriatric Depression Screening Short Form, which is highly indicative of depression.

A majority of the 210 participants (55%) scored in the moderate range (29-43) on the UCLA Loneliness Scale Version 3, indicating that they experienced some loneliness. The average score for the UCLA Loneliness Scale Version 3 was 36, out of a possible range of scores

from 20-80 (*Mdn* 34), which would suggest that some participants were experiencing loneliness. The median of the entire UCLA Loneliness Scale Version 3 is 50. The lowest obtained score on the UCLA Loneliness Scale V3 was 20, with the highest obtained score at 77. Close to a quarter of the participants scored less than 28 on the UCLA Loneliness Scale V3 (23%), indicating that they were not experiencing loneliness, while 23% scored in the high range (>43), suggesting they experienced a great deal of loneliness.

Three items on the adapted U.S.A.B.I.L.I.T.Y. Survey© measured *perceived control* with ePHRs (Nos. 10-12), with responses ranging from strongly agree to strongly disagree (see Table 8). Out of the 210 participants, 55% were neutral, disagreed, or strongly disagreed that ePHRs gave them a feeling of control over their health. A majority (61%) of participants knew what information was needed from the ePHR and could access that information from the record, while 53% reported that they felt more in control when able to access the information they received from the ePHR.

User experience was measured by six items on the adapted U.S.A.B.I.L.I.T.Y. Survey© (Nos. 1-6). Participant responses ranged from strongly agree to disagree (see Table 8). A majority of participants (57%) agreed or strongly agreed that an ePHR was exactly what they needed, and sixty-three percent of participants were satisfied with the appearance of their ePHR. The majority of participants (60%) either did not have an opinion or did not have an audio feature in their ePHR. A majority of participants (63%) reported that they could successfully use an ePHR, while nearly half (49%) identified that the ePHR was pleasant to use. Finally, a majority of the participants (61%) also reported that they would recommend an ePHR to a friend.

The relationship between *sensoriperceptual deficits* and older adults' *intent to use ePHRs* was examined by conducting a Pearson correlation. A weak but statistically significant

correlation (r (207) = -.007, $p > .05$) was found between *sensoriperceptual deficits* and older adults' *intent to use ePHRs* . Likewise, a Pearson correlation was conducted to examine the relationship between older adults' *performance* with and *intent to use ePHRs*. A moderate negative correlation was found (r (62) = -.540, $p < .001$), indicating a significant linear relationship between the two variables of older adults' *performance* with and *intent to use ePHR*.

Standard multiple regression was conducted on participants *intent to use ePHRs* and the relationships between *depression, loneliness, perceived control* and *user experience* (see Table 9). The normal P-P plot and the scatter plot indicate that the variables had no deviations from normality. The model explains 70.3% of the total variance in older adults' *intent to use ePHR* with an adjusted explanation of 69.3% (F (7, 200) = 67.7, p <.001). Two variables were statistically significant, the first being *user experience* recording a higher beta value (*beta* = .50, $p < .001$) and the second was *perceived control* (*beta* = .367, $p < .001$). At that same time that the multiple regression analysis was run, a collinearity test was conducted. The concern was that the variables might be too highly correlated with each other, and the collinearity test identified that the data met the assumption of collinearity, and therefore, multicollinearity was not a concern.

Discussion

This study explored the older adults' facilitators and barriers to electronic personal health record (ePHR) use. Overall, this study supported previous research findings which identified relationships between individual independent variables and the dependent variable of *older adult's use of ePHRs*. This study also suggests that older adults either are using ePHRs or would like to use ePHRs to help manage their health.

Older adults, classified as those aged 65 and older, can be subgrouped: the young-old aged group (65-74 years); the middle-old aged group (75-84 years); and the old-old aged group (85 years and older) (AoA, 2020). There are more older adults (31.5 million) within the young-old aged subgroup compared to those in the old-old aged subgroup (6.6 million) (AoA, 2020). The decreasing percentage of older adults among the general public was similarly identified in this study, with half of the participants (50%) being in the young-old category. As age increased, the number of participants decreased (32% middle-old, 17% old-old). Differences in ePHR use between age groups were also identified. As the participants' age increased, computer ownership, experience, and knowledge, ownership and use of ePHRs decreased. Older adults may be less likely to adopt technology as they age, such as use of an ePHR (Portz et al., 2019). Therefore, ePHR developers and healthcare organizations should obtain ongoing feedback from older adults when developing new tools and updates.

Older adults' use of ePHRs differs between individuals with lower versus higher incomes. Households with higher income levels are more likely to own some form of technology device, which enables access to the ePHR (Vogels, 2021). Differences in income levels was reflected in the older adults' ePHR usage in this study, as evidenced by a moderate positive correlation between household income and computer ownership as well as level of experience with computers. Older adults with higher household incomes in this study were found to be more likely to own a computer, and were more comfortable with using a computer. Older adults who have more advanced computer experience and skills may be more prone to utilize an ePHR to manage their health. Vogels (2021) shared that individuals with lower incomes have fewer options for online access, yet there is a higher likelihood that they have access to a smartphone

with internet access. Therefore, developers of ePHRs and healthcare organizations can focus on mobile apps and interfaces to increase older adults' access and usage of ePHRs.

Participant's level of education was related to computer ownership and use of the computer, as demonstrated by a moderate positive correlation between the two in this study. Participants with a college education or higher were more likely to own a computer and have experience with using a computer compared to the respondents without a college degree. Research has demonstrated that users of ePHRs tend to have more formal education (Hoogenbosch et al., 2018). An assumption that Hoogenbosch et al. (2018) suggested was that individuals who completed higher levels of education had the potential to use the medical information they receive to make informed healthcare decisions.

Alternately, Hoogenbosch et al. (2018) found that limited knowledge or awareness of ePHR is a barrier to older adults' use of ePHR. In the current study, the majority of participants (79%) had basic knowledge of ePHRs, with 55% using an ePHR. However, a remaining 45 participants (22%) had never heard of an ePHR, or had no knowledge of an ePHR. A majority of the participants (53%) who were familiar with or used ePHRs, had learned basic knowledge, including the benefits of accessing the ePHR from their healthcare provider. Surprisingly, 11% of the participants were informed about ePHRs from a nurse, which seems to be a gap in communication by nurses. Nurses should play a more active role in promoting and integrating ePHR use, especially among older adults, to increase older adults' ePHR use and improve their health outcomes.

Electronic personal health records have many benefits, such as promoting patient-provider communication, providing access to healthcare information, and requesting prescription refills (Grossman et al., 2018). According to Johnson et al. (2021), the most common reasons

individuals access their ePHR is to view test results (86%), communicate with providers (58%) and view clinical notes (55%). Similarly, the majority of participants in this study used their ePHR to view lab results (53.8%), communicate with their providers (51.4%), and review their medications and health history (41%). Messaging and lab result sections in ePHRs were perceived as useful and easy to use, making them more attractive to non-ePHR users (Portz et al., 2019). Healthcare providers can promote older adults' ePHR use by introducing easy-to-use features to enable higher rates of ePHR adoption (Portz et al., 2019).

Perceived barriers to older adults' ePHR use were identified in the literature (Abdelrahman et al., 2010). One barrier is the lack of support or training on accessing and using an ePHR. Participants in this study were asked if they had received prior assistance in accessing an ePHR, and most had not received any help (60.5%). Previous research supports the current study's findings, in that older adults had higher usage rates if younger family members or friends supported their use (Abdelrahman et al., 2021). Healthcare providers can assist with ePHR navigation to help older adults overcome the barrier of lack of support and increase their ePHR access and usage. Supporting research suggests that providing appropriate training opportunities for older adults can increase their confidence, leading to increased ePHR usage (Lee et al., 2020).

According to Matthews et al. (2022), treatment for depressive symptoms, especially among newly diagnosed individuals, is low (35.7%), though older adults are at risk for misdiagnosis and undertreatment (Hurly, 2022). Hurley (2022) found that major depression affects about 1% - 5% of the older adult population. However, older adults' use of ePHRs can have a positive impact on managing their depression (Matthews et al., 2022). In this study, there was a higher percentage of participants with depressive symptoms (16%) compared to the

general older adult population. Individuals with depression are more likely to use the messaging feature with an ePHR to maintain regular communication and coordination, and to disclose uncomfortable information in a neutral environment (Matthews et al., 2022). Concerns about stigma surrounding mental health, information sharing, and security breaches, are barriers to using ePHRs for older adults with depression (Matthews et al., 2022). Security measures surrounding the exchange of health information, such as firewalls and security policies, should be considered during development and implementation of ePHRs.

Loneliness is associated with poor physical and mental health outcomes, such as an increased mortality rate, risk of cognitive decline, and decreased physical functioning (Byrne et al., 2021). Even though loneliness has adverse impacts on health, screening for loneliness is rarely integrated into healthcare (Perissinotto et al., 2019). Approximately 43% of older adults experience loneliness (Perissinotto et al., 2019) which increased during the COVID-19 pandemic (Dahlberg, 2021). In this study, the majority of participants had moderate to high degrees of loneliness (77%). Older adults who engage in social technology, including the possibility of using ePHRs for increasing communication and social interaction, may have decreased levels of loneliness (Byrne et al., 2021). Therefore, utilizing ePHRS not only for delivery of healthcare information, but also for social interaction, can positively decrease older adults' experiences of loneliness. Emphasizing social connection, communication, and interactive education and group features within an ePHR may appeal to older adults seeking increased social interaction.

The regression analysis demonstrated that user experience and perceived control were significant facilitators of older adult's intent to use ePHRs. Almost half of participants (45%) identified that the ePHR gave them a feeling of control over their health, and the majority (61%) knew what health information they needed and could access it from their ePHR. Research found

that perceived control is highly correlated with computer ability, therefore, facilitation of older adults' perceived control could increase use of ePHRs (Wong et al., 2019). Previous research suggests that negative user experience influences participants' intent to use ePHRs (Portz et al., 2019). In the current study, participants' responses varied on items measuring user experience, though the responses tended to strongly agreed or agreed. Effects from depression and loneliness were not statistically significant in the regression analysis. Limited research has been done on the impact of depression and loneliness on the older adults' ePHR use. Future studies need to consider the effects of depression and loneliness on the older adults' ePHR use.

Limitations

Although this study analyzed facilitators and barriers of older adults' intent to use ePHRs, the older adults' experiences may differ across ePHR systems. Participants may have variability in responses based on varying ePHR systems, so the findings may not be generalizable to all ePHR systems. As self-selected volunteers, participants have the potential to demonstrate selection bias, however, given that data were collected during the COVID pandemic, participation in the study could have been related to loneliness. Participants who had particularly strong or negative opinions about ePHRs may have been more likely to join the study. The limitations of self-reporting are also inherent to the study design, including unavoidable subjectivity in participant responses. Participants were largely from one geographical area and the collected data might not be representative of different settings or patient populations in other areas of the country. Further, race/ethnicity distribution in the sample was unbalanced. As such, the results should be considered carefully, as there may be significant effects related to race/ethnicity that were not researched or identified in this study. Lastly, restrictions requiring

virtual recruitment and data collection due to COVID-19 may have biased the sample against those with inconsistent internet or access to technology.

Conclusion

To conclude, this study identifies several facilitators and barriers to older adults' intent to use electronic personal health records (ePHRs). Benefits of ePHR use are supported by research, yet barriers to more robust acceptance of ePHRs by the older adult population continue to persist. Results of this study emphasize the need for a more user-friendly design to ePHRs, with feedback from older adults as critical to the development and implementation of ePHRs. Although there is a high correlation of depression and loneliness with poor health outcomes, little research exists on their influence on older adults' intent to use ePHRs. Further research on the influence of depression and loneliness on older adults' intent to use ePHRs should be considered.

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Table 3

Demographic Characteristics of Participants (N = 210)

Characteristic	*n*	%
Age at time of survey		
65-74	105	50%
75-84	69	32%
85-101	36	17%
Gender		
Male	103	49%
Female	51	51%
Race/Ethnicity		
White	207	98.6%
Hispanic or Latino	3	1.4%
Education Level		
Less than high school diploma	3	1.4%
High school degree or equivalent	78	37.3%
Bachelor's degree	70	33.5%
Master's degree	38	18.2%
Doctorate	9	4.3%
Other	11	5.3%
Household Income		
Below $10k	5	2.4%
$10k - $50k	67	31.9%
$50k - $100k	64	30.5%
$100k-$150k	16	7.6%
Over $150k	16	7.6%
Chronic Conditions		
Diabetes	43	20.5%
Asthma	18	8.6%
COPD	18	8.6%

Characteristic	*n*	%
Heart failure	22	10.5%
Kidney dialysis	2	1.0%
Kidney disease	9	4.3%
Hypertension	124	59.0%
High cholesterol	90	42.9%
Lung disease	5	2.4%
Arthritis	85	40.5%
Osteoporosis	35	16.7%
Depression	30	14.3%
Alzheimer's disease	4	1.9%
Cancer	31	14.8%
Other	19	9.0%
Computer Ownership		
No computer ownership	36	17.1%
Owned computer for 6-12 months	3	1.4%
Owned computer for 1-5 years	15	7.1%
Owned computer for greater than 5 years	154	73.3%
Computer Experience		
No computer experience	30	14.3%
Less than 3 months computer experience	3	1.4%
3-6 months computer experience	3	1.4%
6-12 months computer experience	2	1.0%
1-5 years computer experience	16	7.6%
Greater than 5 years computer experience	156	74.3%
Computer Experience Level		
Beginner	69	32.9%
Intermediate	119	56.7%
Expert	22	10.5%
Daily Hours of Computer Use on Average		
No computer use	42	20.0%

Characteristic	*n*	%
0-2 hours	85	40.5%
2-5 hours	64	30.5%
5-8 hours	14	6.7%
More than 8 hours	5	2.4%
Electronic Personal Health Record (ePHR) Knowledge		
Never heard of ePHR	20	9.5%
Heard of ePHR but didn't understand	25	11.9%
Heard of ePHR and understood	50	23.8%
Heard of ePHR, understood and used	115	54.8%
Electronic Personal Health Record (ePHR) Source		
Never heard of ePHR	26	12.4%
Provider	111	52.9%
Nurse	23	11.0%
Medical staff	29	13.8%
Family/Friends	10	4.8%
Internet	4	1.9%
Other	7	3.3%
Amount of Electronic Personal Health Record (ePHR) Help Received		
No help received	127	60.5%
Minimal amount of help received	51	24.3%
Moderate amount of help received	19	9.0%
Significant amount of help received	11	5.2%
Electronic Personal Health Record (ePHR) Source of Help		
No help received	123	58.6%
Provider	26	12.4%
Nurse	7	3.3%
Medical staff	9	4.3%
Family/Friends	29	13.8%
Training program/Course	7	3.3%
Internet	6	2.9%

Characteristic	*n*	%
Other	3	1.4%
Length of Electronic Personal Health Record (ePHR) Ownership		
No ePHR ownership	54	25.7%
Less than 3 months of ePHR ownership	4	1.9%
3-6 months of ePHR ownership	1	<1%
6-12 months of ePHR ownership	5	2.4%
1-5 years of ePHR ownership	52	24.8%
Greater than 5 years of ePHR ownership	94	44.8%
Length of Electronic Personal Health Record (ePHR) Usage		
No ePHR usage	87	41.4%
Less than 3 months of ePHR usage	8	3.8%
3-6 months of ePHR usage	3	1.4%
6-12 months of ePHR usage	3	1.4%
1-5 years of ePHR usage	36	17.1%
Greater than 5 years of ePHR usage	73	34.8%
Features Used Within Electronic Personal Health Record (ePHR)		
No features used	82	39.0%
Logged in	122	58.1%
Sent/received messages	108	51.4%
Scheduled appointments	68	32.4%
Reviewed lab values	113	53.8%
Payed medical bills	34	16.2%
Reviewed medications/health history	86	41.0%
Request prescription refills	54	25.7%
Other	1	<1%
Sensoriperceptual Information		
Hearing impairment	84	40.0%
Visual impairment	149	71.0%
Wear eyeglasses	179	85.2%
Wear contacts	9	4.3%

Characteristic	*n*	%
Use hearing aids	53	25.2%
Use other vision assistive devices	12	5.7%

Table 4

Intercorrelations Among Six Demographic Items with Participant Age

Measure	1	2	3	4	5	6	7
1. Age	___						
2. Computer Ownership	-.25**	___					
3. Computer Experience	-.21**	.74**	___				
4. Level of Experience	-.16*	.54**	.50**	___			
5. Knowledge of ePHR	-.25**	.51**	.47**	.46**	___		
6. Have ePHR	-.28**	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	-.19**	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

*.Correlation is significant a the 0.05 level (2-tailed).

Table 5

Intercorrelations Among Six Demographic Items with Education Level

Measure	1	2	3	4	5	6	7
1. Education	___						
2. Computer Ownership	.35**	___					
3. Computer Experience	.36**	.74**	___				
4. Level of Experience	.24**	.54**	.50**	___			
5. Knowledge of ePHR	.27**	.51**	.47**	.46**	___		
6. Have ePHR	.22**	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	.23**	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

Table 6

Intercorrelations Among Six Demographic Items and Household Income

Measure	1	2	3	4	5	6	7
1. Household income	___						
2. Computer Ownership	.31**	___					
3. Computer Experience	.27**	.74**	___				
4. Level of Experience	.33**	.54**	.50**	___			
5. Knowledge of ePHR	.10	.51**	.47**	.46**	___		
6. Have ePHR	.13	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	.13	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

Table 7

*Frequencies of Participant Total Scores on the Geriatric Depression Scale: Short Form (*N *= 210)*

Total Score	*n*	%
0	60	28.6
1	49	23.3
2	35	16.7
3	25	11.9
4	14	6.7
5	3	1.4
5	5	2.4
6	5	2.4
7	6	2.9
8	4	1.9
9	3	1.4
10	1	.5
12	2	1.0
13	3	1.4

Table 8

*Frequencies of Participant Total Scores on the UCLA Loneliness Scale Version 3 (*N = *210)*

Total Score	*n*	%
20	5	2.4
21	4	1.9
22	9	4.3
23	4	1.9
24	6	2.9
25	3	1.4
26	6	2.9
27	5	2.4
28	7	3.3
29	3	1.4
30	9	4.3
31	17	8.1
32	12	5.7
33	8	3.8
34	11	5.2
35	6	2.9
36	14	6.7
37	3	1.4
38	8	3.8
39	4	1.9
40	8	3.8
41	5	2.4
42	3	1.4
43	4	1.9
44	8	3.8
45	3	1.4
46	4	1.9
48	1	.5

Total Score	*n*	%
50	4	1.9
51	7	3.3
52	3	1.4
53	1	.5
54	1	.5
55	1	.5
56	2	1.0
57	2	1.0
58	1	.5
61	2	.5
62	1	.5
65	2	1
66	1	.5
70	1	.5
77	1	.5

Table 9

*Participant Responses to Adapted U.S.A.B.I.L.T.Y. Survey Items on Perceived Control and User Experience (*N = *210)*

Item Number and Question	Strongly Agree *n*	%	Agree *n*	%	Neither *n*	%	Disagree *n*	%	Strongly Disagree *n*	%
1. An electronic personal health record is exactly what I need.	41	19.5%	80	38.1%	50	23.8%	29	13.8%	10	4.8%
2. I am satisfied with the overall appearance of the electronic personal health record.	35	16.7%	98	46.7%	60	28.6	12	5.7	5	2.4
3. I am satisfied with the audio of the electronic personal health record.	17	8.1	49	23.3	126	60	14	6.7	4	1.9
4. I can successfully use the electronic personal health record.	55	26.2	77	36.7	45	21.4	20	9.5	13	6.2
5. I would recommend an electronic personal health record to a friend.	49	23.3	79	37.6	51	24.3	18	8.6	13	6.2
6. The electronic personal health record is pleasant to use.	30	14.3	73	34.8	74	35.2	24	11.4	9	4.3
10. The electronic personal health record gave me a feeling of control over my health.	29	13.8	66	31.4	78	37.1	30	14.3	7	3.3
11. I know what information I need and can access from the electronic personal health record.	39	18.6	90	42.9	49	23.3	23	11.0	9	4.3
12. The information I received makes me feel in control.	27	12.9	84	40.0	68	32.4	22	10.5	9	4.3

Table 10

*Regression Analysis Summary for Variables Influencing Older Adults' Intent to Use ePHRs (*N = *210)*

Variable	*B*	*SE B*	β	*t*	*p*
Sensoriperceptual Deficits	-.04	.12	-.01	-.31	.76
Age	-.03	.01	-.11	-2.5	.01
Education	-.002	.08	-.001	-.03	.98
Depression Total Score	.08	.05	.10	1.75	.08
Loneliness Total Score	-.004	.011	-.02	-.31	.76
Perceived Control	.31	.07	.37	4.75	.000
User Experience	.22	.04	.50	6.14	.000

Note: R^2 = .70 (*N* = 210, *p* < .001

Manuscript Three: "Exploring Influencing Factors for Older Adults' Performance with Electronic Personal Health Records (ePHRs)"

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Manuscript in Process

Abstract

Background: Technology has the potential to improve older adults' health outcomes and quality of life. Although the percentage of older adults using technology has increased, it remains a smaller proportion than younger generations. Utilization of electronic personal health records (ePHRs) can assist older adults to manage their health. However, research on older adults' performance with ePHRs is lacking.

Methods: A correlational design with a convenience sample of older adults (n = 210). A structured observation of ePHR task performance was conducted (n = 57). Measures included a self-reported survey, adapted U.S.A.B.I.L.I.T.Y. Survey, Geriatric Depression Scale: Short Form, UCLA Loneliness Scale, and an observation checklist. Descriptive statistics, frequency distributions, Pearson r and standard multiple regression were used for data analysis.

Results: Multiple regression analysis for performance indicates the overall model explains 26.3% of the total variance in older adults' intent to use ePHR (F (7, 49) = 2.5, p, <.028). The measure of depression was statistically significant in predicting older adult's performance with ePHRs (β = .32, p <.037).

Conclusions: This study identified several facilitators and barriers to older adults' performance with electronic personal health records (ePHRs). Partnering with providers, healthcare

organizations, and developers of ePHRs can promote more user-friendly designs that appeal to the older adult.

Key words: older adult, technology, electronic personal health record, ePHR, facilitators, barriers, usage, performance

Introduction

Digital technology adoption is increasingly required in business areas, including healthcare (Oh et al., 2021). Technology can contribute to improved health outcomes and positively impact individuals' quality of life (Abdelrahman et al., 2021). The use of technology within healthcare provides improved geriatric care and can reach inaccessible populations (Abdelrahman et al., 2021). The older adult population (aged 65 and older) is projected to grow by 36% in the next 50 years (AoA, 2020), and is the fastest growing subset of internet users (Portz et al., 2019). Although the percentage of older adults using technology has increased, though it remains a smaller proportion than younger generations (Oh et al., 2021).

Improving inclusion and engagement of older adults in technology use is important for healthcare organizations (Oh et al., 2021), as it can increase provider access to health information. Therefore, telehealth platforms have been implemented to increase older adults' access to healthcare (Oh et al., 2021). Electronic personal health records are secure websites that contain personal health information and are directly connected to a provider's electronic medical system (Portz et al., 2019). Utilization of electronic personal health records (ePHRs) can assist individuals to manage their health, leading to care coordination for improved health outcomes and communication with providers (Portz et al., 2019). Benefits of ePHRs include enabling early intervention of healthcare problems, which can reduce health care costs (Portz et al., 2019).

Although ePHRs are a promising tool in managing older adults' health, a lag in older adults' ePHR adoption of technology exists (Portz et al., 2019). Adoption barriers to ePHR use in the older adult population include discomfort with technology, privacy concerns, and lack of knowledge of the benefits of ePHRs (Portz et al., 2019). However, according to the National Poll on Health Aging (2018), approximately 49% of adults between the ages of 65 and 80 reported

having an ePHR. There are demographic differences that contribute to higher utilization of ePHRs in older adults, including higher education level, higher income, and gender (56% of women vs. 45% of men) (National Poll on Aging, 2018). While research on older adults low usage of ePHRs was found in the literature (Oh et al., 2021) , research on older adults' user interface or performance with ePHRs their adoption barriers is lacking (Portz et al., 2019). Therefore, this study aims to identify and understand the older adult's performance with ePHRs and barriers to ePHR adoption.

Purpose

The purpose of the study was to examine the relationship between individual factors of older adults and their performance with electronic personal health records (ePHRs). There were seven guiding questions identified:

1. What is the older adult's level of depression?
2. What is the older adult's level of loneliness?
3. What is the older adult's perceived control with electronic personal health records?
4. How do older adults describe their user experience with electronic personal health records?
5. What is the relationship between sensoriperceptual deficits and performance to use electronic personal health records in the older adult?
6. What is the relationship between older adults' performance and their intent to use electronic personal health records in the older adult?
7. What is the relationship between the independent variables and performance with electronic personal health records in the older adult?

Hypothesis

There was one research hypothesis for this study which stated, controlling for older adults' sensoriperceptual deficits, the degree of depression, the degree of loneliness, perceived control, and user experience will be correlated with the older adults' performance with electronic personal health records.

Methods

Research Design

This investigation was conducted as part of a larger study, which was developed using a correlational design. Four independent variables, depression, perceived control, experience, and loneliness were examined (see Table 1). Sensoriperceptual deficits, age and education were control variables, and performance was the dependent variable. Descriptive statistics and standard multiple regression analyses were performed to identify and describe relationships between the independent and dependent variables. This study was presented to and approved by the University of Wisconsin-Milwaukee Institutional Review Board.

Table 11

Independent, Dependent, and Control Variables

Independent Variables	Control Variables	Dependent Variable
Depression	Sensoriperceptual deficits	Performance
Perceived control	Age	
User experience	Education	
Loneliness		

Sample/Subjects

The target population for this study was the older adult, which is classified as individuals aged 65 years or older (WHO, 2015). Inclusion criteria were that the participant was aged 65 years or older, that the participant could speak and read English, and that the participant had a minimum of telephone access to communicate. Since this study researched the older adult's performance with electronic personal health records, participants needed to either have access to a screen for video conferencing or participate in face-to-face data collection for observation. A power analysis by obtaining at least 30 subjects for each study variable measured (Gray et al., 2017) indicated a total of 210 participants were needed for this study. Out of the 210 total participants, 63 participants were able to complete the observed performance of accessing a sample electronic personal health record. The regression results revealed 6 extreme values, which were eliminated from the analysis, bringing the total participant sample reported here to 57.

Setting

Recruitment was completed via face-to-face interaction, advertisements, flyers, letters, and emails, as well as convenience and snowball sampling. To ensure participant confidentiality, the environment was screened for potential security breaches prior to data collection. If the environment could not remain confidential, a different location was chosen. Data was collected virtually over the video conferencing platform Zoom, or face-to-face meetings. In-person data collection took place at senior housing facilities and local churches.

Measures

Five measures were used for data collection.

1. Demographic information was gathered through a questionnaire developed by the primary researcher. Data included age, gender, race or ethnicity, education level, and income. Information regarding chronic conditions, computer and ePHR ownership and usage, hearing loss and visual deficits was reported. All survey items provided the participant with options for their responses, except for the fill in the blank option for age.
2. The Geriatric Depression Scale: Short Form (Sheikh & Yesavage, 1986) was used to measure the degree of depression in the older adult. There are 15 yes/no questions on the GDS: Short Form. For ten of the questions, if the participant answered "yes," the presence of depression was indicated. The remaining five questions indicated symptoms of depression when the participant answered "no." A total score was calculated to determine the overall degree of depression.
3. The UCLA Loneliness Scale Version 3 (Russell, 1996) was used to measure the degree of loneliness in the older adult. The scale consists of 20 items measuring the participant's

subjective feelings of loneliness using a 4-point Likert scale. Each item is scored from 1 (Never) to 4 (Often), and a sum score calculated. Three categories of scores could be obtained: no/low, moderate, and high. A total score less than 28 indicated no/low loneliness, scores 29-43 suggest moderate loneliness, and scores greater than 43 indicate a high level of loneliness.

4. An adapted version of the U.S.A.B.I.L.I.T.Y. Survey© (Caboral-Stevens, 2015) was used to measure the variables of perceived control, user experience, and intent to use. Items 10-12 on the adapted U.S.A.B.I.L.I.T.Y. Survey© measure perceived control. Items 7-9 on the adapted U.S.A.B.I.L.I.T.Y. Survey© measure intent to use, and items 1-6 measure user experience. Each item on the adapted U.S.A.B.I.L.I.T.Y. Survey© is a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).
5. A researcher-developed checklist was used to ensure consistency with recording observations of participant's performance. The checklist consisted of 6 Likert items, ranging from 1 (unable to perform) to 5 (independent). Each item identified tasks to perform within a sample ePHR. Tasks were also individually timed and recorded from the initiation to completion of the task.

Procedures

Participants were interviewed initially to ensure they met the inclusion criteria for the study and informed consent was explained. A request to waive documentation of informed consent due to COVID-19 health practices and social distancing was completed and approved by the University of Wisconsin – Milwaukee IRB. The older adults verbally consented to participate in the study, and their participating in the data collection confirmed their consent, and a random participant number was assigned. Each survey was administered by the primary researcher who

verbally read each item to the participant. Participant answers were electronically recorded on a Microsoft Word document by the primary researcher, and then verified with the participant for accuracy.

A demographic survey was the first measure administered to the participants, including items on hearing loss and visual deficits. The Geriatric Depression Scale: Short Form was administered following completion of the demographic survey. Participants answered 15 yes/no questions, and the researcher used the scoring guidelines to calculate a total score. If a total score was greater than 5, the participant was allowed to continue with the study, but the researcher verbally recommended a follow-up assessment with a provider. All participants were offered a list of resources for services addressing depression, regardless of score. Participants then completed the UCLA Loneliness Scale: Version 3. The researcher asked the participant the 20 items and calculated a total score, ranging from a minimum of 20 to a maximum of 80.

Upon completion of the first three surveys, participants with video conferencing capability proceeded to perform tasks within a sample ePHR provided by Twin Cities Physicians. Tasks to perform in the ePHR were: (a) log into the electronic personal health record; (b) send message; (c) read notes or messages; (d) look up lab values; (e) review medications; and (f) log out of the electronic personal health record. Video and screen sharing meetings were set up as screen share only, so the participant's face was not visible. A majority of participants (56%) did not require instructions on how to share screens via video conferencing at the beginning of the observation phase. Once the participant's screen was shared, video recording began. Participants were given verbal instruction to complete six basic tasks, such as logging in, sending a message to a provider, and reviewing medications. Each task was timed from the initiation of the task to the completion of the task. The researcher scored whether the participant

could independently (68%) perform each task, or if they required assistance (32%), using the observer checklist (see Table 2). Video recording was stopped at the completion of the observation phase. Recordings were reviewed by the primary investigator within 10 minutes following data collection for verification of how long it took for the participant to complete each of the 6 tasks, and then the recording was permanently deleted.

After the participant completed tasks within the sample ePHR, the adapted U.S.A.B.I.L.I.T.Y. Survey© was administered. Participants answered 12 items on perceived control, intent to use, and user experience with electronic personal health records. The researcher electronically recorded participant's responses on a Microsoft Word document, and verified the responses with the participant. At the completion of the data collection, participants were thanked, and the researcher responded to any remaining questions from the participants or comments.

Results

Data Analysis

Data analysis was conducted using SPSS software, version 28. Missing data were identified and the value 999 was inserted to account for data not completed on the surveys. Descriptive statistics, including frequencies, means, and standard deviations were computed to describe the participants' demographic characteristics. The independent variables of intent to use, user experience, sensoriperceptual deficits, and perceived control were transformed to produce a sum score. Correlations between the independent and dependent variables were identified through a Pearson *r* correlation and due to the small sample size of participants completing the sample ePHR (n = 57) a standard multiple regression was run.

Participant Characteristics

A total of 210 adults aged 65 and older participated in the study. Table 3 summarizes participant characteristics. Half of the participants were between the ages of 65 and 74 years, (see Table 3) Gender was equally represented, with 49% being male and 51% being female, and most participants were White (*n* = 207). A majority of participants had college or higher levels of education (*n* = 117), and reported at least one chronic condition, with the most common disorder being high blood pressure (*n* = 124). When asked about sensoriperceptual deficits, the majority of participants (*n* = 179) used glasses for vision, 84 participants reported a hearing impairment, and 53 needed to use a hearing aid for assistance.

Most participants owned a computer for over 5 years (*n* = 154), with 156 having greater than 5 years of computer experience. When participants were asked to select their level of computer use, 141 of the participants were intermediate level or higher. Participants' responses about knowledge of and use of electronic personal health record (ePHR) use were evaluated. A majority of participants (54%) knew about, understood, and used an ePHR for managing their health. Participants primarily learned about ePHRs from their providers (52.9%). However most participants (*n* = 127) had never received help to learn how to utilize an ePHR. Nearly half of the participants (*n* = 95) had utilized an ePHR for greater than 5 years. Participants mostly review their lab results (*n* = 113), communicate with their providers (*n* = 108) and review their medications and health history (*n* = 86) within their ePHR.

Findings

A correlational analysis was conducted to look at the relationship between the participant's age, and each of these variables: (a) computer ownership; (b) computer experience;

(c) level of experience; (d) and knowledge; (e) ownership; and (f) experience with ePHRs. All of the correlations were statistically significant, yet there were weak negative correlations (see Tables 4).

Additionally, a Pearson correlation coefficient analysis was run to assess the relationship between the participant's level of education and their experience with using computers (see Table 5). Moderate positive correlations were found between participants' education and their ownership of computers ($r(208) = .35$, $p < .01$), and participants' education and experience with computers ($r(208) = .36$, $p < .01$).

Household income was explored in relation to participant's income. A Pearson's correlation coefficient was run to identify whether there was a relationship between the participant's household income (see Table 6) and computer ownership. A statistically significant relationship was found between participants' household income and the variables of computer ownership ($r(208) = .31$, $p < .01$) and experience with computers ($r(208) = .33$, $p < .01$).

All 210 participants completed the depression screen. Frequencies from the depression screen were calculated to identify the older adults' *degree of depression* (see Table 7) and amount of *loneliness* (see Table 8). Twenty-seven participants scored a 5 or greater on the depression screen, which is suggestive of some depressive symptoms. Three percent of the participants ($n = 6$) had a total score of 10 or greater, which is highly indicative of depression. On the UCLA Loneliness Scale Version 3, scores could range between 20 and 80 ($M = 50$). Participants scored between 20 and 77 ($M = 36$). Most participants ($n = 115$) had total loneliness scores in the moderate range (29-43), with equal percentages scoring in the low ($n = 49$) and high ranges ($n = 46$) (see Table 8).

Perceived control calculations included using items 10, 11 and 12 from the subscale included on the adapted U.S.A.B.I.L.I.T.Y. Survey©. Participants selected options ranging from strongly agree to strongly disagree (see Table 9). When asked whether the ePHR gave participants a feeling of control over their health, 95 agreed or strongly agreed with that statement. Participants (*n* = 129) knew what information was needed from the ePHR and could access it from the record, and 111 participants felt more control with the information they received from the ePHR (see Table 9).

The adapted U.S.A.B.I.L.I.T.Y. Survey© measured the concept of *user experience*, including ease of use through items 1-6 on the survey. Participant responses ranged from strongly agree to strongly disagree, with the majority responding that an ePHR was exactly what they needed (*n* = 121). While most participants were satisfied with the appearance of their ePHR (*n* = 133), a few were less satisfied with the audio features within their ePHR (*n* = 125). The majority of participants (*n* = 132) identified they could successfully use an ePHR, and just under half (*n* =103) thought the ePHR was pleasant to use. Additionally, 128 of the participants would recommend an ePHR to a friend (see Table 9).

The ePHR observation section was completed by 63 participants. Most participants (*n* = 38) independently performed the first task, logging into the sample ePHR account. However, 12 participants were completely unable to log into the sample ePHR account, and required assistance from the researcher to complete the task. Participants during the second task were requested to send a message within the sample ePHR, which 45 participants were able to do without assistance. The older adults were able to perform Task 3, read notes (*n* = 50); Task 4, find lab results (*n* = 54); and Task 5, reviewing medications (*n* = 54) with little to no assistance. Only 42 of the participants were able to log out of the sample ePHR account. However

participants on video conferencing often had the video screen covering the logout icon. With minimal guidance from the researcher regarding the manual process for moving the video screen, participants were then able to successfully log out without further assistance (see Table 10).

Each task completed by the participant was timed in seconds from start to completion of the task. It took participants between 12 seconds to 5 minutes to log into the sample ePHR account, after both written and verbal instructions were given to the participant. The time range for participants to complete the remaining tasks in the sample ePHR account was 1 second to 5 minutes (see Table 11).

A correlation analysis was conducted to determine if there was a relationship between *sensoriperceptual deficits* and older adults' *performance* with ePHRs. A weak but not significant correlation was found (r (62) = -.130, $p > .05$). In addition, a correlation analysis was conducted to identify whether there was a relationship between older adults' *performance* with and *intent to use* ePHRs. A moderate negative correlation was found (r (62) = -.540, $p < .001$), indicating that there is a significant linear relationship between the older adult's *performance* and their *intent to use* ePHRs.

The relationships between *depression*, *loneliness*, *perceived control* and *user experience* with *performance* with ePHRs was examined using standard multiple regression (see Table 12). Multicollinearity was not a concern in the regression as tolerance levels were not less than 0.1 and the variance inflation factor (VIF) for all variables was less than 10. The normal probability-probability plot (P-P plot) and the scatter plot indicate there are no deviations from normality, but 6 extreme values were removed. The overall model explains 26.3% of the total variance in older adults' *performance* with ePHR with an adjusted explanation of 15.8% (F (7, 49) = 2.5, p

<.028). The measure of *depression* was statistically significant in predicting older adults' *performance* with ePHRs (*beta* = -.32, $p < .037$).

Discussion

This study examined the older adults' facilitators and barriers to electronic personal health record (ePHR) use. Overall, this study supported previous research findings by identifying relationships between individual factors and the older adult's use of ePHRs. The findings suggest that older adults are using or are interested in using ePHRs to help manage their health. A gap in the literature was identified in this research related to the association between depression and loneliness and the older adult's performance with ePHRs.

An older adult is defined as an individual who has reached the chronological age of 65 years (WHO, 2015). The Administration on Aging (AoA, 2020) divides the older adult into three groups: the young old (65-74 years), the middle-old (75-84 years), and the old-old (85 years and older). There are approximately 31.5 million older adults who fall within the young-old group, compared to only 6.6 million older adults in the old-old group (AoA, 2020). In this study, 50% of participants were in the young-old group. As participant age increased, the number of participants decreased (32% middle old, 17% old-old). Research findings suggest that older adults are receptive to using ePHRs, however, older adults who are not as comfortable with technology may have different support needs to learn and use ePHRs (Son & Nahm, 2019). As younger adults who are technologically savvy start to age, the proportion of older adults using ePHRs is expected to grow in the future, so design of ePHRs with adult-friendly aspects should be considered (Son & Nahm, 2019).

Financial strain, lack of devices and unreliable or limited internet access are potential barriers to older adults using ePHRs. Older adults are often on fixed incomes, and may not be able to afford the high-speed internet that is often required for ePHRs to function effectively (Crouch & Gordon, 2019). Previous research has shown that low income is a social determinant of being an internet user (Crouch & Gordon, 2019), which can limit ePHR usage. As electronic personal health records use the internet as a platform, limited access to the internet is correlated with a lower usage rate of ePHRs. Consistent with previous research, the results of this study found that a higher household income was associated with an increased likelihood of older adults' access and use of an ePHR. Although individuals with lower incomes may have less access to the internet, it is more likely that older adults own a smartphone with internet capability (Vogels, 2021). Healthcare organizations and ePHR developers should take into consideration a mobile interface for the ePHR. In addition, web-based resources should be easy to navigate, and the content accessible to older adults who may have physical or computer skill deficits (Crouch & Gordon, 2019).

Education as a sociodemographic variable is influenced by other factors, such as income, occupation, and wealth (Fang et al., 2018). Individuals who have higher education levels often have more access to technology, and are more likely to use ePHRs (Fang et al., 2018). In addition, individuals with higher education levels often have a more positive perception of technology to access healthcare information to make decisions about their health (Lee et al., 2020). In this study, participants with a higher level of education were more likely to own a computer, and to have more experience with using a computer. As healthcare organizations and legislation continue to move forward with increasing ePHR access and use, investments should be made in staying connected with less affluent groups, including the older adult. Interventions

could be developed and implemented to provide affordable internet access and devices to underserved populations, and to provide tailored and relevant training opportunities at convenient locations.

Electronic personal health records (ePHRs) have the potential to increase patient engagement in their health management, which can lead to improved patient outcomes (Hoogenbosch et al., 2018). However, older nonusers of ePHRs tend to be those with fewer chronic health conditions (Hoogenbosch et al., 2018). Limited knowledge or awareness of ePHRs is a barrier to ePHR use, as older adults may not have access to the benefits ePHRs can provide (Hoogenbosch et al., 2018). Results from this study indicate that a majority of participants (79%) were aware of ePHRs, with approximately 55% of participants having used an ePHR previously. Prior research studies identify about 37% of older adults being nonusers and unaware of ePHRs (Hoogenbosch et al., 2018), compared to 22% of nonusers in this study. Healthcare providers were the most likely group to inform older adults about the benefits of the ePHRs and the benefits, while only 11% of participants were informed by nurses. Healthcare professionals can have an influential role in patient's healthcare management. By integrating ePHR usage into daily care, as well as providing support and training to older adults, healthcare providers can help increase ePHR use in the older adult population.

User experience and the ease of navigating an ePHR are often facilitators that lead to increased usage of ePHRs. Individuals are more likely to adopt a new technology if it is perceived as useful, credible, and has obvious benefits (Portz et al., 2019). Prior studies have shown that older adults identify communication, access to lab results, and the ability to electronically refill prescriptions as the more important features within an ePHR (Portz et al., 2019). Similarly, results from this study identify the most commonly used ePHR feature was to

review lab results (53.8%), communicate with the healthcare team (51.4%), and to review their medications or health history (41%). The features of messaging and lab results within an ePHR are often simple to use and easily understood, which can lead to improved communication between patient and provider and more seamless medication management (Portz et al., 2019). In addition, if older adults engage with user-friendly features, an increased satisfaction with the ePHR may contribute to further engagement with other components (Portz et al., 2019). Therefore, healthcare providers can provide education on easy-to-use features and provide navigational support to older adults in order to increase ePHR usage.

Social support and encouragement can compel older adults' active engagement with ePHRs (Fang et al., 2019). Adults who need help from another person to use the internet or other web-based application such as ePHRs were less likely to use them (Crouch & Gordon, 2019). Most participants in this study did not receive any help to learn how to use an ePHR (60.5%) and those that did received assistance from family members or friends (13.8%). Providing assistance and training opportunities to older adults can have the potential to increase their confidence with technology to maximize the utilization of ePHRs (Lee et al., 2020).

Use of ePHRs by patients has been correlated with higher rates of depression treatment and decreases in depressive symptoms (Matthews et al., 2022). Between 1% - 5% of older adults are diagnosed with depression, but many more may be undiagnosed (Hurley, 2022). Sixteen percent of older adult participants in this study scored a 5 or higher on the Geriatric Depression Screen: Short Form (Sheikh & Yesavage, 1986). In addition, the regression analysis showed that depression was the only significant variable of older adults' performance with ePHRs. The regression results supports previous research which demonstrated that participants with depression were less likely to perform effectively with an ePHR. Electronic personal health

record features such as messaging and scheduling are appealing to older adults' with depression as it facilitates accessibility (Matthews et al., 2022). However, older adults with depression identified barriers to ePHR use, such as privacy concerns regarding the exchange of health information (Matthews et al., 2022). Additionally, older adults with depression were less likely to use an ePHR if there was no regular communication or if there was no perceived control over their health information (Matthews et al., 2022). Electronic personal health records with usability concerns were identified as a barrier to older adults' usage of ePHRs (Matthews et al., 2022). One solution to overcome ePHR security concerns is to implement policies that guide both patient and provider exchange of healthcare information. Additionally, ePHRs can be designed to promote healthcare management, by focusing on accessibility of the user interface.

Loneliness can have major implications on the health of older adults (National Poll on Health Aging, 2019). Social isolation is a risk factor for loneliness, which is associated with poor health outcomes, lower patient well-being, and higher mortality (Dahlberg, 2021). Prior to the COVID-19 pandemic, 34% of older adults reported feeling a lack of companionship, and 27% identified isolation (National Poll on Aging, 2019). Since the outbreak of COVID-19, loneliness has increased not just in older adults, but among the general public (Dahlberg, 2021). Older adult participants in this study scored an average of 36 on the UCLA Loneliness Scale Version 3 (Russell, 1996), indicating a moderate degree of loneliness. The majority of participants (n = 161) total loneliness scores suggested a moderate to high degree of loneliness. Digital technology, including ePHRs, can positively impact older adults' perceived social support, leading to decreased feelings of social isolation (Byrne et al., 2021). Inclusion of screening tools for loneliness and isolation should be integrated into existing and future ePHRs (Perissinotto et

al., 2019). By identifying older adults at risk or experiencing loneliness and isolation, guidelines and interventions can be developed to address this barrier.

Limitations

Participants in this study performed tasks with a sample ePHR account provided by Twin Cities Physicians. However, because there is significant variability across different ePHR systems, the results may not be generalizable to all ePHR interfaces. Participants were not randomized, but were self-selected volunteers, making it difficult to generalize to a broader population. Participants with a strong or negative opinion on ePHRs may have been drawn to participate in the study, leading to results which may not be representative of the older adult population. Response bias may be present due to the use of self-reported instruments. Race, ethnicity, and geographical location were not uniformly represented, again, influencing the generalizability of results to other locations or population groups. Due to COVID-19 restrictions requiring virtual recruitment and data collection, the sample may be biased against older adults with inconsistent internet or access to technology. In addition, recruitment challenges due to COVID-19 limited the number of participants who were able to participate in the ePHR task performance, leading to a small final sample size.

Conclusion

In summary, this study identifies several facilitators and barriers to older adults' performance with electronic personal health records (ePHRs). Electronic personal health records can provide solutions to address healthcare challenges faced by older adults. This study demonstrates that a considerable number of older adults are familiar with and use ePHRs. Importantly, older adults who use ePHRs tend to be highly satisfied with them, and plan to

continue using them in the future. Understanding facilitators and barriers to older adults' performance with ePHRs could inform progress in this area. Partnering with providers, healthcare organizations, and developers of ePHRs can promote more user-friendly designs that appeal to the older adult. One potential implication from this study is that by including social technology and screening tools for depression and loneliness within ePHRs can reduce loneliness and the associated health consequences. However, further research on the impact of loneliness and depression on older adults' performance with ePHRs should be considered.

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Table 12

ePHR Task Observation Checklist

Task	Time to Complete	Independent	Minimal Assistance	Moderate Assistance	Significant Assistance	Unable to Perform	Comments
Log into the electronic personal health record		5	4	3	2	1	
Send message		5	4	3	2	1	
Read notes or messages		5	4	3	2	1	
Look up lab values		5	4	3	2	1	
Review medications		5	4	3	2	1	
Log out of the electronic personal health record		5	4	3	2	2	

Table 13

Demographic Characteristics of Participants (N = 210)

Characteristic	*n*	%
Age at time of survey		
65-74	105	50%
75-84	69	32%
85-101	36	17%
Gender		
Male	103	49%
Female	51	51%
Race/Ethnicity		
White	207	98.6%
Hispanic or Latino	3	1.4%
Education Level		
Less than high school diploma	3	1.4%
High school degree or equivalent	78	37.3%
Bachelor's degree	70	33.5%
Master's degree	38	18.2%
Doctorate	9	4.3%
Other	11	5.3%
Household Income		
Below $10k	5	2.4%
$10k - $50k	67	31.9%
$50k - $100k	64	30.5%
$100k-$150k	16	7.6%
Over $150k	16	7.6%
Chronic Conditions		
Diabetes	43	20.5%
Asthma	18	8.6%
COPD	18	8.6%

Characteristic	*n*	%
Heart failure	22	10.5%
Kidney dialysis	2	1.0%
Kidney disease	9	4.3%
Hypertension	124	59.0%
High cholesterol	90	42.9%
Lung disease	5	2.4%
Arthritis	85	40.5%
Osteoporosis	35	16.7%
Depression	30	14.3%
Alzheimer's disease	4	1.9%
Cancer	31	14.8%
Other	19	9.0%
Computer Ownership		
No computer ownership	36	17.1%
Owned computer for 6-12 months	3	1.4%
Owned computer for 1-5 years	15	7.1%
Owned computer for greater than 5 years	154	73.3%
Computer Experience		
No computer experience	30	14.3%
Less than 3 months computer experience	3	1.4%
3-6 months computer experience	3	1.4%
6-12 months computer experience	2	1.0%
1-5 years computer experience	16	7.6%
Greater than 5 years computer experience	156	74.3%
Computer Experience Level		
Beginner	69	32.9%
Intermediate	119	56.7%
Expert	22	10.5%
Daily Hours of Computer Use on Average		
No computer use	42	20.0%

Characteristic	*n*	%
0-2 hours	85	40.5%
2-5 hours	64	30.5%
5-8 hours	14	6.7%
More than 8 hours	5	2.4%
Electronic Personal Health Record (ePHR) Knowledge		
Never heard of ePHR	20	9.5%
Heard of ePHR but didn't understand	25	11.9%
Heard of ePHR and understood	50	23.8%
Heard of ePHR, understood and used	115	54.8%
Electronic Personal Health Record (ePHR) Source		
Never heard of ePHR	26	12.4%
Provider	111	52.9%
Nurse	23	11.0%
Medical staff	29	13.8%
Family/Friends	10	4.8%
Internet	4	1.9%
Other	7	3.3%
Amount of Electronic Personal Health Record (ePHR) Help Received		
No help received	127	60.5%
Minimal amount of help received	51	24.3%
Moderate amount of help received	19	9.0%
Significant amount of help received	11	5.2%
Electronic Personal Health Record (ePHR) Source of Help		
No help received	123	58.6%
Provider	26	12.4%
Nurse	7	3.3%
Medical staff	9	4.3%
Family/Friends	29	13.8%
Training program/Course	7	3.3%
Internet	6	2.9%

Characteristic	*n*	%
Other	3	1.4%
Length of Electronic Personal Health Record (ePHR) Ownership		
No ePHR ownership	54	25.7%
Less than 3 months of ePHR ownership	4	1.9%
3-6 months of ePHR ownership	1	<1%
6-12 months of ePHR ownership	5	2.4%
1-5 years of ePHR ownership	52	24.8%
Greater than 5 years of ePHR ownership	94	44.8%
Length of Electronic Personal Health Record (ePHR) Usage		
No ePHR usage	87	41.4%
Less than 3 months of ePHR usage	8	3.8%
3-6 months of ePHR usage	3	1.4%
6-12 months of ePHR usage	3	1.4%
1-5 years of ePHR usage	36	17.1%
Greater than 5 years of ePHR usage	73	34.8%
Features Used Within Electronic Personal Health Record (ePHR)		
No features used	82	39.0%
Logged in	122	58.1%
Sent/received messages	108	51.4%
Scheduled appointments	68	32.4%
Reviewed lab values	113	53.8%
Payed medical bills	34	16.2%
Reviewed medications/health history	86	41.0%
Request prescription refills	54	25.7%
Other	1	<1%
Sensoriperceptual Information		
Hearing impairment	84	40.0%
Visual impairment	149	71.0%
Wear eyeglasses	179	85.2%
Wear contacts	9	4.3%

Characteristic	*n*	%
Use hearing aids	53	25.2%
Use other vision assistive devices	12	5.7%

Table 14

Intercorrelations Among Six Demographic Items with Participant Age (N = 210

Measure	1	2	3	4	5	6	7
1. Age	___						
2. Computer Ownership	-.25**	___					
3. Computer Experience	-.21**	.74**	___				
4. Level of Experience	-.16*	.54**	.50**	___			
5. Knowledge of ePHR	-.25**	.51**	.47**	.46**	___		
6. Have ePHR	-.28**	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	-.19**	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

*.Correlation is significant at the 0.05 level (2-tailed).

Table 15

Intercorrelations Among Six Demographic Items with Participant Education Level (N = 210)

Measure	1	2	3	4	5	6	7
1. Education	___						
2. Computer Ownership	.35**	___					
3. Computer Experience	.36**	.74**	___				
4. Level of Experience	.24**	.54**	.50**	___			
5. Knowledge of ePHR	.27**	.51**	.47**	.46**	___		
6. Have ePHR	.22**	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	.23**	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

Table 16

Intercorrelations Among Six Demographic Items and Participant Household Income (N = 168)

Measure	1	2	3	4	5	6	7
1. Household income	___						
2. Computer Ownership	.31**	___					
3. Computer Experience	.27**	.74**	___				
4. Level of Experience	.33**	.54**	.50**	___			
5. Knowledge of ePHR	.10	.51**	.47**	.46**	___		
6. Have ePHR	.13	.44**	.42**	.39**	.65**	___	
7. Experience with ePHR	.13	.45**	.50**	.47**	.73**	.73**	___

**.Correlation is significant at the 0.01 level (2-tailed).

Table 17

*Frequencies of Participant Total Scores on the Geriatric Depression Scale: Short Form (*N *= 210)*

Total Score	*n*	%
0	60	28.6
1	49	23.3
2	35	16.7
3	25	11.9
4	14	6.7
5	3	1.4
5	5	2.4
6	5	2.4
7	6	2.9
8	4	1.9
9	3	1.4
10	1	.5
12	2	1.0
13	3	1.4

Table 18

*Frequencies of Participant Total Scores on the UCLA Loneliness Scale Version 3 (*N = *210)*

Total Score	*n*	%
20	5	2.4
21	4	1.9
22	9	4.3
23	4	1.9
24	6	2.9
25	3	1.4
26	6	2.9
27	5	2.4
28	7	3.3
29	3	1.4
30	9	4.3
31	17	8.1
32	12	5.7
33	8	3.8
34	11	5.2
35	6	2.9
36	14	6.7
37	3	1.4
38	8	3.8
39	4	1.9
40	8	3.8
41	5	2.4
42	3	1.4
43	4	1.9
44	8	3.8
45	3	1.4
46	4	1.9
48	1	.5

Total Score	*n*	%
50	4	1.9
51	7	3.3
52	3	1.4
53	1	.5
54	1	.5
55	1	.5
56	2	1.0
57	2	1.0
58	1	.5
61	2	.5
62	1	.5
65	2	1
66	1	.5
70	1	.5
77	1	.5

Table 19

*Participant Responses to Adapted U.S.A.B.I.L.I.T.Y. Survey Items on Perceived Control and User Experience (*N = *210)*

Item Number and Question	Strongly Agree *n*	%	Agree *n*	%	Neither *n*	%	Disagree *n*	%	Strongly Disagree *n*	%
1. An electronic personal health record is exactly what I need.	41	19.5%	80	38.1%	50	23.8%	29	13.8%	10	4.8%
2. I am satisfied with the overall appearance of the electronic personal health record.	35	16.7%	98	46.7%	60	28.6	12	5.7	5	2.4
3. I am satisfied with the audio of the electronic personal health record.	17	8.1	49	23.3	126	60	14	6.7	4	1.9
4. I can successfully use the electronic personal health record.	55	26.2	77	36.7	45	21.4	20	9.5	13	6.2
5. I would recommend an electronic personal health record to a friend.	49	23.3	79	37.6	51	24.3	18	8.6	13	6.2
6. The electronic personal health record is pleasant to use.	30	14.3	73	34.8	74	35.2	24	11.4	9	4.3
10. The electronic personal health record gave me a feeling of control over my health.	29	13.8	66	31.4	78	37.1	30	14.3	7	3.3
11. I know what information I need and can access from the electronic personal health record.	39	18.6	90	42.9	49	23.3	23	11.0	9	4.3
12. The information I received makes me feel in control.	27	12.9	84	40.0	68	32.4	22	10.5	9	4.3

Table 20

*Frequencies of Participant ePHR Task Performance Ability (*N = *63)*

ePHR Task	*n*	%
Log in		
Unable to perform	12	19.0
Significant assistance	2	3.2
Moderate assistance	5	7.9
Minimal assistance	6	9.5
Independent	38	60.3
Send message		
Unable to perform	5	7.9
Significant assistance	3	4.8
Moderate assistance	3	4.8
Minimal assistance	7	11.1
Independent	45	71.4
Read provider note		
Unable to perform	7	11.1
Significant assistance	1	1.6
Moderate assistance	2	3.2
Minimal assistance	3	4.8
Independent	50	79.4
Access lab results		
Unable to perform	3	4.8
Significant assistance	1	1.6
Moderate assistance	3	4.8
Minimal assistance	2	3.2
Independent	54	85.7

ePHR Task	*n*	%
Review medications		
Unable to perform	2	3.2
Significant assistance	1	1.6
Moderate assistance	2	3.2
Minimal assistance	4	6.3
Independent	54	85.7
Log out		
Unable to perform	2	3.2
Significant assistance	1	1.6
Moderate assistance	5	7.9
Minimal assistance	13	20.6
Independent	42	66.7

Table 21

Frequencies of Participant Time in Seconds to Complete ePHR Task

Time to complete ePHR task in seconds	*n*	%
Task 1: Log on (N = 52)		
<1	1	1.9
12	1	1.9
45	1	1.9
46	1	1.9
52	1	1.9
54	1	1.9
55	1	1.9
56	3	5.8
60	1	1.9
62	2	3.8
64	2	3.8
65	1	1.9
67	1	1.9
68	1	1.9
69	1	1.9
71	1	1.9
73	1	1.9
75	2	3.8
76	1	1.9
77	3	5.8
78	1	1.9
80	1	1.9
82	1	1.9
83	1	1.9
84	1	1.9
85	1	1.9
88	1	1.9
89	1	1.9

90	2	3.8
93	1	1.9
101	3	5.8
120	3	5.8
128	1	1.9
139	1	1.9
162	1	1.9
180	1	1.9
183	1	1.9
234	1	1.9
240	1	1.9
300	1	1.9
Task 2: Send message (N = 61)		
<1	3	4.9
2	7	11.5
3	6	9.8
4	3	4.9
5	4	6.6
6	3	4.9
7	6	9.9
8	3	4.9
9	1	1.6
10	1	1.6
11	2	3.3
13	1	1.6
15	4	6.6
21	1	1.6
22	1	1.6
24	1	1.6
26	1	1.6
30	1	1.6
32	1	1.6
35	1	1.6

57	1	1.6
78	1	1.6
89	1	1.6
117	1	1.6
120	3	4.9
160	1	1.6
180	1	1.6
300	1	1.6
Task 3: Read provider note (N = 61)		
<1	1	1.6
1	5	8.2
2	4	6.6
3	4	6.6
4	6	9.8
5	9	14.8
6	2	3.3
7	4	6.6
8	9	14.8
10	3	4.9
12	1	1.6
14	2	3.3
15	1	1.6
19	1	1.6
22	1	1.6
29	1	1.6
38	1	1.6
60	1	1.6
120	3	4.9
160	1	1.6
300	1	1.6
Task 4: Access lab results (N = 61)		
1	13	21.3
2	23	37.7

3	8	13.1
4	5	8.2
5	1	1.6
7	1	1.6
8	1	1.6
18	1	1.6
22	1	1.6
42	1	1.6
60	1	1.6
120	3	4.9
160	1	1.6
300	1	1.6
Task 5: Review medications (N = 61)		
1	15	24.6
2	20	32.8
3	7	11.5
4	6	9.8
5	2	3.3
6	2	3.3
10	1	1.6
13	1	1.6
28	1	1.6
60	1	1.6
120	3	4.9
160	1	1.6
300	1	1.6
Task 6: Log out (N = 61)		
1	1	1.6
2	2	3.3
3	6	9.8
4	7	11.5
5	5	8.2
6	3	4.9

7	1	1.6
8	1	1.6
9	1	1.6
10	2	3.3
11	3	4.9
12	1	1.6
13	3	4.9
15	1	1.6
16	1	1.6
17	1	1.6
19	1	1.6
20	2	3.3
21	1	1.6
24	1	1.6
25	1	1.6
30	2	3.3
31	1	1.6
32	1	1.6
41	1	1.6
45	1	1.6
48	1	1.6
50	1	1.6
58	1	1.6
60	1	1.6
83	1	1.6
120	3	4.9
160	1	1.6
300	1	1.6

Table 22

*Regression Analysis Summary for Variables Influencing Older Adults' Performance with ePHRs (*N = *57)*

Variable	*B*	*SE B*	β	*t*	*p*
Sensoriperceptual Deficits	-.89	.46	-.25	-1.95	.06
Age	-.19	.06	-.39	-3.02	.004
Education	.37	.32	.15	1.17	.25
Depression Total Score	-.41	.19	-.32	-2.14	.04
Loneliness Total Score	.02	.06	.05	.34	.74
Perceived Control	.04	.23	.03	.16	.88
User Experience	-.06	.14	.14	-.48	.64

Note: R^2 = .26 (*N* = 57, *p* < .0)

Chapter Summary

In this chapter, two of the three manuscripts that were produced as part of this presentation were presented. Each manuscript provided data on the research questions and addressed the individual research hypotheses. Results were analyzed and interpreted for each manuscript. The findings in this study were supported with previous research findings. Identified barriers to ePHR use included depression, loneliness, financial strain, lack of devices, unreliable or limited internet access, and lack of knowledge of the benefits of ePHRs. Facilitators to ePHR use included higher completed levels of formal education, user experience, perceived control, ability to communicate, and support.

Chapter 5

Discussion

Introduction

The purpose of this dissertation was to examine the relationship between individual factors of older adults and their use of electronic personal health records (ePHRs). A correlational design format was used to collect and analyze data to respond to each research question. This chapter discusses the findings of this research and addresses the strengths and limitations of the study, possible impact on the discipline of nursing, and suggestions for future research.

Synthesis of the Research

Older adults' healthcare management can be positively impacted through the implementation of information and communication technologies (ICTs) (Rikard et al., 2018). To promote older adults' self-management of their health and be compliant with meaningful use legislation, and to improve patient outcomes, many healthcare organizations are utilizing electronic personal health records (ePHRs) (Nahm et al., 2020). Patients can access their health information and communicate with providers through secure web-based systems that facilitate access to electronic personal health records (Huang et al., 2022). According to Portz et al. (2019), utilization of ePHRs can lead to improved care coordination and communication, and decrease healthcare costs through prevention and early intervention.

Although there are identified benefits to older adults using ePHRs, digital inequality, often referred to as the digital divide, still exists (Rikard et al., 2018). The digital divide is a gap in technology use between older and younger adults, which can be seen in the adoption rates of

ePHRs (Bixter et al., 2019), as older adults lag in ePHR adoption and use compared to younger adults (Portz et al., 2019). Older adults are less likely to be technologically savvy, yet have expressed interest in using ePHRs, and the adoption rate of ePHR use is growing in the older adult population (Abdelrahman et al., 2021).

Potential facilitators and barriers to older adults' ePHR use were found in a systematic review of the literature, which revealed three facilitators and five barriers to older adults' ePHR use (Theisen et al., 2021). Facilitators included improved communication between patient and provider, support for patients who want to utilize ePHRs, and training opportunities to enable navigation of ePHRs. Perceived barriers to ePHR use were a lack of experience, anxiety using technology, privacy and security concerns, physical and mental health deficits, and a lack of personal interaction between the older adult and the healthcare team.

Messaging systems within ePHRs are often the most popular feature for older adults, as ePHRs can improve communication with healthcare providers (Cross et al., 2021). As a result of improved communication, older adults may have more control over their health and have improved self-management of chronic conditions (Grossman et al., 2018). However, some older adults prefer in-person communication and interaction, which creates a barrier to their use of ePHRs for communication (Portz et al., 2019). However, older adults' intent to use ePHRs may be improved through the promotion of the benefits and addressing user interface challenges (Reed et al., 2019).

A gap in older adults' skills and comfort in using web-based applications, such as ePHRs, often exists (Crouch & Gordon, 2019). A lack of computer skills and confidence can contribute to computer anxiety or apprehension (Portz et al., 2019). Physical limitations, such as visual impairments, may hinder older adults' ePHR adoption (Nahm et al., 2021). Design principles

such as font sizes and color combinations may be a barrier to ePHR use in older adults due to visual changes associated with aging (Nahm et al., 2021). Older adults are more likely to use ePHRs if they receive encouragement and are provided with support to learn how to access and use an ePHR (Abdelrahman et al., 2021). In addition, older adult training programs or courses were correlated to higher utilization of ePHRs (Lee et al., 2020). Older adults' ePHR use is influenced by electronic personal health record advocacy from healthcare providers (Hoogenbosch et al., 2018). Older adults had higher ePHR usage rates if they received support from younger family members or friends (Abdelrahman et al., 2021). Healthcare providers can guide older adults' navigation of ePHRs by introducing patients to common, easy-to-use ePHR features and then incorporating ePHR use into care interactions (Cross et al., 2021). Likewise, providing older adults with appropriate training opportunities for using technology and ePHRs can increase their confidence levels (Lee et al., 2020).

Older adults expressed concern about ePHRs online data safety and security (Abdelrahman et al., 2021), and privacy, especially amongst those dealing with depression. (Matthews et al., 2022). Older adults with depression are more likely to use features such as the messaging system to maintain regular communication with their healthcare provider (Matthews et al., 2022). Implementation of privacy and security measures, such as firewalls and password protection, must be ensured to safeguard older adults' privacy and confidentiality (Matthews et al., 2022).

Loneliness among older adults is a common health problem that can be associated with their physical and mental health problems (Byrne et al., 2021). Older adults experiencing loneliness have an increased risk of mortality, as well as dementia, stroke, and physical mobility limitations (Finlay & Kobayashi, 2018). Technology, especially social platforms, can decrease

older adults' feelings of loneliness, leading to improved health outcomes (Byrne et al., 2021). Healthcare providers can aide in reducing older adults' loneliness by integrating screening tools for loneliness and isolation into ePHRs (Perissinotto et al., 2019).

Gaps still exist in the literature regarding older adults' intent to use and performance with ePHR, including factors such as physical limitations or motivations. A majority of research that focuses on older adults' experiences with ePHRs have not investigated the impact that individual factors can have on older adults' use of ePHRs. Specifically, few investigations explore the predictors of ePHR use in the older adult, including the relationship between depression and loneliness. This dissertation adds to the growing body of knowledge in facilitators and barriers to older adults' ePHR use.

Synthesis of the Manuscripts

Contributing factors to older adults' low ePHR adoption rates have been suggested. However, extensive research has not been completed. Therefore, manuscript one, *Facilitators and Barriers to Patient Portal Use in the Older Adult: A Systematic Review of the Literature*, was prepared to address the gaps in the literature. A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher et al., 2009) to identify factors influencing older adults' use of ePHRs (Theisen et al., 2021).

Research was needed on identifying facilitators and barriers to older adults' ePHR use. One way in which this investigation examined facilitators of ePHRs use, was discussed in the second manuscript, *Factors Affecting Older Adults' Intent to Use Electronic Personal Health Records (ePHRs).* The relationships between independent variables of depression, loneliness,

perceived control, and user experience and the dependent variable of intent to use ePHRs were studied. The dependent variable of older adults' ability to access and use an ePHR was addressed in manuscript three, *Exploring Influencing Factors for Older Adults' Performance with Electronic Personal Health Records (ePHRs).* In this manuscript, the relationships between independent variables of depression, loneliness, perceived control, and user experience were examined with the dependent variable of the older adults' ability to use ePHRs. The findings from this dissertation suggest that although the benefits of ePHR use is supported, barriers to older adult's ePHR utilization persist.

The manuscripts reporting on the findings of the study, identified differences in ePHR use between subgroups of older adults. The study found that as older adults age, their computer ownership, experience, and knowledge and usage of ePHRs decreases. Older adult users of ePHRs had higher household incomes, higher education levels, and were younger in age. When using ePHRs, older adults identified the ability to access lab results, review health history and medication, and to communicate with providers as commonly used features. The results are congruent with prior research in regards identification of facilitators and barriers of older adult ePHR use.

Depression and loneliness as influencing factors on older adults' ePHR use were investigated during this study. A higher percentage of older adults with depression participated in the study compared to the general public. Individuals with depression may be drawn to use ePHR systems for communication but are less likely to access an ePHR without perceived control over their health information (Matthews et al., 2022). While depression may be an influencing factor on older adults' ePHR use, depression was only a significant predictor to older adults' performance with ePHR, not with their intent to use ePHRs. In manuscript two and three,

loneliness was not a significant predictor to either older adults' performance or intent to use ePHRs.

The regression analysis indicated that user experience and perceived control were significant facilitators of older adults' intent to use ePHRs. Older adults' perceived control is highly correlated with computer ability (Wong et al., 2019), demonstrated by a majority of participants being able to access information from their ePHR. Consistent with prior research findings, older adults who used ePHRs identified user experience as a significant facilitator to ePHR use (Portz et al., 2019).

Implications of the Study

The purpose of conducting research is to generate new knowledge in a discipline. Electronic personal health records can provide solutions to address healthcare barriers faced by older adults. Understanding facilitators and barriers to older adults' intent to use and performance with ePHRs could inform more progress in this area. This dissertation holds the potential to have an impact on nursing practice and policy and can contribute to the growing data on ePHRs.

Nursing Practice

ePHR Design

Differences in ePHR use between older adult subgroups suggest that as age increases, use of ePHRs decreases. Older adults are less likely to adopt ePHRs as they age (Portz et al., 2019). Research suggests that older adults are interested in using ePHRs, though they may not be as comfortable with technology (Son & Nahm, 2019). Physical changes associated with aging, such as visual impairments and decreased mobility, could make navigating ePHRs more difficult

(Crouch & Gordon, 2019). In order to increase ePHR usability for older adults, it is recommended is to obtain feedback from older adults when developing ePHRs (Dendere et al., 2019). Simple layouts with clear, large font could be incorporated into ePHRs to improve accessibility for older adults with decreased visual acuity (Son & Nahm, 2019). Another important consideration is to present information using nonmedical descriptions and images (Son & Nahm, 2019) or to include a medical dictionary (Hoogenbosch et al., 2018) to increase older adults' understanding of medical language. Involvement of the end-user of ePHRs during development and implementation addresses unique needs and abilities of the older adult (Nahm et al., 2020). Additionally, conducting evaluation of older adults' perspectives is imperative for future improvements in ePHR usability (Hoogenbosch et al., 2018).

Education and Support

Lack of knowledge and experience with using ePHRs can be a barrier for older adults. In order to address the gap in computer skills, healthcare providers can promote ePHR education and support to older adults (Crouch & Gordon, 2019). Providing education to older adults and their family members about ePHR features can increase ePHR use (Cross et al., 2021; Nahm et al., 2020). Healthcare professionals can further impact older adults' ePHR use by integrating ePHRs into patient care (Hoogenbosch et al., 2018) and by demonstrating proactive uses of technology (Cross et al., 2021). Training programs targeting older adults and caregivers can provide assistance when using ePHRs (Son & Nahm, 2019) and increase ePHR use in vulnerable populations (Grossman et al., 2018). Additionally training programs for providers and other healthcare members on ePHR features such as messaging can positively affect older adult's engagement with ePHRs (Cross et al, 2021). For example, demonstrating screen sharing or how

to integrate ePHR task completion during a clinic visit may be a viable communication strategy to increase ePHR use by older adults (Cross et al., 2021).

Policy

Increase Internet Access

Financial strain, lack of internet-capable devices, and unreliable or limited internet can be barriers to older adults' ePHR use. Older adults are less likely to use internet resources than younger adults due to affordability devices or internet on a fixed income (Crouch & Gordon, 2019). Disparities seen in access to the internet and usage can be a barrier to ePHR use (Son & Nahm, 2019). Older adults with higher incomes are more likely to own more expensive computer devices and have high-speed internet. Individuals with lower incomes may instead utilize a smartphone(Vogels, 2021). Public health organizations can develop strategies and policies based on this data to increase internet access to vulnerable populations, including the older adult (Son & Nahm, 2021), while electronic personal health record vendors can focus on mobile apps and interfaces to increase the access and usage of ePHRs by older adults. Additionally, healthcare organizations could provide assistance to older adults in obtaining devices or high-speed internet, or assist in identifying public resources such as libraries to gain access (Crouch & Gordon, 2019).

Financial Investment

Federal laws and quality-based payment programs, such as The Medicare and Medicaid Electronic Health Record (HER) Incentive Programs, help to increase ePHR use and electronic communication by patients (Cross et al., 2021). As of January 2021, all CMS-regulated payers are required to implement web-based interfaces that allow patients to easily access their health

information (CMS, 2020). Although initiatives are in place to increase ePHR access and use, a gap in guidance and support is evident (Cross et al., 2021). Ongoing federal initiatives focusing on financial strategies to provide continuing development and integration of ePHR applications that improve self-management could increase ePHR use (Cross et al., 2021). Policy change is also needed to provide financial incentives to ePHR vendors for continuous improvement of ePHRs, and develop features that address more challenging primary care tasks (Cross et al., 2021). Strategies to assist in increasing older adults' self-efficacy in using ePHR can be established to include more social support and interaction with the ePHR (Son & Nahm, 2019). In addition, creating federal-level standards of quality for ePHR development can be a more effective approach to ensure usability (Nahm et al., 2020).

Suggestions for Future Research

More definitive research examining the facilitators and barriers to older adults' ePHR use is needed. Currently, there are still significant differences between older adults and the general adult population in relation to the use of ePHRs. In response to the gap in older and younger adults' ePHR use, future research should focus on older adults in order to better understand the needs and perceived facilitators and barriers for this group. In addition, future research is needed to understand the underlying challenges that are present in the implementation of ePHRs and study the feasibility and readiness of healthcare providers to leverage this tool to support patient care. While facilitators to ePHR use have been identified, more research is needed to determine best strategies for promoting ePHR engagement among older adults. Finally, limited research exists on the impact of depression and loneliness on older adults' ePHR use. Research on the impact of loneliness and depression on older adults' performance with and intent to use ePHRs should be considered.

Conclusion

In this chapter, synthesis of the literature was presented, as well as the findings from the three manuscripts associated with this dissertation. Implications for nursing practice and policy were discussed, along with areas for future research. The background of older adults' ePHR use shows the continued need for research into facilitators and barriers to ePHR use. The findings from this study can have great implications on future research in the area of technology and ePHR development and use.

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Appendices

Appendix A

Demographic Questionnaire

Instructions: Answer all questions to the best of your ability. Either fill in the appropriate blank or fill in the circle next to the best choice.

1. Age: _____

2. Gender:
    - Male
    - Female
    - Other (please specify) _____
    - Prefer not to say

3. Race/Ethnicity: Select all that apply
    - White
    - Hispanic or Latino
    - Black or African American
    - Native American or American Indian
    - Asian/Pacific Islander
    - Other

4. What is the highest degree or level of school you have completed? If you are currently enrolled in school, please indicate the highest degree you have received.
    - Less than a high school diploma
    - High school degree or equivalent
    - Bachelor's degree (e.g. BA, BS)
    - Master's degree (e.g. MA, MS, MEd)
    - Doctorate (e.g. PhD, EdD)
    - Other (please specify) _____

5. What is your household income?
    - Below $10k
    - $10k - $50k
    - $50k - $100k
    - $100k - $150k
    - Over $150 k

6. Have you ever been told by a provider that you have any of the following chronic conditions?
    - Diabetes

- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Heart failure
- Kidney dialysis
- Kidney disease
- Hypertension (high blood pressure)
- High cholesterol
- Lung disease
- Arthritis
- Osteoporosis
- Depression
- Alzheimer's Disease
- Cancer
- Other: _____

7. How long have you had a computer?
    - I don't own a computer
    - I have owned a computer for 0-6 months
    - I have owned a computer for 6-12 months
    - I have owned a computer for 1-5 years
    - I have owned a computer for greater than 5 years

8. What previous experience have you had with using computers?
    - I have no experience using a computer
    - I have less than 3 months of experience using a computer
    - I have 3-6 months of experience using a computer
    - I have 6-12 months of experience using a computer
    - I have 1-5 years of experience using a computer
    - I have greater than 5 years of experience using a computer

9. How would you consider your experience with computer use?
    - Beginner
    - Intermediate
    - Expert

10. Approximately how many hours per day on average do you use a computer?
    - I don't use a computer
    - I use a computer 0-2 hours per day on average
    - I use a computer 2-5 hours per day on average
    - I use a computer 5-8 hours per day on average
    - I use a computer more than 8 hours per day on average

11. Have you heard about electronic personal health records?
    - I have never heard about electronic personal health records
    - I have heard about electronic personal health records, but I don't understand what they are

- I have heard about electronic personal health records, and I understand what they are
- I have heard about electronic personal health records, and I understand and use one for my health needs

12. How did you find out about electronic personal health records?
    - I have never heard about electronic personal health records
    - From a provider
    - From a nurse
    - From other medical staff
    - From family/friends
    - From the internet
    - Other: _____

13. Have you ever received help to learn how to use an electronic personal health record?
    - I have never received help to learn how to use an electronic personal health record
    - I have received minimal help to learn how to use an electronic personal health record
    - I have received a moderate amount of help to learn how to use an electronic personal health record
    - I have received a significant amount of help to learn how to use an electronic personal health record

14. Where did you receive help to learn how to use an electronic personal health record?
    - I have never received help to learn how to use an electronic personal health record
    - From a provider
    - From a nurse
    - From other medical staff
    - From family/friends
    - Training program/course
    - From the internet
    - Other: _____

15. How long have you had an electronic personal health record?
    - I don't have an electronic personal health record
    - I have had my electronic personal health record for less than 3 months
    - I have had my electronic personal health record for 3-6 months
    - I have had my electronic personal health record for 6-12 months
    - I have had my electronic personal health record for 1-5 years
    - I have had my electronic personal health record for greater than 5 years

16. What previous experience have you had using an electronic personal health record?
    - I have no experience using an electronic personal health record
    - I have less than 3 months experience using my electronic personal health record
    - I have 3-6 months experience using my electronic personal health record
    - I have 6-12 months experience using my electronic personal health record

- I have 1-5 years experience using my electronic personal health record
- I have greater than 5 years experience using my electronic personal health record

17. Have you used any features in an electronic personal health record? Select all that apply.
    - I have not used any features in an electronic personal health record
    - I have logged into my electronic personal health record
    - I send and/or receive messages with my health care team in my electronic personal health record
    - I schedule medical appointments (i.e. clinic visits, lab visits) in my electronic personal health record
    - I look up my laboratory values in my electronic personal health record
    - I pay medical bills online in my electronic personal health record
    - I review my medications and/or my health history in my electronic personal health record
    - I request prescription refills in my electronic personal health record
    - Other (please specify): _____

18. Have you ever been told by a provider that you have a current and/or past hearing impairment?
    - Yes
    - No

19. Have you ever been told by a provider that you have a current and/or past visual impairment?
    - Yes
    - No

20. Do you use corrective eyeglasses?
    - Yes
    - No

21. Do you use corrective contact lenses?
    - Yes
    - No

22. Do you use hearing aids?
    - Yes
    - No

23. Do you use any other assistive devices to help your vision?
    - Yes
    - No
    - What type: _____

24. Do you use any other assistive devices to help your hearing?
    - Yes
    - No

- What type: _____

Appendix B

Adapted U.S.A.B.I.L.I.T.Y. Survey© Item Measures of Variables

Variable Type	Variable Name	Adapted U.S.A.B.I.I.T.Y. Survey Items
Independent	Perceived control	• The electronic personal health record gave me a feeling of control over my health. • I know what information I need and can access from the electronic personal health record. • The information I received makes me feel in control.
Dependent	Intent to use	• I will change my habits because of the electronic personal health record. • I will continue with what I am doing with my health. • I plan to use electronic personal health records in the future.
Independent	User experience	• An electronic personal health record is exactly what I need. • I am satisfied with the overall appearance of the electronic personal health record. • I am satisfied with the audio of the electronic personal health record. • I can successfully use the electronic personal health record. • I would recommend an electronic personal health record to a friend. • The electronic personal health record is pleasant to use.

Appendix C

Dr. Caboral-Stevens,

I am following up on a previous email that I had sent regarding use of your developed U.S.A.B.I.L.I.T.Y. Survey. I am a nursing doctoral student, and finishing up my dissertation. I had contacted you earlier in my process to obtain permission to use your framework and survey, which you granted. I can forward you any previous messaging we have had if that would be helpful. Due to time constraints among other things that have come up during my research, I am not able to measure each variable in your framework. I was wondering if I could use the subsets on the survey you have developed to help measure the select concepts I am measuring for my study. Basically, I am hoping to use some but not all of the questions, as I won't be measuring them all. Looking forward to your response. Thank you so much for your assistance thus far.

Hi Janelle

That should be ok. You just have to interpret each subscale and discuss them separately. If you do that you should be ok

Best

Meriam

Dr. Caboral-Stevens,

My name is Janelle Theisen, and I am a doctoral student in nursing at the University of Wisconsin-Milwaukee. I had contacted you a while ago about using the U.S.A.B.I.L.I.T.Y. Survey for my dissertation study. I am researching facilitators and barriers to older adults using patient portals. From our initial conversation, you had agreed to let me use the survey. I am asking if you would be ok with me modifying the instructions and the visual scale to look like a 5-point Likert-type scale? Also, would it be possible for me to modify and/or add to the observer questions?

Janelle Theisen

Hi Janelle

Thank you for asking. Yes you may modify the scale and you may add the observer questions.

Good luck on your studies.

Best regards,

Meriam

Dr. Caboral-Stevens,

My name is Janelle Theisen, and I am a nursing faculty member at the University of Northwestern in St. Paul, Minnesota. I am also a PhD student at the College of Nursing at the University of Wisconsin-Milwaukee. My dissertation study is utilizing the U.S.A.B.I.L.I.T.Y. framework as a theoretical model, and I would like to use the surveys for perceived control and user experience that you incorporated in your research. I am writing to you to ask your permission, and to receive a copy of the survey instrument. I would appreciate your response.

Janelle Theisen

Hi Janelle,

I am sorry for the late response. I am currently in the process of moving to a new house plus so everything is chaotic on my end.

But regarding the use of the U.S.A.B.I.L.I.T.Y. Theory, you absolutely have my permission to use it and the instrument as well. I will have to send you a copy of the USABILITY instrument shortly. I will have to locate the memory stick that is was on or I have to look into my boxes for a clean copy, and send it to you. Could you please send me an email reminder if I do not send you the instrument by next week. Thank you for your consideration.

Thank you for your interest in using my theory. Please let me know if there is anything else I can do to assist you.

Best,

Meriam

Appendix D

Correlation of Original and Adapted U.S.A.B.I.L.I.T.Y. Survey Items

Variable	**Original U.S.A.B.I.L.I.T.Y. Survey Item**	**Adapted U.S.A.B.I.I.T.Y. Survey Item**
User experience	Item 14	Item 1
	Item 15	Item 2
	Item 16	Item 3
	Item 17	Item 4
	Item 18	Item 5
	Item 19	Item 6
Intent to use	Item 20	Item 7
	Item 21	Item 8
	Item 22	Item 9
Perceived control	Item 23	Item 10
	Item 24	Item 11
	Item 25	Item 12

Appendix E

Geriatric Depression Scale: Short Form

Statement	Yes	No	Score
1. Are you basically satisfied with your life?	Yes	**No**	
2. Have you dropped many of your activities and interests?	**Yes**	No	
3. Do you feel that your life is empty?	**Yes**	No	
4. Do you often get bored?	**Yes**	No	
5. Are you in good spirits most of the time?	Yes	**No**	
6. Are you afraid that something bad is going to happen to you?	**Yes**	No	
7. Do you feel happy most of the time?	Yes	**No**	
8. Do you often feel helpless?	**Yes**	No	
9. Do you prefer to stay at home, rather than going out and doing new things?	**Yes**	No	
10. Do you feel you have more problems with memory than most?	**Yes**	No	
11. Do you think it is wonderful to be alive now?	Yes	**No**	
12. Do you feel pretty worthless the way you are now?	**Yes**	No	
13. Do you feel full of energy?	Yes	**No**	
14. Do you feel that your situation is hopeless?	**Yes**	No	
15. Do you think that most people are better off than you are?	**Yes**	No	
Total Score			

A score of $\geq$ 5 suggests depression

(Russell, 1996)

Appendix F

UCLA Loneliness Scale Version 3

Statement	Never	Rarely	Sometimes	Often
*1. How often do you feel that you are “in tune” with the people around you?	1	2	3	4
2. How often do you feel that you lack companionship?	1	2	3	4
3. How often do you feel that there is no one you can turn to?	1	2	3	4
4. How often do you feel alone?	1	2	3	4
*5. How often do you feel part of a group of friends?	1	2	3	4
*6. How often do you feel that you have a lot in common with the people around you?	1	2	3	4
7. How often do you feel that you are no longer close to anyone?	1	2	3	4
8. How often do you feel that your interest and ideas are not shared by those around you?	1	2	3	4
*9. How often do you feel outgoing and friendly?	1	2	3	4
*10. How often do you feel close to people?	1	2	3	4
11. How often do you feel left out?	1	2	3	4
12. How often do you feel that you relationships with others are not meaningful?	1	2	3	4
13. How often do you feel that no one really knows you well?	1	2	3	4
14. How often do you feel isolated from others?	1	2	3	4
*15. How often do you feel you can find companionship when you want it?	1	2	3	4

*16. How often do you feel that there are people who really understand you?	1	2	3	4
17. How often do you feel shy?	1	2	3	4
18. How often do you feel that there are people around you but not with you?	1	2	3	4
*19. How often do you feel that there are people you can talk to?	1	2	3	4
*20. How often do you feel that there are people you can turn to?	1	2	3	4

Scoring:

The items with an asterisk are reverse scored. Keep scoring on a continuous basis.

(Russell, 1996)

Appendix G

Ms. Theisen,

I left you a voicemail at your office number listed in your email that yes Twin Cities Physicians would be interested in this. Let me know what else you need from us and what time frame. Thank you.

Chad Werth RN BSN Nurse Liaison/Manager

Twin Cities Physicians, PC.

Good morning Chad. I wanted to give you an update as to where I am with my dissertation. As we had previously discussed, I am PhD student looking at facilitators and barriers to patient portal use in the older adult. Our last conversation was about access to a test account through your organization. My proposal was approved and I am almost ready to submit to IRB. Would you be able to get me access to the test account so I can verify my documents are correct before I submit? Once I have IRB approval, I will send you the approval letter, and I should be able to start my data collection this summer.

Janelle,

Thank you yes I was and we use a 2 factor authentication process for our portal and if you have any questions regarding it feel free to contact me. It should be set up today or tomorrow. Thank you

Chad Werth RN BSN Nurse Liaison/Manager

Twin Cities Physicians, PC.

Appendix H

Observation Checklist

Task	Time to Complete	Independent	Minimal Assistance	Moderate Assistance	Significant Assistance	Unable to Perform	Comments
Log into the electronic personal health record		5	4	3	2	1	
Send message		5	4	3	2	1	
Read notes or messages		5	4	3	2	1	
Look up lab values		5	4	3	2	1	
Review medications		5	4	3	2	1	
Log out of the electronic personal health record		5	4	3	2	2	

Appendix I

University of Wisconsin-Milwaukee
Informed Consent to Participate in Research

Study title: Examining Facilitators and Barriers to Electronic Personal Health Record Use in Older Adults

Researcher[s]: Julia Snethen, PhD, RN (PI); Janelle Theisen, MAN, BSN

What is the purpose of this study?
We are interested in examining what promotes and what limits older adults using an electronic personal health record. An electronic personal health record is an online website where patients can access their personal health information, such as medications and laboratory results, or to communicate with their providers. We would like to have a great understanding of what factors impact the older adult's decision to use electronic personal health records.

What will I do?
You will be administered four surveys asking questions about hearing and visual deficits, depression, loneliness, and usability of electronic personal health records. I will be asking you the questions either over the phone, video conferencing such as Zoom, or in-person if it is permitted. I will be documenting your responses on the survey for you. No names or other information that can identify you will be included on the surveys. You are not required to answer any questions that you are uncomfortable with. The survey will take about 40-55 minutes. Surveys will be conducted either over the phone or by video conferencing. If social distancing and health risks have subsided enough to allow for in-person data collection, face-to-face interactions may be used instead of telephone or video conferencing. If you have video conferencing capability or if in-person observation is possible, you will be asked to perform basic tasks within a fake electronic personal health record, such as finding lab results and sending a message to a provider. The task observation should take about 10-15 minutes.

Risks

- Some questions may be personal or upsetting. You can skip them or quit the survey at any time. There is a small potential for a breach of confidentiality of data, but your name will not be attached to the data.

Possible benefits: There are no direct benefits to you for participating in this study. Participation in this study will aid the academic and research communities to gain a greater understanding of how easy or difficult it is to use an electronic personal health record, as well as the overall experience that older adults have with using an electronic personal health record. In addition, it will provide information on how well older adults are able to use features within an electronic personal health record, such as sending a message to a provider.

Estimated number of participants: 242 older adults

How long will it take? The total time to complete the study should be around 1 hour.

Costs: None

Compensation: None

Future research: Your data won't be used or shared for any future research studies.

Confidentiality and Data Security
All information collected during the course of this study will be kept confidential to the extent permitted by law. This means that no information that can identify you will be included on the surveys or during observation. Your name will not appear anywhere and no one will know about your specific answers. We may decide to present what we find to others, or publish our results in scientific journals or at scientific conferences in aggregate form only. Only the primary researcher and research dissertation committee members, including biostatisticians will have access to the de-identified information. However, the Institutional Review Board at UW-Milwaukee or appropriate federal agencies like the Office for Human Research Protections may review our records. Data will be stored in an encrypted, password-protected computer. Video conferencing will be recorded. Participants will be instructed to log into Zoom, the video conferencing software, using an assigned participant ID number, instead of names. In addition, the Zoom recording will be set up to screen share only, so your face will not be visible. This is to ensure that no identifying information is attached to the video recording.

Where will data be stored? All data will be stored in encrypted, password-protected computers of primary investigator.

How long will it be kept? Data will be kept up to 3 years after collection and then deleted. Video recordings will be reviewed for up to 10 minutes following data collection. Video conferencing will be recorded to a password-protected computer. The video will be reviewed for up to 10 minutes immediately following the survey and/or task performance. The recording will be used to verify participant responses, and then permanently deleted.

Who can see my data?

- We (the researchers) will have access to de-identified data collected from surveys and video observation recordings. This is so we can analyze the data and conduct the study.
- Agencies that enforce legal and ethical guidelines, such as
    - The Institutional Review Board (IRB) at UWM
    - The Office for Human Research Protections (OHRP)
- We may share our findings in publications or presentations. If we do, the results will be aggregated or group data, with no individual results.

Questions about the research, complaints, or problems: Contact Julia Snethen, PhD, RN at julia@uwm.edu or 414-229-5505 or Janelle Theisen, MAN, RN at theise24@uwm.edu or 651-235-6436.

Questions about your rights as a research participant, complaints, or problems: Contact the UWM IRB (Institutional Review Board) at 414-612-3544 / irbinfo@uwm.edu.

Please print or save this screen if you want to be able to access the information later.
IRB # 20.014
IRB Approval Date: November 11, 2020

Agreement to Participate
Your participation is completely voluntary, and you can withdraw at any time.
To take this survey, you must be:

- 65 years or older
- Able to speak and read English
- Willing to participate
- Have telephone access

By completing the surveys and optional video conferencing/in-person observation, you are giving your consent to voluntarily participate in this research project.

Appendix J

Adapted U.S.A.B.I.L.I.T.Y. Survey©

Instructions:

Rate your agreement with the following statements about how you feel in general when using electronic personal health records. Fill in the bubble that corresponds to the level of agreement that applies. For each question, 1 means strongly agree, 3 means neither disagree nor agree, and 5 means strongly disagree.

Questions					
1. An electronic personal health record is exactly what I need.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
2. I am satisfied with the overall appearance of the electronic personal health record.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
3. I am satisfied with the audio of the electronic personal health record.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
4. I can successfully use the electronic personal health record.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
5. I would recommend an electronic personal health record to a friend.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
6. The electronic personal health record is pleasant to use.	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree

7. I will change my habits because of the electronic personal health record.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
8. I will continue with what I am doing with my health.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
9. I plan to use electronic personal health records in the future.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
10. The electronic personal health record gave me a feeling of control over my health.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
11. I know what information I need and can access from the electronic personal health record.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree
12. The information I received makes me feel in control.	(1) Strongly Agree	(2) Agree	(3) Neither	(4) Disagree	(5) Strongly Disagree

(Caboral-Stevens, 2015)

Curriculum Vitae

Janelle Lynn Theisen MAN, RN, CNE

Education

University of Wisconsin, Milwaukee, WI

- PhD in Nursing
- May 2015-August 27, 2022

Bethel University, St. Paul, MN

- August 2009-May 2011
- Masters of Arts in Nursing Education

Bethel University, St. Paul, MN

- August 2003-May 2007
- Bachelors of Science
- Major in Nursing

Employment

Assistant Professor

- May 2015-present
- University of Northwestern, St. Paul, MN

ATI Live Educator

- May 2022-present
- ATI Nursing Educator, Leawood, KS

Assistant Professor

- August 2011-May 2015
- St. Catherine University, Minneapolis, MN

Staff Nurse, Float Pool

- July 2007-November 2015
- St. John's Hospital, Maplewood, MN
- I floated to 5 adult medical-surgical units within St. John's Hospital, including the telemetry unit. I worked with a variety of patients, ranging from telemetry to oncology. Duties consisted of evaluating the patient, monitoring telemetry, labs and diagnostic studies, administering medications, and teaching patients about medications, treatments and diagnoses.

Teaching Experience

University of Northwestern, St. Paul, MN

- Assistant Professor-Baccalaureate Degree Nursing Program

- May 2015-Present
- Ranked faculty teaching in both the accelerated and traditional nursing programs
- Health Sciences Internship Course
    - Summer 2022
    - Spring 2022
    - Supervise nursing students during nursing internship with external healthcare organizations.
    - Provide academic oversight throughout the semester to ensure students achieve learning outcomes.
- Honors Component Course
    - Assist honors student to design, plan, and complete a scholarly project.
    - Provide guidance to allow student to produce a specific product that demonstrates learning.
    - Supervise and grade learning opportunity.
    - Spring 2022
        - Student research in process on the evolution of the philosophy of nursing, including the concept of nursing as a vocation rather than an occupation.
    - Fall 2021
        - Examining the Response to Fluid Bolus Therapy for Hypoperfusion to Kidneys due to Nephrolithiasis: A Case Study
    - Fall 2020
        - HIV/AIDS
    - Fall 2019
        - Effects of Sleep Deprivation Among Nurses: Poor Health Outcomes and Increased Occurrence of Medical Errors
    - Fall 2018
        - Diabetes Mellitus
    - Fall 2017
        - The Decline of Antibiotics
        - Physician-Assisted Suicide: A Nursing Perspective
- Success in Nursing Course
    - Co-teach a pre-nursing course on strategies to be successful in nursing school.
    - Develop and implement content and active learning strategies for course instruction.
- Medical-surgical courses (Semesters 1 and 2)
    - Responsible for teaching adult medical-surgical content in theory, laboratory, and clinical settings. Experience in active learning strategies, simulation,

skills validations, and curriculum development for these courses.
    - Designed and implemented twelve, six-part unfolding simulations for the advanced med-surg course.
- Semester 3 Courses
    - Co-led transcultural trip to Quito, Ecuador spring semester 2021, and spring semester 2022.
    - Clinical faculty for mental health course at VA Hospital in inpatient and outpatient settings.
    - Assist in OB/Pediatrics summative simulation. Responsible for co-developing simulation and implementation of scenarios.
- Semester 4 Courses
    - Taught synthesis course spring semester 2019, including theory and laboratory simulation test-outs.
    - Taught NCLEX-RN prep course spring semester 2019.
    - Co-developed leadership clinical opportunities, such as Term 4 students teaching frontloading skills, study skills seminar, mentoring program and others.
- Remediation Course
    - Developed and implemented a remediation course for students who will be re-entering the program. Includes monthly learning sessions, additional learning resources, and frequent communication.

St. Catherine University, Minneapolis, MN

- Assistant Professor-Associate Degree Nursing Program
- August 2011-May 2015
- Ranked faculty teaching in the day traditional program.
- 2 and 3 Semester Medical-Surgical Courses
    - Responsible for teaching medical-surgical content across the lifespan for second and third semester nursing students in theory, laboratory, and clinical settings. Experience in active learning strategies, simulation, skills validations, and curriculum development for these courses.
- Course Coordinator January 2014-May 2015
    - Coordinate course activities, such as platform navigation, identifying course outcomes, calendar and syllabus, incorporating various learning activities and assignments, and team leadership.
- IPE Simulation Development September 2014

- Collaborated with nursing faculty, lab faculty/simulation expert, and physical therapy department to develop and implement an IPE simulation involving nursing students and physical therapy students, focusing on cardiac care and interpersonal interaction.

Scholarly Activities

Published Articles

- Theisen, J. L., Snethen, J. A., Gwon, S. H., Ellis, J. L., & Sapp, M. (2021). Facilitators and barriers to patient portal use in the older adult: A systematic review of the literature. *Journal of Informatics Nursing, 6*(3), 23-34.
- Theisen, J. L., & Sandau, K. E. (2013). Competency of new graduate nurses: A review of their weaknesses and strategies for success. *Journal of Continuing Education in Nursing, 44*(9), 406-414. doi: 10.3928/00220124-20130671-38

Unpublished Article

- Kreuziger, S.K., Treisman, P.E., Kent, D.C., Theisen, J., Triesman, R.A., Kelber, S.T., & Snethen, J.A. (2020). *Nurse educator perceptions of student health needs.* Manuscript in preparation.

Poster Presentations

- Theisen, J., Snethen, J., Gwon, J., & Ellis, J. (2022, April). *Facilitators and Barriers to Electronic Personal Health Record Use in the Older Adult Population*. Poster session presented at MNRS Conference, Schaumburg, IL.
- Theisen, J. (2020, November). *Facilitators and Barriers to Older Adult Patient Portal Use: A Systematic Review of the Literature.* Poster session presented at the Eta Nu Chapter Poster Symposium, Milwaukee, WI.
- Brockway, C., Krist, D., & Theisen, J. (2019, July). *To sim or not to sim? A comparative analysis of overall standardized test scores.* Poster session presented at the NEC Conference, Vale, CO.
- Brockway, C., Krist, D., & Theisen, J. (2018, June). *Utilization of simulation to educate nursing students on spiritual care*. Poster session presented at the Innovations in Faith-Based Nursing Conference, Marion, IN.

Presentations

- Theisen, J., Skoglund, A., & Wolgemuth, V. (2019, April). *HIPAA: Considerations for educational purposes*. Symposium presentation conducted at the Don't Hide From HIPAA Symposium, St. Paul, MN.

Awards

- 1st place PhD Student Poster Award. Eta Nu Chapter 6th Annual Poster Symposium. November, 2020.

Continuing Education

SimCapture Training, June 18, 2021

- Participated in hands-on SimCapture training by Laerdal.

Sim Baby Virtual Training, June 11, 2021

- Participated in virtual training of Sim Baby Simulator by Laerdal.

UNW Faculty Symposium, May 6, 2021

- Participated in virtual presentations.

BLS Certification Course, April 2021

- BLS Renewal April 2023

NEC Conference, July 9-12, 2019, Vale, CO

- Poster presenter and participant in conference.

Don't Hide From HIPAA Symposium, April 27, 2019, St. Paul, MN

- Podium presentation and participant in conference.

Nursing Anne Simulator Orientation, March 19, 2019

- Participated in hands-on training of Nursing Anne Simulator by Laerdal.

Preparing for CCNE Accreditation 2019: Getting a Jumpstart on the New Year, January 2019

- Participated in webinar with UNWSP faculty.

Social Media and the Law Webinar, January 2019

- Participated in webinar with UNWSP faculty.

Innovations in Faith-Based Nursing Conference, June 18-21, 2018, Marion, IN.

- Poster presenter and participant in conference with UNWSP faculty.

Saline Process Training, June 17, 2018

- Attended conference with UNWSP faculty.

Best Practices in Simulation Conference, May 17-18, 2017

- Attended conference with UNWSP faculty.

NLN SRIC Courses

- Completed 12 online courses on concepts related to simulation.

Elsevier Faculty Development Conference, March 15-18, 2017

- Attended and distributed information to faculty.

Simulation Conference-Regions Hospital, October 21, 2016

- Attended and distributed information to faculty.

Strengths Finder Assessment and Workshop, January, 2014

- Attended the workshop to identify strengths and utilize information for teamwork, collaboration, leadership, and service to students and colleagues.

Elsevier Faculty Development Conference, January 2-5, 2013

- Attended and distributed information to St. Catherine's University faculty members.

Certified Nurse Educator Course, December, 2013

- Participated in the course and passed the certified nurse educator exam in March, 2014.
- CNE certification renewal in March 2024.

Formation of the Heart: Dignity, Solidarity & Charity, January 2012

- Attended the workshop to better understand Catholic social teaching and how to incorporate that into the classroom.

Creating an Inclusive Nursing Environment, January 2012

- Attended the workshop to better understand how to incorporate different perspectives in the classroom.

NIH Stroke Scale Assessment, May 2011

- Attended the class to become stroke certified on the stroke unit at St. John's Hospital.

Foundations of Telemetry, March 2010

- Attended the class to become telemetry certified at St. John's Hospital.

ECG Rhythm Interpretation, November 2009

- Attended the class to become telemetry certified at St. John's Hospital.

Professional Service

St. Catherine University, St. Paul, MN

- Committee on Students
  - Member 2011-May 2015
  - Co-chair 2012-May 2015
- Academic Advising
  - September 2012-May 2015
- Pinning Committee
  - Co-chair 2012-May 2015
  - Responsible for organizing biannual pinning ceremony for ADP nursing students.
- Educating Nurses Across Borders: Eritrea Project
  - March 2014-January 2015
  - Mission is to provide comprehensive nursing education for remote communities around the world. Funded by the Catholic Health Association of the United States.
  - Responsibilities include curriculum development, conversion of content to online format, participating in courses on instructional design, and collaboration with other healthcare professionals to develop an online curriculum for nuns providing nursing care in Eritrea, Africa.
- Curriculum Redesign Project for Associate Degree Nursing Program
  - 2011-2012 academic year
    - Focus on course NURS 7; 3rd level medical-surgical course
    - My focus was collaborating with other faculty members to develop NURS 7, including outcomes, course description and activities

University of Northwestern-St. Paul

- Faculty Personnel Committee
    - August 2021-present
    - Work with administration and faculty on issues of importance to individual faculty members.
    - Assist in developing, reviewing, and revising standards and procedures for promotion into professional ranks.
    - Review dossiers from applicants for promotion and make recommendations for promotion.
    - Review dossiers from applicants for extended contracts and make recommendations for extended contract.
    - Review grievance process.
    - Evaluate and make recommendations regarding faculty duties, working conditions, compensation and benefits.
    - Review the Faculty Handbook and submit recommendations, and submit suggested major changes to the administrative liaison and Faculty President to be presented to faculty-at-large.
- ATI Champion
    - January 2021 – present
    - Serve as advocate for student success and program improvement. Function as an on-staff guide.
    - Help coordinate training, point faculty in the right direction, and ensure everyone is getting the most out of ATI solutions.
    - Develop yearly success plan for the program.
    - Explore and preview products and resources.
    - Maintain open communication with representatives.
    - Coordinate the development, approval, implementation, and evaluation of a fair and equitable testing and remediation policy.
    - Evaluate student progress towards attainment of goals, identify at-risk students, refer students to appropriate resources for remediation and identify gaps in courses and program.
- ATI Taskforce Chair
    - November 2018-present
    - Chaired committee as liaison with ATI. Summarized recommendations for curriculum integration and presented findings to faculty.
- Nurse Mentor
    - Summer 2020
        - Worked with nursing education graduate student as a nurse preceptor/mentor in the

academic setting. Supervised and evaluated nursing education activities in the online classroom environment.
    - Spring 2018
        - Worked with nursing education graduate student as a nurse mentor in the academic setting. Supervised and evaluated nursing education activities, including clinical, simulation, and classroom teaching.
- UNWSP SON Scrub Run 5k
    - May 6, 2017
    - Organized, obtained sponsors, and supervised students to host a 5k fundraiser.
- Mentor Program
    - Fall 2017-present
    - Developed and oversaw a mentor program between cohorts as a way to provide support to incoming nursing students.
- Academic Technology Roundtable
    - Fall 2017-present
    - Served on University committee
    - Faculty representative for SON and university faculty
- Eagle Advising
    - 2016-present
    - Advise pre-nursing students upon acceptance to University of Northwestern
- Academic Advising
    - August 2016-present
    - Advise nursing students throughout program
- Simulation
    - February 2016-present
    - Developed and implemented a total of twelve, six-part unfolding simulation experiences for the advanced medical-surgical course.
    - Develop and implement simulation scenarios throughout curriculum as needed and in collaboration with other course/faculty.
- Global Leadership Summit
    - August 13-14, 2016
    - Attended and facilitated discussion between nursing students and faculty members.