

A Closer Look at the Social Influence Construct in the UTAUT model: An Institutional Theory Based Approach to Investigate Health IT Adoption Patterns of the Elderly

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Abstract

This study aims to investigate and improve understanding of the social influence construct in the Unified Theory of Acceptance and Use of Technology (UTAUT) model that influence patient portal use behavior among the elderly. Underpinned by institutional theory, our proposed model examines the three social environmental factors of normative, mimetic, and coercive forces within the health Information Technology (HIT) context. The proposed model was tested using an empirical study of 117 subjects in the United States. Using the partial least squares method, the study found empirical support that normative and mimetic pressures significantly influence patient portal use behavior when mediated by behavioral intention. Coercive pressure is found to have a direct effect on patient portal use behavior when not mediated by behavioral intention. These findings signal that social influences just partially influence behavioral intention and in part they directly influence the use behavior. A revised UTAUT model social influence section is introduced.

1. Introduction

Improving patient outcomes through better provider-patient communication [1, 2] is gaining attention in the healthcare industry. Healthcare providers are increasingly relying on patient portals, defined as secure online websites that give patients access to their personal health information from anywhere with an Internet connection [3]. In the Encyclopedia of Portal Technologies Davey defines a portal operationally as “a portal provides a single door to information” [80]. Patient portals are designed to communicate summaries of recent visits, medications, immunizations, allergies, and lab results (HealthiT.gov). Some patient portals are also capable of handling prescription refills, scheduling non-urgent appointments, accepting payments, downloading and completing forms, and viewing educational material [4]. These uses of technology are critical in addressing

the problem of rapidly aging populations in most countries [5].

Electronic health records (EHR) use is on the rise. About 80% of office-based physicians make use of EHRs [6], and most of them (70%) are committed to participate in the “meaningful use” based monetary incentives offered in the United States [7]. One of the Stage 2 Core Set objectives for meaningful use is to “provide patients the ability to view online, download, and transmit their health information”. Therefore, providers with EHR systems are mandated to provide their patients with access to their own health information over the Internet through a secure online portal. Similar initiatives are being introduced in several other countries as they try to both improve health outcomes and strive for efficiencies in their health systems [8].

Patient portal acceptance and use has been the basis of numerous studies [4, 9-14]. Ancker et al. (2011) investigated potential differences in patient portal adoption and use based on patients' socioeconomic and clinical characteristics [15]. More specifically, a low usage level was found to be associated with characteristics such as health literacy [10], education [4, 10, 11], those within ethnic and racial sub-groups [10, 11, 12], and the elderly [10, 12, 13, 14]. The existence of chronic conditions was found to be one of the factors that potentially affected the rate of acceptance and use of patient portals [4, 9, 16]. Contrary to this, patient age is found to be negatively correlated with patient portal adoption and use, especially among older patients [12-14]. Approximately 20% of the US population will be over the age of 65 years in the next decade due to an increase in average lifespan. It is also known that doctor visits and medical spending increase during the final years of life [17]; some studies find a quarter of an individual's medical spending happens in the last-year-of-life [18]. Therefore, the older patient population is the group who would get the most use

out of patient portals, yet they are less likely to use them [12-14].

A number of empirical studies examined the factors to better understand consumer health information technology (CHIT) acceptance and use, and these studies primarily on technology acceptance theories [19]. The variety of antecedents in the competing models concluded that older patients are less likely to accept CHIT and make use of online health information due to less comfort, efficacy, and control [10, 20]. However, one of these antecedents is social influence, also called subjective norm [21-23], and has not been explored in regards to older patients. Other health information technology (HIT) acceptance contexts, found that clinicians' use of handheld computers was significantly affected by colleagues and supervisors (who are important to them) perception to the same technology [24]. Chen et al. (2007) [25] also concluded that social factors impact radio frequency identification (RFID) technology acceptance in the emergency rooms. Potential barriers for patient portal adoption and use among the elderly has been studied through portal usability [15, 26]. Elderly patients are likely to conform to the attitudes, norms, and beliefs those around them [27]. Therefore social influence, which may motivate the elderly to adopt and use a patient portal, should be studied in more detail beyond the technology acceptance theories.

In this empirical study, we argue that elderly patients form a belief about patient portal acceptance and use based on the influence of those peers they respect. We propose a conceptual model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) interwoven with institutional theory's driving forces in the social influence construct. Data collected from the elderly in different social settings provides the basis of our empirical evidence that normative, coercive, and mimetic forces significantly impact older patients' use behavior toward a patient portal. The findings may help to understand the driving forces that influence the patient portal use behavior among the elderly. This could lead to wider adoption rate and increased communication between providers and patients.

In the next section we provide an overview of the theoretical background and the conceptual model development, followed by the methodology and data analysis. Finally, the results are discussed and managerial and theoretical implications are presented, followed by limitations, further directions, and conclusions.

2. Theoretical background and conceptual model

2.1. Theoretical background

An individual's beliefs about technology acceptance and use are driven by two major determinants: individual beliefs and social factors. The social pressure to engage in an activity is referred to as subjective norm [28]. Driven by the motivation to comply, an individual develops beliefs about the extent to which other people who are important to them think they should or should not perform [29]. In the technology domain, influence of peers and superiors is found to be a strong determinant of this belief [30, 31]. This study is not exploring or hypothesizing any relationship among the individual beliefs or social factors; rather it is approaching the social influence construct within the UTAUT model from the basis of institutional theory.

2.1.1. UTAUT Model

The UTAUT model [32] is comprises elements from eight competing models and theories to integrate the existing research at the time to identify the antecedents of intention and usage of information technology. The authors empirically proved that UTAUT has the highest explain power of intention (about 70%) and use (about 50%) of technology.

UTAUT, shown in Figure 1., includes three direct determinants of behavioral intention to use a technology. Namely, performance expectancy, effort expectancy, and social influence. The two direct determinants of technology use are behavioral intention and facilitating conditions. The four moderators affecting the above relationships are gender, age, experience, and voluntariness of use.

The determinants of behavioral intention constructs can be divided to individual and social factors. The individual factors - performance expectancy, effort expectancy - are found to greatly vary among users and the moderators play an important role in their relationships with the behavioral intention. The social factors - social influence - are more uniform aspects that affect the behavioral intention. Studies that applied UTAUT in specific geographic, cultural or contextual setting found that the moderators played a less significant role, especially with the social influence construct [33, 34].

This study concentrates on the social factors and seeks to further understand its driving forces beyond the definition by the authors: "social influence is the extent to which consumers perceive that

important others (e.g., family and friends) believe they should use a particular technology”[35].

In the healthcare context, social influence factor has been investigated in the adaption literature mainly through HIT acceptance [24, 25] and the electronic health records (EHR) and electronic medical records (EMR) acceptance among providers (e.g. [35, 36, 37, 38]).

2.1.2. Institutional Theory

Technology use among individuals has been explored through the characteristics of individuals and organizations. These studies found that institutional characteristics show strong influence on technology use [39-41]. Institutional theory has been developed and applied in the organizational context [42-44], however, organizations operate at the local, interpersonal relationships level with a network of individuals [45]. The first studies of institutional theory identified three mechanisms that promote structure and process similarities, namely, coercive, normative, and mimetic [44,45].

Institutional theory deals with two major aspects behavioral intentions: the creation of formal structures and the incorporation of institutionalized practices. These aspects provide proper foundation for our study where we consider the healthcare providers’ encouragement to use patient portal the formal structure, which is the foundation for the rules and beliefs systems that support compliance [46]. While healthcare providers’ encouragement to use patient portal symbolizes formal structure, following respected peers’ advice and example symbolizes the institutionalization of practice.

These structures and practices support the purposes of our study through the understanding of social factors in the UTAUT model. The three mechanisms together guide the scope from the formal pressures of the governing force, such as the respected providers’ advice to the more informal pressures of peer level influences.

There is a rich literature on subjective norms, which is the social influence component in many technology acceptance models, as a significant determinant of behavioral intention to use a technology in the healthcare context (e.g. [47, 48, 49]).

Therefore, our study will empirically investigate the effect of social factors on patient portal use by the elderly based on the institutional theory’s three forces. This study will expand the theory’s applicability through theoretical and practical implications.

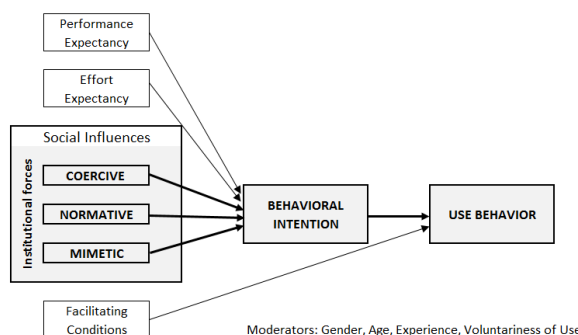
2.2. Conceptual model and hypotheses

This study proposes a conceptual model (Figure 1.) based on the UTAUT model and drawn upon the

institutional theory [44]. The proposed conceptual model seeks to better understand how the institutional forces influence patient portal use behavior among the elderly.

Figure 1: Conceptual Model

2.2.1. Behavioral Intention and Use Behavior



Behavioral intention and use behavior are two of the most widely examined variables in the literature of technology acceptance. Behavioral intention represents the user’s intention and motivational factors that influence the technology usage behavior [35, 36]. Also, behavioral intention is the indicator on the effort a user puts forth in technology usage [21].

The actual use of a technology is the outcome variable in the UTAUT model and is anticipated to be directly determined by the intention to use a technology. For the purposes of this study, we do not consider the other constructs besides the social influences and their effect on use behavior, mediated by behavioral intention.

Intention to use is a mediator in the technology acceptance literature. Intention is specific or general action, whose prediction is of interest in the particular model [50,51]. The technology acceptance literature widely uses the behavioral intention as the mediator to the actual use of technology. This mediator 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 proper use of health information technology is central for the safe and effective care for patients. Even a successful technology implementation is considered failed if the users do not actually use the system and involve workarounds or use another system in parallel [52].

Empirically, several studies have also confirmed that behavioral intention has a significant influence on the actual use of health information technology [24, 49, 53]. Hence, we propose the following hypothesis:

H1: Older patients’ behavioral intention will positively influence their actual use of patient portal.

2.2.2. Coercive pressure

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 is defined as coercive pressure [44]. A number of sources may generate formal or informal coercive pressure on the organizational level, such as regulatory agencies, customers, suppliers, and other powerful actors [54].

On the individual level in the context of healthcare, regulatory pressure is often present for many facets of care. However, for the purposes of this study of patient portal acceptance, we investigate the pressure the provider may put on the patient to use the patient portal. Physicians, for example, as more powerful actors may informally pressure patients to check on their portal for health-related communication and ultimately to increase the effectiveness of care. Hence, we hypothesize:

H2: Older patients who perceive higher coercive pressure are more likely to use a patient portal.

2.2.3. Normative pressure

Institutional theory posits that if an action, behavior, or belief is taken by a large enough group of actors, a social actor is more likely to copy that action. This action of copying is not mandated, nor conscious, but rather becomes the norm, the “right” way [55, 56]. As a social factor for adopting a behavior or belief, normative pressure results in discord if peers whose opinion is valued are using an innovation [44, 57].

Older patients with a large enough network may often discuss their physical health with each other. If others, whose opinion is valued, reference the use of patient portals, an individual is more likely to consider trying one out. This effect has been described generally by Abrahamson as theories of fads [58]. Hence, we posit:

H3: Older patients who perceive higher normative pressure are more likely to use a patient portal.

2.2.4. Mimetic pressure

DiMaggio and Powell (1983) proposed mimetic pressure as a phenomenon, describing the conscious and voluntary act of copying behaviors of those with higher status and success. This copying behavior is driven by the belief that actions of more successful and respected actors result in positive outcomes. It is also believed that copying behavior of respected members of a network is safer than experimenting new, “untested” behavior [54].

Older people are aware of their health status and more actively seek information about their health [59]. If a trusted friend refers to their patient portal as a reliable source of information, those who have not adopted a portal are more likely will try and possibly use it. Therefore, we hypothesize:

H4: Older patients who perceive higher mimetic pressure are more likely to use a patient portal.

2.3. Control Variables

Demographic variables, such as age and gender, have been found to have significant effect on social factors studies [60, 61]. Morris et al [62] found that older individuals are more susceptible to social influences, yet they are more cautious before they decide on an action [63]. Women are found to be more perceptive regarding others opinion than men [32]. This study also controls for residence since an assisted living environment may have an effect on social factors as opposed to those who are somewhat more isolated in their residence [64, 65]. Furthermore, technical efficacy [66, 67] and attitude toward self-health [68] were also examined for their effect on use behavior.

3. Research methodologies

3.1. Measurement

Questionnaire items were adopted from the literature for social forces [42, 54, 69] and use behavior [32, 70]. The social factors constructs were measured by six indicators, while the dependent variable was measured by three indicators. The complete questionnaire can be found in the Appendix.

3.2. Data Collection

Convenient and snowball sampling was 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 and they were asked to do the same. 117 fully completed questionnaires were returned prior to data analysis.

4. Data analysis and results

4.1. Instrument validation

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 [71-73]. We used the most recent version of SmartPLS (version 3.2.1 for Windows 64 bit). We examined the

relationships between constructs (path coefficients) and the predictive power of the dependent variable – R-squared [73].

Table 1 indicates the measurement model t-statistics and factor loadings of the full model. 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 with a low number of factors per latent variables [74]. Construct reliability was tested by Cronbach’s Alpha and they were above the recommended 0.7 value [75]. Convergent validity values, in terms of average variance extracted (AVE) were above the recommended 0.5 value [76].

Table 1. Factor loadings, t-statistic and Cronbach’s Alpha for the measurement model

Construct Loading	t-statistic	Cronbach’s Alpha
Intention 0.48**	5.61	0.88
Coercive 0.32 ^{NS}	1.12	0.82
Normative 0.18*	2.01	0.72
Mimetic 0.41**	5.08	0.86

4.2. Hypotheses testing

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 [77]. T-statistics were calculated using bootstrapping technique in SmartPLS.

Path coefficient from behavioral intention to usage behavior (b=0.48, P<0.001), from normative pressure to patient portal use behavioral intention (b = 0.18, p<0.05), and from normative pressure to patient portal use behavioral intention (b=0.41, p<0.001) showed significant impact and supported hypotheses 1, 3, and 4. From coercive pressure to patient portal use behavioral intention (b=0.32, p>0.05) showed insignificant impact and did not support hypothesis #2.

The research model explains 24% of the variance in behavioral intention and 38% in patient portal usage

as indicated by the r-squared value. This magnitude is somewhat expected as technology adoption and use behavioral intention is a cumbersome subject with numerous antecedents. The focus of this study was on social factors and intentionally omitted other, well established constructs that are affected by individual factors (i.e. performance expectancy, effort expectancy). 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 behavioral intention with path coefficients of b= 0.05, -0.02, -0.07, 0.03 respectively for attitude toward gender, age, experience, and, voluntariness of use respectively.

4.3 Mediating Effect Analyses

As indicated in Table 1, all institutional forces relate significantly to patient portal use behavioral intention, and in turn, behavioral intention is related to patient portal use behavior. This relational chain indicates the mediating effect of behavioral intention on patient portal use behavior. To test this mediating effect, two more models were tested as suggested by Barron & Kenny (1986) [78].

The first test model excluded the behavioral intention mediator and connected the institutional forces directly with the patient portal use behavior directly. The second test model connected the institutional forces to patient portal use behavior in addition to the mediating links.

Table 2. Indicates the factor loadings without the mediating effect of behavioral intention. Path coefficient from coercive pressure to use behavior (b=0.24, p<0.05) and from mimetic pressure to patient portal use behavior (b = 0.351, p<0.001) supported hypothesis 2 and 4 respectively. However, normative pressure showed no significant impact on patient portal use behavior (b=0.11, NS) and hypothesis 3 was not supported.

The first research model explains 28% of the variance of social forces on patient portal use behavior as indicated by the r-squared value. This showed a significant drop from 38% compared to the model when the mediating effect of behavioral intention was considered.

The second test model showed an interesting factor loading from the institutional forces to the patient portal use behavior while also connected to the behavioral intention mediator. Coercive force became significant determinant when not moderated by the behavioral intention. Normative and mimetic forces both were insignificant determinants of patient portal use intention when also connected to the mediator of behavioral intention. There was a slight increase in the R² value that increased to 42% from 38%. The results

of the test models jointly signaled that the influences of normative and mimetic forces on patient portal use behavior are completely mediated by behavioral intention.

It is important to note that coercive force had no significant effect on behavioral intention of patient portal use behavior. However, his force had a significant direct effect on patient portal use behavior when not mediated by behavioral intention.

Control variables showed an insignificant effect on patient portal use behavior for both of the mediating effect test models.

Table 2. Factor loadings, t-statistic and Cronbach’s Alpha for the measurement model without the mediating effect.

Construct Loading	t-statistic	Cronbach’s Alpha
Coercive 0.24**	2.93	0.71
Normative 0.11	1.31	0.78
Mimetic 0.35**	4.83	0.80

5. Limitations and future directions

While we feel that this study contributes to the relevant literature and provides valuable directions, it has limitations that may affect the generalizability of the findings.

Data collection followed convenience samples and snowballing approach. Geographical distribution was not tracked and the results may only represent that of a particular area. Also, the subjects were mostly asked through email and social media and the survey took place through the Internet. Therefore, every respondent must have possessed a basic level of familiarity with the Internet and computers.

The survey group was relatively small and no attempt was made to segment the population. There may be sub groups within this sample population and these should be investigated to provide a richer picture.

It is important to keep in mind that a large portion (62%) of variables in use behavior remains unexplained by the variance in the measurement model. Therefore there are a number of other factors that influence adoption and usage of patient portals by the elderly. This may also serve as future research direction to enhance the model to find other important

social factors that strengthen the predictive power of the model.

6. Discussion and conclusion

This study examined the effect of social factors on patient portal adoption and use behavior among the elderly mediated by behavioral intention. The conceptual model was built on the UTAUT model and the institutional theory. The study empirically tested the strength of the effects of three independent variables, namely coercive, normative, and mimetic pressures on the elderly to adopt and use patient portals as the dependent variable while mediated by behavioral intention. The social forces component of UTAUT model

The study found theoretical and practical implications.

We found empirical support for the institutional forces as the underlying constructs of social forces in the UTAUT model. Our study found that normative and mimetic forces have a significant effect on the behavioral intention and use behavior of patient portals among the elderly. One of the main normative forces on elderly patients come from their peers. Discussing health related topics with respected peers may positively influence the behavioral attitude of the elderly patients, and in turn, positively influence the patient portal use behavior as well. This is also known as the theories of fads [58] and bandwagon effect in the literature [79]. It can be concluded that older patients’ attitude is affected by the advice or attitude of respected peers. However, there is no direct relationship found between normative force and patient portal use while not mediated by behavioral intention. This may be explained by the fact that without motivational factors, the established practices are stronger.

In regards to mimetic forces, it became apparent that higher profile, respected peers have influence on the elderly with regard to patient portal adoption. Mimetic pressure has a stronger influence than normative pressure; satisfied portal users will have a stronger effect on other elderly patients to adopt and use patient portals. Older patients may feel that they can save time and effort by using a patient portal if it worked favorably for their respected peers, rather than trying something new that is not used or favorably considered by someone from their network.

The significant effect of coercive pressure on use behavior is a considerable finding of the study. We found empirical support that the coercive forces have positive and significant effect on patient portal use behavior if they are not mediated by behavioral intention. Coercive forces on elder patients usually

come from their health provider. Therefore, it suggests that elder people respect, trust, and follow their providers' advice regardless of their own behavioral intention. This finding suggests that while the mimetic and normative forces are mediated, coercive force has a significant direct effect on patient portal use behavior. Therefore, our originally presented model will need some modification to indicate the direct relationship.

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.

Theoretical contribution of this study has been made through the suggestions of expanding the social influences construct of the UTAUT model. While the definition of this construct of the model is general ("the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology"), it is important to approach this social influence on a more granular level. Especially since an individual's social network can be quite extended and the influences can be heterogeneous. The empirical result suggests that significant relationship exists between the three institutional forces and the actual patient portal use behavior. More specifically, the normative and mimetic forces directly and positively influence behavioral intention, while coercive forces are found to be directly and positively influence the use

behavior. Figure 2. depicts this relationship through the granular view of social influence of model UTAUT model.

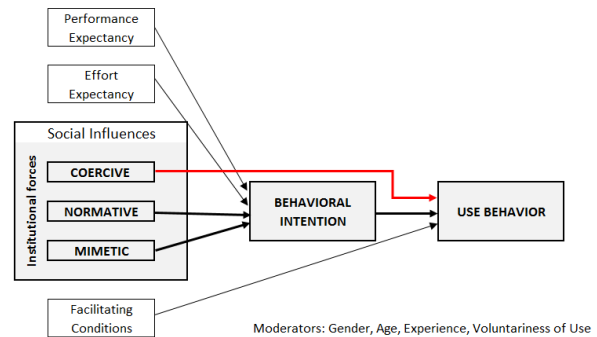


Figure 2. Revised social influence construct of UTAUT

The literature has also been expanded on patient portal use, as the use behavior of elderly has not been investigated through social forces. Applying institutional theory as the pillar of our model with significant findings adds to the growing literature on the adoption and usage of information and communication technologies in healthcare by the elderly. Therefore, significant additional factors have been identified for health communication technology adoption by the elderly population.

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Appendix

Questions used in this study

Measures

Items

Coercive Pressure (Teo, et al., 2003; Liang, et al., 2007; Jan, et al., 2012)

1. My physician strongly encourages me to use and understand information on my Online Personal Health Information website.
2. I understand that information related to my condition can be found on my Online Personal Health Information website.
3. Interaction with my physician requires me to access my Online Personal Health Information website.

Normative Pressure (Teo, et al., 2003; Liang, et al., 2007; Jan, et al., 2012)

1. I am aware that some of my close family or friends are regularly accessing their Online Personal Health Information website.
2. Those who use their Online Personal Health Information website would help me to access my Online Personal Health Information website if I asked for it.
3. I feel that I would be better informed if I used my Online Personal Health Information website.

Mimetic Pressure (Venkatesh, et al., 2003; Liu, et al., 2010)

1. My close friends who regularly access their Online Personal Health Information website have benefited from it.
2. My close friends who regularly access their Online Personal Health Information website are more respected for taking charge of their health.
3. I feel that I would be favorably perceived if I used my Online Personal Health Information website.

Behavioral Intention (Venkatesh, et al., 2012; Klein, 2007; Bhattacharjee, 2001)

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

Use Behavior (Venkatesh, et al., 2012; Venkatesh et al., 2003; Attuquayefio et al., 2014)

1. I use an Online Personal Health Information website for accessing my health related information.
 2. I use an Online Personal Health Information website to learn more about my health status.
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