Chapter 24
Patient Portal Acceptance by the Elderly:
Explained by the Elaboration Likelihood Model and Social Heuristics

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ABSTRACT

The motivating factors that influence patient portal acceptance among the elderly are not well understood. Using the social heuristic theory, the elaboration likelihood model, and the unified theory of acceptance and use of technology, this study proposes a model that examines the persuasive mechanisms for the elderly to use patient portals. An empirical study involving 117 subjects in the United States was used to test the proposed model. Using the partial least squares method, social power, and imitate-the-successful social heuristics were found to significantly influence patient portal acceptance among the elderly. These findings indicate that older people invest less effort cognitively elaborating when presented with technology acceptance decisions and accept influence from their higher status peers from their network. Imitate-the-majority heuristics and central route processing were not found to be significant, implying that older people are more inclined to take advice from sources, which they find credible and invest less cognitive effort in evaluating the complex phenomena.

INTRODUCTION

The healthcare industry is paying greater attention to improving patient outcomes through better provider-patient communication (Tang et al., 2013; Chrischilles et al., 2014). One such tool that is seeing greater utilization by healthcare providers is the patient portal. Patient portals are secure online websites that allow patients to access their personal health information, such as communicate summaries of recent visits, medications, immunizations, allergies, and lab results, from any location with an Internet connection (Krist et al., 2012; HealthIT.gov at https://www.healthit.gov/). More sophisticated patient portals are also capable of scheduling non-urgent appointments, downloading and submitting forms, processing prescription refills, accepting payments, and providing viewable educational material (Goldzweig et al., 2013). Patient portals have become a valuable tool for addressing the problem of rapidly aging populations in most countries (Bierman, 2012).

The use of electronic health records (EHR) is also on the rise. A 2014 study (Hsiao & Hing, 2014) shows that about 80% of office-based physicians in the US use EHRs, and a majority of them (69%) are committed to participate in the meaningful use incentive payment program available in the United States (Blumenthal & Tavenner, 2010). One of the Stage 2 Core Set objectives to achieve meaningful use is "provide patients the ability to view online, download, and transmit their health information" (HealthIT.gov). This means that healthcare providers with EHR systems are mandated to provide patients with access to personal health information over the Internet using a secure online portal. Several other countries are introducing similar initiatives as they try to both improve health outcomes and strive for efficiencies in their health systems (Wickramasinghe, Davey, & Tatnall, 2013).

Numerous studies examine patient portal acceptance and use (Goldzweig et al., 2013; Ancker et al., 2011; Smith et al., 2015; Sarkar et al., 2011; Goel et al., 2011; Jung et al., 2011; Weppner et al., 2010). Patients with chronic conditions are more likely to accept and use patient portals (Goldzweig et al., 2013; Ancker et al., 2011; Millard & Fintak, 2002). Patient age is negatively correlated with portal adoption and use, especially among older patients (Goel et al., 2011; Jung, Padman, Shevchik, et al., 2011; Weppner et al., 2010). Roughly 20% of the US population will be over the age of 65 by 2030 due to longer life spans and aging baby boomers (CDC, 2013), and it has been established that doctor visits and medical spending increase during the final years of life (Hogan, Lunney, Gabel, & Lynn, 2001). In fact, some studies indicate a quarter of an individual's medical spending occurs in their final year (Lubitz & Riley, 1993). Hence, one can conclude that while older patients could benefit most from patient portals, they are the least likely group to use them.

While there exists a number of empirical studies that examine various factors to better understand consumer health information technology (CHIT) acceptance and use, they rely primarily on technology acceptance theories (Klein, 2007). The variety of antecedents in the competing models show that older patients are less likely to accept CHIT by making use of online health information because of less comfort, efficacy, and control (Smith et al., 2015; Or & Karsh, 2009). However, one of these antecedents is social influence, also called subjective norm (Ajzen, 1991; Venkatesh & Davis, 2000; Moore & Benbasat, 1991), which remains unexplored in regards to older patients. According to Carley and Kaufer (1993), elderly patients are likely to conform to the attitudes, norms, and beliefs of those around them, meaning that social influence may be a motivator for the elderly to adopt and use patient portals. It is therefore prudent to examine social influence in more detail beyond the technology acceptance theories.

This empirical study argues that elderly patients' opinions about patient portal acceptance and use are influenced by those peers in their social environment that they respect. The conceptual model proposed

herein is based on institutional theory's driving forces as a precursor of the driving forces of behavioral intention and use behavior within the Unified Theory of Acceptance and Use of Technology (UTAUT) Model. The study further scrutinizes these driving forces with complementing theories and empirically tests the proposed model. Data collected from the elderly in various social settings provides the basis of our empirical evidence that social forces significantly influence older patients' use behavior toward patient portals when information and understanding of the technology is limited (Goel et al., 2011).

BACKGROUND

This chapter examines three complementary theories that pertain to the individual decision-making process. The focus is on the *social aspect* of these theories and how they can be combined into a comprehensive model to empirically evaluate the precursors of behavioral intention to use patient portals by the elderly. The three models are: 1) Unified Theory of Acceptance and Use of Technology (UTAUT) Model, 2) Elaboration Likelihood Model (ELM), and 3) Social Heuristics Hypothesis (SHH).

Unified Theory of Acceptance and Use of Technology (UTAUT)

Two major determinants drive technology acceptance and use: individual beliefs and social factors. "Subjective norm" is the term commonly used to describe the social pressure to engage in an activity (Fishbein & Ajzen, 1975). An individual develops beliefs shaped by a motivation to comply with the perception of how influential peers or superiors think they should or should not perform (Fishbein, 1980). In the technology domain, influencers in the form of respected peers or superiors are found to be a strong determinant in shaping beliefs (Mathieson, 1991; Taylor & Todd, 1995). This study does not explore or hypothesize any relationship among the individual beliefs or social factors, but rather approaches the social factors from the basis of institutional theory.

Technology use by individuals has been explored by examining the characteristics of both individuals and organizations. Institutional characteristics have been found to strongly influence technology use (Delone, 1988; Sanders & Courtney, 1985; Boynton, Zmud, & Jacobs, 1994). While institutional theory was developed and applied in an organizational context (Liang, Saraf, Hu, & Xue, 2007; Ang & Cummings, 1997; DiMaggio & Powell, 1983), organizations actually operate at the local, interpersonal relationships level through a network of individuals (Scott, 2001).

Social Heuristic Hypothesis

Heuristics are simplified models of reality, which help reduce the complexity of the decision-making process by building on previous experiences (Tversky & Kahneman, 1975). SHH is a guiding principle to help make decisions when part of the available information is ignored and only a few relevant predictors are considered. Some relevant information for decision making is ignored due to limited cognitive ability to process all relevant information or due to lack of motivation (Chen, Duckworth, & Chaiken, 1999). It is particularly applicable in this research study considering that patient portals are complex applications and elderly patients tend to ignore the technical aspect and rely on other characteristics and recommendations from within their social environment. For example, if most actors in an older patient's social environment use and recommend the patient portal, the individual will conform even

though not all aspects of the patient portal are understood. This type of social heuristic is called *imitate-the-majority* heuristic. Another type of social heuristic is the *imitate-the-successful.* The desire to consciously or unconsciously follow those who are more successful leads individuals to feel gratification due to the expectation that they will achieve a similar level of success. (Hertwig and Hoffrage, 2012; Pachur, Rieskamp, & Hertwig, 2005). In the context of this study, the elderly are likely to follow the example of those they respect and deem to be successful. One of the most pervasive social concepts is *social power,* due to its function within social heuristics for decision making (Keltner, Van Kleef, Chen et al., 2008). Social power is a result of a multitude of complex decision-influencing social factors such as formal/informal norms, social status, and resource/action dependencies (Castelfranchi, 2003). Those with higher social status, for example physicians, would likely have stronger influence on the elderly in the patient portal acceptance decision.

Elaboration Likelihood Model

ELM is concerned with the amount of cognitive efforts individuals are likely to invest when facing complex information for decision making (Petty & Cacioppo, 1979,1984). The goal is to understand the factors that influence the effort older patients are willing to invest into making a rational choice toward the acceptance of patient portals. The model is based on the premise that individuals can change their intention based on the source of information and the context in which it is presented (Petty & Cacioppo, 1986). Specifically, this model helps us understand how elderly users may choose to accept patient portals, even though they may have concerns, such as privacy or usability (Angst & Agarwal, 2009). Originally, this model was developed in the consumer behavior domain, and recently has been used to explain individuals' intention to respond to online advertisements (Flavian, 2010) and electronic health record acceptance (Angst & Agarwal, 2009).

When elderly individuals are presented with new information, such as patient portal details, cognitive elaboration is required to make the decision about acceptance (Petty & Cacioppo, 1986). Cognitive elaboration refers to supplementing one's pre-existing knowledge structure through the integration of new information (Anderson, 1983). New beliefs may be formed or previously established beliefs changed by the source and credibility of the new information (Petty & Wegener, 1999). Forming a belief as a response to the information is greatly dependent on the extent to which individuals elaborate on the new information, cognitively processing and giving consideration (Tam & Ho, 2005). Those who exhibit a high degree of elaboration will experience a *central route of persuasion*, while those who ignore the message content and exhibit a low degree of elaboration experience a *peripheral route of persuasion* (Petty & Cacioppo, 1986). The latter situation results in use behavior decisions based on simple criteria and cues such as the attractiveness of the person who conveys the information rather than the content itself. Nonexperts and those with no prior experience rely on the peripheral route of decision making and follow the social force rather than make a well-thought out and considered decision (Lord, Lee, * Sauer 1995; Petty & Cacioppo, 1981).

In the context of elderly patients facing the decision of patient portal acceptance, they will either consider the portal's design features or follow guidance from their respected peers. The former is expected by those with prior experience or having the cognitive ability to evaluate the portal for their needs. The latter is likely followed by those elderly patients who ignore the design features and follow the advice or example of their peers from their social environment.

Hence, this study will empirically investigate the effect of social factors on patient portal use behavior by the elderly, and will expand the theory's applicability through theoretical and managerial implications.

INFLUENCES ON PATIENT PORTAL USE BY THE ELDERLY

In order to better account for the ways in which institutional forces influence patient portal use behavior by the elderly, this study presents the conceptual model shown in Figure 1, based on institutional theory (DiMaggio & Powell, 1983), SHH (Hertwig & Hoffrage, 2012), ELM (Petty & Cacioppo, 1984) and the UTAUT model (Venkatesh, Morris, Davis, & Davis, 2003). Although social forces are a major precursor in almost all major technology acceptance models, none of them have investigated social forces on a more granular level (Bozan, Davey, & Parker, 2015). Early studies of institutional theory identified three mechanisms, coercive pressure, normative pressure, and mimetic pressure, which promote structure and process similarities (DiMaggio & Powell, 1983; Scott, 2001). The Social Heuristic Hypothesis similarly groups the social influences on behavioral intention to accept the patient portal. The Elaboration Likelihood Model groups the social influences into central and peripheral route processing, where greater prior knowledge is expected to allow for greater elaboration (Alba & Hutchinson, 1987). This study empirically tests the model and examines which elaboration route older individuals favor when facing the decision to accept a patient portal. The moderating effect of prior knowledge of patient portals is also investigated.

Figure 1. Conceptual Model
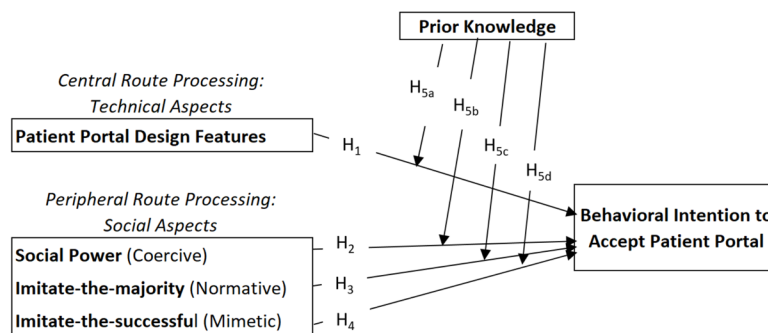
MODEL COMPONENTS

Behavior Intention to Accept Patient Portal

An individual's behavioral intention refers to the individual's decision to perform a specific behavior in the future (Chatzoglu et al., 2009). For the purposes of this study, use behavior intention to accept patient portal is defined as the degree to which a user intends to regularly use the patient portal for the purposes for which it is designed. The most common dependent variables in technology acceptance literature are actual use, intention to use, and behavior. Behavior is defined as a specific or general action whose prediction is of interest in a particular model (Ajzen & Driver, 1991; Ajzen & Fishbein,

1980). In the "competing" technology acceptance models, the dependent variable is often preceded by the subjective norm, which is an individual's perception of influencers' approval or disapproval of the specific or general target behavior. The antecedents of use behavior are often linked to the subjective norm or social influence, hence our choice for the dependent variable of use behavior in our proposed conceptual model.

Central Route

Patient Portal Design Features

System characteristics are a major consideration when individuals decide to adopt technology for long term use. The main technology acceptance models include system characteristics such as usability, usefulness, effort it takes to learn (Ajzen & Fishbein, 1980), and other advanced characteristics such as interconnectivity and connectedness (Liu, Wu, Sun, 2014). Such characteristics are considered to be difficult to evaluate for novice users and are often overlooked during an acceptance decision (Lin, Shih, & Sher, 2007). Therefore, it takes more effort and cognitive ability to evaluate the system characteristics of a patient portal, especially for elderly users. This evaluation process is also known as central route processing by ELM and refers to a higher degree of user involvement during the acceptance process, leading to the first hypothesis:

H1: Higher level of elaboration will positively influence behavioral intention to accept patient portals among the elderly.

Peripheral Route

Social Power / Coercive Pressure

Weber (1962) defines social power as "the probability that an actor within a social relationship is in the position of doing as he wills not withstanding resistance, independently over the basis on which this probability stands". Most definitions agree on the concept that individuals with high social power possess the potential to exert a force toward change in another person. In a social environment, such actors are usually superiors or someone having formal authority such as doctors over patients, or teachers over students.

Coercive pressure, the institutionalized form of social power, includes both the formal and informal pressures on an individual (social actor) by a more powerful individual (actor) to adopt the same practices, behaviors, or attitudes (DiMaggio & Powell, 1983). Formal or informal coercive pressure at the organizational level can be generated by a variety of sources, such as regulatory agencies, customers, suppliers, and other powerful actors (Teo, Wei, & Benbasat, 2003).

In the context of healthcare, regulatory pressure often impacts many facets of care at the individual level. Given its focus on patient portal acceptance, this study investigates the pressure that providers may put on patients to use patient portals. For example, physicians are powerful actors in the physician-patient relationship, and may informally pressure patients to access their portal for health-related communications in order to increase the effectiveness of care. Hence, it is hypothesized:H2: Higher degree of perceived social power will positively influence behavioral intention to accept patient portals among the elderly.

Imitate-the-Majority / Normative Pressure

Individuals with limited insight on information presented to them will more likely imitate the behavior of the majority of individuals in their reference group (Boyd & Richerson, 2005). For example, if more people are waiting for a service, then the more likely it is that uninformed agents will prefer that service (Raz & Ert, 2008). Very simple decision criteria are the driving factor in such situations. Elderly individuals may not have the cognitive ability to consider and process all relevant information to properly evaluate patient portals and are more likely to agree with its adoption even though they initially would not consider it. The peripheral route of persuasion is likely to change elderly individuals' minds about patient portals if they decide to follow the majority of their peers who choose to accept patient portals.

Institutional theory posits that if an action, behavior, or belief is exhibited by an adequately large group of actors, a social actor is more likely to copy that action. Copying is not mandated and may not even be conscious, but rather becomes the norm, the "right" way (Harcourt, Lam, & Harcourt, 2005; Johnson, Dowd, & Ridgeway, 2006). When normative pressure acts as a social factor for adopting a behavior or belief, it can result in discord if peers whose opinions are valued are already using an innovation (DiMaggio & Powell, 1983; Van den Bulte & Lilien, 2001). Therefore, following the behavior, using the innovation, becomes an obvious and "right" choice for the social actor.

Older patients supported by a large network may often share details about their physical health with each other. During such discussions, if a respected peer mentions the use of patient portals, other individuals are more likely to consider trying one out. This effect has been described generally by Abrahamson (1991) as theories of fads. Hence, it is posited:

H3: Higher degree of perceived imitate-the-majority social heuristic will positively influence behavioral intention to accept patient portals among the elderly.

Imitate-the-Successful / Mimetic Pressure

Individuals who rely on social heuristics may choose to follow the advice of a successful person in their reference group. Celebrity endorsements or media influence fall into this category as source credibility is often ignored under such social heuristic scenarios (Boyd et al., 2005).

DiMaggio and Powell (1983) proposed mimetic pressure as the conscious and voluntary act of copying the behaviors of those with higher status and success. Such copying behavior is driven by the belief that the actions of more successful and respected actors result in positive outcomes. The assumption is that copying the behavior of respected members of a network is safer than experimenting new, "untested" behavior (Teo, Wei, & Benbasat, 2003). Seniors are often more aware of their health status because they more actively seek information about their health (Bennenbroek, Buunk, van der Zee, & Grol, 2002). If a trusted friend mentions their patient portal as being a reliable source of information, those who have not adopted a portal are more likely to try using it. Therefore, it is hypothesized:

H4: Higher degree of perceived imitate-the-successful social heuristic will positively influence behavioral intention to accept patient portals among the elderly.

Moderating Effect of Prior Knowledge

Petty and Cacioppo (1979) empirically found that individuals with high involvement with an issue they were investigating used enhanced information processing in the central route. A higher degree of expertise or significant prior experience with the technology moderate the central route processing to behavioral intention in technology acceptance (Bhattacherjee & Sanford, 2006). The current investigation explores the degree to which prior knowledge moderates the relationship of patient portal design features (the central route, e.g. usability, interconnectedness, privacy, security… etc.) and social heuristics (the peripheral route) with our dependent variable of behavioral intention to accept patient portals among the elderly. The findings are expected to be in line with the literature that an elderly user's prior knowledge of patient portals will impact their behavioral intention to accept a patient portal and more likely consider the central route to evaluate patient portals. This expectation is reflected in the following hypotheses:

H_{5a-d}: Prior knowledge of patient portal will attenuate the relationship of patient portal design features (H5a), social power (H5b), imitate-the majority heuristic (H5c), and imitate-the-successful heuristic (H5d) with behavioral intention to accept patient portal among the elderly.

RESEARCH METHODOLOGIES

Measurement

Questionnaire items were adopted from the literature for social forces (Liang et al., 2007; Teo, Wei, & Benbasat, 2003; Jan, Lu, & Chou, 2012) and use behavior (Venkatesh et al., 2003; Liu, Wu, & Sun, 2014). Social factors constructs were measured by six indicators, while the dependent variable was measured by three indicators. The moderator and system design feature items were adopted from Bhattacherjee & Sanford (2009), Khalfan (2004), Smith et al. (2007), and Dhillon & Blackhouse (2000). (Please see Appendix for the questionnaire items and indicators.)

Data Collection

Convenience and snowball sampling were used for data collection. Several assisted living establishments were contacted and asked to promote our survey among their residents. The survey was also disseminated among a network of elderly individuals who were asked to share it with their contacts. 117 fully completed questionnaires were returned prior to data analysis.

Control Variables

Demographic variables, such as age and gender, have been found to have significant effect on social behavior studies (Mazman, 2011; Dabaj, 2009). Morris and Venkatesh (2000) found that older individuals are more susceptible to social influences, but a study by Botwinick (1973) indicates they are more cautious before they decide on an action. Women are found to be more perceptive regarding others' opinions than men (Venkatesh et al., 2003). Our study also controls for residence, since dwelling in an assisted living environment may have an effect on social factors as opposed to those who are somewhat

more isolated in their residence (Cattan, White, Bond, & Learmouth, 2005; Nicholson, 2008). In addition, technical efficacy (Chaffin & Harlow, 2005; Purdie & Boulton-Lewis, 2003) and attitude toward self-health (Karwalajtys et al., 2005) were also examined for their effect on use behavior.

DATA ANALYSIS AND RESULTS

Test of Measurement Model

The Partial Least Squares (PLS) statistical method was used for scales validity assessment and hypotheses testing because it provides more flexibility with sample size and residual distribution (Anderson & Gerbing,1988; Chin, Marcolin, &Newsted, 2003; Chin, 1998). Using the most recent version of Smart-PLS (version 3.2.8 for Windows 64 bit), the relationships between constructs (path coefficients) and the predictive power of the dependent variable – R-squared (Chin, 1998) is examined.

Common Method Bias

The study checked for common method bias, which occurs when the independent and dependent variables are collected from the same respondents at the same time (Podsakoff et al. 2003). The exploratory factor analysis on the items in the measurement model revealed four items with eigenvalues > 1.0 with 70.2% total variance accounted for. 38.7% variance was captured by the first factor, below the recommended 50% mark (Schriesheim, 1979).

Content and Construct Validity

The survey items were adopted from previous studies (see Appendix A), therefore content validity for these items' constructs have been ascertained. The multi-item constructs were assessed by confirmatory factor analysis, which is well suited for validated constructs (Gefen & Straub, 2005). The measurement items on their latent constructs exhibited significantly higher loading than on other constructs, and hence satisfies discriminant validity. The discriminant validity (inter-construct correlations) is also satisfied as the correlation between any constructs is lower than the square root of average variance extracted (AVE) shared by items in a construct (Fornell & Larcker, 1981) and exceeds the recommended 0.5 threshold.

Construct validity is the degree to which a test measures what it claims to measure for the reflective constructs. Cronbach's alpha values ranged from 0.631 for patient portal design features to 0.914 for imitate-the-successful constructs and fall within the acceptable range of > 0.5 (Rivard & Huff, 1988). The composite reliability is also greater than the recommended 0.5 (Forner & Larcker, 1981) for all constructs, and therefore the instrument exhibits satisfactory construct validity.

Factor loadings of less than 0.7 have been removed to strengthen the item reliability. Since reflective indicators are interchangeable (meaning they ask the same thing), some can be omitted and PLS is flexible and reliable even with a low number of factors per latent variables (Wold, 1985), therefore the factors loaded less than 0.7 can be safely removed. Construct reliability was tested by Cronbach's alpha and the results were above the recommended 0.7 value (Nunnaly, 1978). Convergent validity values, in terms of average variance extracted (AVE), were above the recommended 0.5 value (Fornell & Larcker, 1981).

Test of Structural Model

The study used Structural Equation Modeling (SEM) with component-based PLS software, which is an appropriate choice for this early stage of model development (Chin et al., 2003; Anderson & Gerbing, 1988).

Our measurement model was tested against the hypotheses through path coefficients (relationship strength between IV and DV) and R-squared values to measure the predictive power of the model (Barclay, Higgins, & Thomson, 1995). T-statistics were calculated using the bootstrapping technique in SmartPLS.

The (H_1) path coefficients from design features to behavioral intention to accept patient portal (b=0.216, p<0.05) and (H_2) from social power to behavioral intention to accept patient portal (b = 0.174, p<0.01) supported hypotheses 1 and 2 respectively, indicating that design features and social power have a significant effect on the behavioral intention to accept patient portals among the elderly. However, (H_3) imitate-the-majority showed no significant impact on behavioral intention to accept patient portals (b=-0.039, NS) and (H_4) imitate-the-successful had a borderline significance (0.186, p=0.0546) on behavioral intention to accept patient portals. Table 2. summarizes the hypotheses and their path coefficients along with t-statistics and moderating effects. Figure 2 displays the measurement model.

The research model explains 31% of the variance of social forces and technical design on behavioral intention to accept patient portals as indicated by the r-squared value. This magnitude is somewhat expected as technology adoption and use behavior is a cumbersome subject with numerous antecedents. This study focuses on social factors and patient portal design features familiar to only small number of elderly users. Our model intentionally omitted other, well established constructs. Therefore, the predictive power of the model was expected to be on the lower side.

Control variables showed an insignificant effect on patient portal use behavior with path coefficients of b= 0.143, -0.209, -0.195, 0.703 respectively for attitude toward self-health, gender, resident type, and technical affinity respectively.

*Table 2. Structural model analysis results including prior knowledge (moderator)*

Relational Path	Direct Path		Moderation of Prior Knowledge	
	B-coefficient	t-statistics (sig.)	B-coefficient	t-statistics (sig.)
H_1: Design Features → Behavioral Intention H_{5a}: Moderation effect of Prior Knowledge	0.216*	2.189	-0.141*	2.419
H_2: Social Power → Behavioral Intention H_{5b}: Moderation effect of Prior Knowledge	0.174**	3.194	0.191[ns]	1.081
H_3: Imitate-the-majority → Behavioral Intention H_{5c}: Moderation effect of Prior Knowledge	-0.039[ns]	-0.916	0.061**	2.619
H_4: Imitate-the-successful → Behavioral Intention H_{5d}: Moderation effect of Prior Knowledge	0.186†	1.941	-0.172**	2.637

** Significant at the 0.01 level; * significant at the 0.05 level; † significant at the 0.10 level; ns not significant. Two-tailed hypotheses

Figure 2. Measurement model
*** Significant at the 0.01 level; * significant at the 0.05 level; † significant at the 0.10 level; ns not significant. Two-tailed hypotheses*
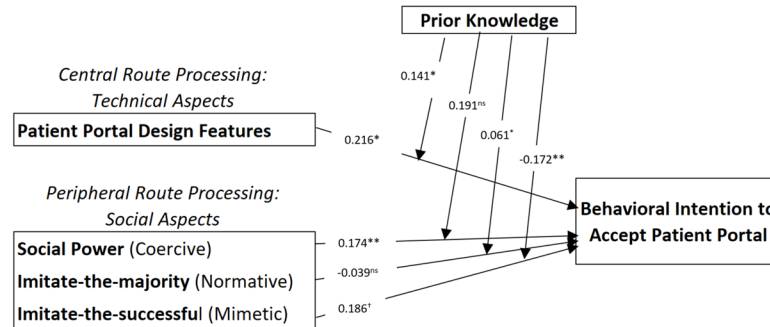
DISCUSSION

This study empirically tested our proposed model to study the elderly individuals' elaboration route to patient portal acceptance with respect to prior knowledge of patient portal.

The study revealed findings that contribute to theory and practice. First, it extended understanding of the *social norm* construct of the commonly used UTAUT model. The additional granularity sheds light on the social force component as the strongest indicator of patient portal acceptance. In the context of this study it can be concluded that new technology acceptance is strongly encouraged by those with more informal authority over the elderly users. This authority usually comes from the healthcare provider and trusted family members based on the survey responses. This indicates the importance of proper guidance from these sources as the elderly are more likely to be influenced by their suggestions to accept patient portal. This provides additional insight on the role of physicians (Peck & Conner, 2011; Lipworth et al., 2013). The authors recommend that healthcare providers are formally trained and equipped with resources to guide the elderly in patient portal acceptance. Similarly, family members should understand the role they represent in the technology acceptance decision of their older family members and provide support and guidance as needed. This significant finding leads us to the recommendation that healthcare providers should consistently provide guidance via patient portal suggestions and equip providers with audience-appropriate handouts and resources. Similarly, our findings suggest that family members need to realize the influencing power they have in their elderly relatives' patient portal adoption decisions, which is reflected in earlier literature (Lorenzen-Huber et al., 2011; Courtney et al., 2008)

Second, the non-significant path coefficient of *imitate-the-majority* to *behavioral intention to accept patient portal* indicates that elderly individuals are not concerned about what the majority of their peers do in terms of patient portal adoption. It may be due to the fact that there are many other variables impacting this decision, for example their previous experience with technology, specifically, with patient portals. The not strong yet statistically significant path coefficient of the moderating effect of prior knowledge suggests this conclusion. Elderly individuals respect their trusted and successful peers and follow their example (Bozan, Davey, Parker, 2017). However, our current study shows that having prior experience with a patient portal diminishes the significance of peers, in both the *imitate-the-majority* and *imitate-the-successful*. In fact, the significant and strong *negative* moderating effect of prior knowledge indicates that the more prior experience an elderly individual has, the less likely will they follow their

successful peers' example in terms of patient portal adoption decision and avoid fads and bandwagon effects (Abrahamson, 1991; Abrahamson & Rosenkopf, 1993).

The impact of *patient portal design features* is statistically significant and exhibits strong positive correlation with *behavioral intention to accept patient portal.* The *prior knowledge* moderating effect also displays strong positive correlation. This indicates that the elderly find the patient portal design features important in their decisions to accept this technology. Having prior experience with patient portals encourages elderly individuals to elaborate more on the acceptance decision and consider all relevant information by taking the central route of elaboration.

The findings of our study highlight the importance of informal authority, the transparency of patient portal design features, and prior experience with patient portals. Those elderly individuals who prefer the peripheral route of elaboration will more likely follow the guidance of those who have informal authority over them such as caregivers, providers, and trusted and respected family members. Those elderly who further elaborate rely more on their prior experience and value the transparency of patient portal features such as confidentiality, integrity, auditability, interconnectivity, and security (Appendix A.). Having this information available would increase their understanding and the elderly would more likely intend to accept patient portals.

The low effects of the control variables are also important findings as a more general approach is sufficient to reach the elderly to the same extent, aside from previous experience with patient portals.

FUTURE RESEARCH AND DIRECTIONS

While this study makes a contribution to the relevant literature and provides valuable directions, it has limitations that may affect the generalizability of the findings. Data collection followed convenience and snowball sampling. Geographical distribution was not tracked and the results may only represent that of a particular area. Also, the subjects were mostly contacted through email and social media and the survey was conducted online, in effect requiring that every respondent have a basic level of familiarity with the Internet and computers.

It is important to keep in mind that most of the variables (69%) in use behavior remain unexplained by the variance in the measurement model, which implies that there could be a number of other factors that may influence the decision to adopt patient portals by the elderly. This provides the opportunity for future research to enhance the model to examine other important social factors that may strengthen the predictive power of the model.

It might be informative to investigate a similar model with behavioral intention to accept patient portals as the mediator between social factors and design features of the patient portal and actual portal use, similar to UTAUT. Since this study investigates social factors on a more granular level, one may wonder whether or not all three social heuristics are significant with the moderator or only with the intention to accept patient portal as the dependent variable.

CONCLUSION

This study examined the effect of social heuristics and patient portal design features on patient portal adoption intention among the elderly. The conceptual model was constructed on the social heuristics,

elaboration likelihood model, and UTAUT. The predictive indicators were measured by considering prior knowledge and experience with patient portals as moderator. With the adoption intention of patient portals by the elderly serving as the dependent variable, this study empirically tested the strength of the effects of four independent variables, namely 1) patient portal design features, 2) social forces, 3) imitate-the-majority, and 4) imitate-the-successful.

This study serves to extend the literature on the patient portal acceptance decision by the elderly, which has not been previously investigated with respect to social heuristics and elaboration likelihood model. The application of these models along with UTAUT as the pillar of our model, accompanied by significant findings, adds to the growing literature on the adoption of information and communication technologies in healthcare by the elderly, specifically the patient portal. Additional factors have been identified for patient portal adoption by the elderly population, and promise to lead to future research that can reveal additional important guiding factors that may strengthen the predictive power of the model.

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KEY TERMS AND DEFINITIONS

Elaboration Likelihood Model (ELM): In the context of our study, ELM is concerned with the amount of cognitive effort the elderly are willing to invest when facing complex technical acceptance decision. Our study investigates whether prior technical knowledge and the social context has an impact on behavioral intention to accept patient portal.

Elderly Citizens: People over the age of 65 years.

Health IT Adoption: Healthcare information technology (Health IT) is the use of computer applications to record, store, protect, retrieve, and transfer clinical, administrative, and financial information

electronically within and among various health care settings. Adoption of Health IT for the purposes of this research is defined as the process from being aware of the technology to the effective and efficient usage for the intended purpose.

Health IT Usage: Accessing personal health information by the intended recipient through electronic medium and application designed for informational or decision-making reason purpose.

Institutional Theory: In this paper, Institutional Theory is defined as the guidelines for social behavior in the form of accepted structures, schemas, rules, norms, and routines influenced by other members of the collective network of actors.

Social Heuristics: In the context of this study, we define social heuristics as the decision making and behavioral guiding principles followed by the elderly. For example, ignoring certain complex aspects of technology or relying on more knowledgeable peers is an example of social heuristics as a tool of bounded rationality among the elderly.

Unified Theory of Acceptance and Use of Technology (UTAUT): The UTAUT model explains technology use intention and behavior with numerous constructs, including social influence.

Patient Portal Acceptance by the Elderly

APPENDIX

Questionnaire Items

(Strongly Disagree =1, Strongly Agree =7)
    Social Forces / Coercive Pressure (adopted from Teo, et al., 2003; Liang, et al., 2007; Jan, et al., 2012)

CP-1: I trust the diagnosis and treatment my physician prescribes.

CP-2: My physician strongly encourages me to use and understand information on an Online Personal Health Information website.

CP-3: I understand that information related to my condition can be found on an Online Personal Health Information website.

CP-4: Interaction with my physician requires me to access an Online Personal Health Information website.

CP-5: Is your physician the only person who controls your treatment? If not who else do you go to for help and how much help do you get from them? (Do not use an actual name, rather please describe the person's role or your relation to this person)

CP-6: Who is the most important person you go to for health advice outside your physician and why do you trust their advice? (Do not use an actual name, rather please describe the person's role or your relation to this person)

    Imitate-the-majority / Normative Pressure (adopted from Teo, et al., 2003; Liang, et al., 2007; Jan, et al., 2012)

NP-1: I am aware that some of my close family or friends are regularly accessing their Online Personal Health Information website.

NP-2: Those who use their Online Personal Health Information website would help me to access an Online Personal Health Information website if I asked for it.

NP-3: People around me believe that it is beneficial to access their Online Personal Health Information website.

NP-4: I feel that I would be better informed if I used an Online Personal Health Information website.

NP-5: What new technology have you used in the last few years? E.g. do you use the internet, do you have a tablet or portable computer, do you use your mobile phone for more than phone calls?

    Imitate-the-successful / Mimetic Pressure (adopted from Teo, et al., 2003; Liang, et al., 2007; Jan, et al., 2012)

MP-1: My close friends who regularly access their Online Personal Health Information website have benefited from it.

MP-2: My close friends who regularly access their Online Personal Health Information website are more respected for taking charge of their health.

MP-3: I feel that I would be favorably perceived if I used an Online Personal Health Information website.

MP-4: I feel motivated to find more information about my condition.

MP-5: If everyone near me were to use an Online Personal Health Information website, it would influence me to try it.

<u>Behavior Intention to adopt patient portal</u> (adopted from Venkatesh, et al., 2003, Liu, et al., 2010)

BI-1: I plan to access an Online Personal Health Information website in the next year for the first time.
BI-2: I plan to access an Online Personal Health Information website regularly.
BI-3: I plan to continue using an Online Personal Health Information website.

<u>Prior Knowledge</u> (adopted from Bhattacherjee & Sanford, 2009 and modified. All items were based on a 7 point Likert scale)

PK-1: How knowledgeable are you regarding patient portals? novice….expert
PK-2: Have you previously discussed patient portal with someone who is knowledgeable about this topic? never….often (new item).
PK-3: Have you previously read news coverage regarding patient portals? never….often (new item).

<u>Patient Portal Design Features</u> (adopted from Khalfan, 2004; Smith et al. 2007; Dhillon & Backhouse 2000;

DF-1: Confidentiality is the disclosure of information only to authorized persons, entities, and processes in the authorized method only at the authorized time. Would you address confidentiality concerns prior to using patient portals?
DF-2: Integrity is the preservation of accuracy and completeness of information or prevention of unauthorized modification. Would you address integritity concerns prior to using patient portals?
DF-3: Auditability is the ability of an EHR system to be able to trace a series of actions and processes performed by one or more users leading to a change in the input, process and/or output. Would you address auditability concerns prior to using patient portals?
DF-4: Systems interconnectivity offers benefits such as reduced operating cost, improved efficiency, greater functionality, and centralized data access. Would you address interconnectivity concerns prior to using patient portals?
DF-5: System security ensures unauthorized access to the patient portal. Would you address security concerns prior to using patient portals?

Patient Portal Acceptance by the Elderly

Controls

Q1: I live in:
    My own home
    A retirement village
    In a nursing home

Q2: I am very good with technology:
    Strongly Disagree
    Disagree
    Neither Agree nor Disagree
    Agree
    Strongly Agree

Q3: My age is:
    Under 65
    Over 65

Q4: I am:
    Male
    Female

Q5: Having good information about the state of my health and any conditions is important to me.
    Strongly Disagree
    Disagree
    Neither Agree nor Disagree
    Agree
    Strongly Agree

Q6: I have used the internet for health advice.
    Strongly Disagree
    Disagree
    Neither Agree nor Disagree
    Agree
    Strongly Agree

Q7: I ask other people to find health advice on the internet.
    Strongly Disagree
    Disagree
    Neither Agree nor Disagree
    Agree
    Strongly Agree