Can Information Security Awareness Mitigate Resistance Towards Patients Healthcare Portals?

Completed Research

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Abstract

Resistance behaviors toward newly implemented technology are generally predicted by the perceptions of threats associated with the use of the technology. Recent studies of resistance towards Health Information Technology (HIT) revealed users describing the fear of losing private data due to potential cyber-attacks as an important perceived threat. This study is underpinned by concepts of the information security policy compliance theory. It aims to investigate the impact information security awareness can have on mitigating HIT resistance. Precisely, it evaluates patient’s behavior towards a new Patient Portal System (PPS) after enforcing a new cyber risk management insurance policy. This work contributes to the underdeveloped area of research concerned with patients’ interactions with HIT, as well as to practice by providing important insights about the impact of information security awareness on mitigating patients’ threats from the PPS.

Keywords  

Introduction

Resistance of Health Information Technology (HIT) is a phenomenon that is strongly present within most healthcare organizations, and it is not limited to only healthcare providers but also extends to include patients (Rogers 2003, Samhan and Joshi 2015). With today’s technology advancements, patients can access their health records via applications such as patient portal systems (PPS). A PPS is a secure online application that allows patients convenient access to their personal health information from anywhere at any time. Patients can use the PPS to view health information such as: recent doctor visits, lab results, or doctors’ notes. They can also use it as an interactive system to book and manage appointments, and communicate with their doctors about health concerns or questions they might have. However, despite the potential benefits PPS can offer to its users, but patients are hesitant to use these systems (Bhattacherjee and Hikmet 2007, Samhan 2017, Weingart, Rind, Tofias, and Sands 2006).

User resistance is one of the main contributor to system failure (Kim and Kankanhalli 2009), especially in the healthcare industry (Samhan and Joshi 2015). However, the review of prior studies in the Information Systems (IS) literature showed limited work on HIT resistance (Lapointe and Rivard 2005, Samhan and Joshi 2017), and more specifically, studies concerned with patients’ resistance towards HIT (Bhattacherjee and Hikmet 2007, Samhan and Joshi 2017, Samhan 2017b). Although patients are becoming major stakeholders of HIT, but most of the extent HIT studies focused on other types of users such as physicians, nurses, radiologists, lab specialists, pharmacists, and health organizations managers (Bhattacherjee and
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Hikmet 2007, Joshi 1991, Lapointe and Rivard 2005). This is an important research gap in the IS literature that the current study aims to address.

This work is part of a larger project that investigates perspectives of healthcare providers and patients about newly implemented HIT at their hospital. The sample used for this study is formed from patients who reported the fear of having their data compromised by potential cyber-attack as a main threat influencing their intentions to resist the PPS. The hospital’s objective is to create information security awareness to make users cognizant of risks related to information security and to educate them about their roles and responsibilities concerning those risks.

According to the 2015 KPMG Healthcare Cybersecurity Survey (2015), more than 80% of healthcare executives reported that their organizations have been affected by at least one cyber-attack between 2013 and 2015. Additionally, 13% reported being a victim of an external hacking attempt on daily basis, and only 6% felt like they are prepared to prevent similar attacks. A 2015 report by the Ponemon Institute (2015) found that 90% of healthcare organizations had a data breach and that 40% had over five incidents in the last two years, resulting in a $6 billion loss to the industry.

The targeted hospital in this study is one of the healthcare organizations that responded to these reports by enforcing a cyber-risk management insurance policy (CRMIP) while keeping its standard data security measures. It also provided educational information online to all users about how medical data are secured.

The study investigates the impact of information security awareness on mitigating threats and in turn minimizing patients’ intentions to resist the PPS due to data privacy concerns. This work contributes to the IS research that has limited work examining patients’ behaviors towards HIT. Prior Research on IT security focused mainly on the organizational level aspects of security (Hillson and Murray-Webster 2007, Moore and Benbasat 1991), which lead researchers to know little about user security behavior at an individual level (Mathieson, Peacock, and Chin 2001). More importantly, the review revealed limited work directed towards security-related issues of HIT (Samhan 2017b).

This work aims to address this important research gap by enriching the literature with findings from the patients’ perspective. Understanding the potential impacts information security awareness has on patient resistance behavior can help decision makers take appropriate measures to raise awareness to minimize resistance behaviors and any subsequent effects (Samhan 2017). Further, it aims to provide HIT developers, who mostly focus on aspects such as newer functionalities and focus less on user-related issues such as their perceptions of levels of data security (Samhan 2017b), with more insights about the importance of data security awareness.

This work will examine the following research questions: what is the impact of information security awareness on PPS resistance? To address the research question, the underpinnings of the information security policy compliance theory are used to form a conceptual research model, which is empirically tested using survey data. The next section illustrates the theoretical background of this work.

Theoretical Background

This work builds on the Information Security Policy Compliance Theory (ISPCT) (Bulgurcu, B., Cavusoglu, H., and Benbasat, I. 2010) to investigate the impact information security awareness has on perceived threat. The ISPCT suggests that Information Security Awareness (ISA) is a second-order construct that is shaped by General Information Security Awareness (GISA) and Information Security Policy Awareness (ISPA).

GISA refers to patients’ overall knowledge and understanding of information security issues and its consequences (Bulgurcu, Cavusoglu and Benbasat 2010). Additionally, it includes patients’ awareness of all security measures the hospital is taking to secure their data. This information is available by the hospital online for all users.

ISPA refers to patients’ awareness of the rules and regulations of the policy in place (in this study: the CRMIP). ISPA includes patients’ knowledge and understanding of the requirements prescribed in the CRMIP and the aims of those requirements. The hospital has specific expectations of how patients should comply with CRMIP. For example, using a strong password, not writing it down, and keeping it secret. ISPA is different from GISA. It is a sense of awareness of CRMIP’S security objectives. For example, a patient may be aware of the necessity of using a password but may not know that the CRMIP requires the
password to be of a certain length, composed of specific characters, or needs to be changed periodically (Bulgurcu, Cavusoglu, and Benbasat 2010).

Perceived threat was identified as the main predictor of technology resistance in prior studies (Bhattacherjee and Hikmet 2007, Kim and Kankanhalli 2009, Lapointe and Rivard 2005). However, the work of Samhan and Joshi (2017) was one of the earliest to further explore the black box of resistance to reveal the main factors shaping the construct. They used Electronic Health Records as the object of resistance and found that 73% of the responses identified cyber-security issues as perceived threat. In this study, perceived threat refers to the cyber threats patients perceive when interacting with the PPS. It is defined as the personal conviction that the use of the PPS will have serious potential negative consequences on patients’ data cyber security. Cyber-attacks refer to any attempt to gain unauthorized access, steal, damage, or destroy PPS data. This may result in losing data, losing access, making the PPS slower, and/or not being able to accomplish desired tasks accurately. Therefore, cyber-risk is a major pillar shaping the perceived threat construct (Samhan and Joshi 2017).

ISPCT draws on the Theory of Planned Behavior (TPB; Ajzen 1991) and suggests that intention to perform a behavior can be predicted by the attitude toward the behavior, and that attitude is associated with one’s beliefs about the outcomes of the examined behavior (Ajzen 1991, Ajzen and Fishbein 1980, Fishbein 2007). Therefore, beliefs about the overall assessment can influence attitude toward the behavior. In the context of this study, patients’ beliefs about the PPS making them susceptible to cyber-risk situations can be associated with unfavorable attitudes towards the PPS and thus resistance intentions will be formed.

**Research Model and Hypotheses**

ISA refers to patients’ cognizance of the CRMIP requirements and their general knowledge about information security (Bulgurcu, Cavusoglu, and Benbasat 2010). According to the ISPCT, ISA is a second order construct shaped by ISPA and GISA. Patients’ awareness of CRMIP and its rules and requirements will help develop a broader sense of information security awareness. The more patients become aware of the policy in place the more aware they will be about information security issues and potential harms they may endure (Bulgurcu, Cavusoglu, and Benbasat 2010). The general knowledge about information security can be formed by previous experiences such as the exposure to external resources of security information, like professional journals, news, or workshops (Bulgurcu, Cavusoglu, and Benbasat 2010). When patients develop enough general awareness of security, they will develop higher levels of ISA. Therefore, by following the ISPCT and based on the arguments above, it is hypothesized that:

H1: Patients’ ISPA can positively affect their ISA.

H2: Patients’ GISA can positively affect their ISA.

When patients interact with the PPS, they evaluate the potential outcomes of its use (Ajzen 1991). This evaluation can determine the way they perceive the PPS. These perceptions are directly influenced by the information security concerns associated with using the PPS (Samhan and Joshi 2017). When patients become fully aware of how their information is being secured, they will have a good understanding of the policy in place, the potential threats, and how are they protected against these threats. This will develop a sense of confidence, which allows them to enjoy the benefits of using the PPS without the fear of potential threats. This can be explained through TPB, which argues that background factors can affect behavior indirectly by forming behavioral, normative, and control beliefs (Ajzen and Albarracin 2007). Therefore, in the context of this study, ISA is conceptualized as a background factor, which influences the formation of outcome beliefs about the PPS. This implies that patients who are aware of the information security concepts will be less inclined to perceive the PPS as a threat. Therefore, it is hypothesized that:

H3: Patients’ ISA is negatively associated with perceived threat.

According to Ajzen and Albarracin (2007), many background factors can influence intentions of any examined behavior. The work of Fishbein (2007) suggested that there are endless number of variables that can be conceptualized as predictors to intentions and behavior. Therefore, this study suggests that ISA may directly influence patients’ attitude toward resisting the PPS since the TPB posited the possibility of non-TPB construct predicting an effect on any of the TPB constructs (Ajzen and Albarracin 2007, Conner and Armitage 1998, Fishbein 2008) and patients’ attitude about the PPS may be effected by their awareness of the existing information security measures.
The research model in this study hypothesizes that ISA can mitigate PPS resistance attitude. This is drawn on the work of the innovation decision process to information security (Rogers 2003) by viewing ISA as knowledge, attitude as persuasion, and intention as a decision. Patients’ knowledge about the available information security measures can shape a favorable or unfavorable attitude toward the PPS to describe persuasion. According to Rogers (2003), the persuasion stage can affect decisions, which means in the context of this study that attitude towards the PPS can effect patients’ decision to resist the PPS. This is consistent with prior research suggesting that security awareness is the most important factor in persuading individuals to change their actions (Bulgurcu, Cavusoglu, and Benbasat 2010, Siponen 2000). Therefore, it is hypothesized that:

H4: Patients’ ISA negatively affects attitude toward PPS resistance.

The TPB suggests that beliefs about the consequences of a given behavior can affect attitude toward that behavior. In the context of this study, patients perceiving security threats associated with the use of the PPS would be more likely to have favorable attitudes towards PPS resistance. Additionally, prior studies that used the Rational Choice Theory (RCT) suggested that beliefs about the outcomes of an examined behavior could affect attitude towards that behavior (Ajzen 1991, Ajzen and Fishbein 1980, Fishbein 2007, McCarthy 2002, Paternoster and Pogarsky 2009). In the context of this study, patients that perceive security threats associated with the use of the PPS begin to evaluate the costs related to these threats and based on their evaluation they would form attitudes of PPS resistance. Therefore, it is proposed that:

H5: Patients’ perceived threat positively affects attitude toward PPS resistance.

In the context of this study, attitude refers to the degree to which patients have positive or negative feelings about resisting the PPS (Ajzen 1991). According to the TPB, if patients evaluate resisting the PPS as a positive (attitude), this will result in a higher intention to resist the PPS and they become more likely to do so. Therefore, following the extent literature of the TPB, it is hypothesized that:

H6: Patients’ attitude towards PPS positively affects intentions to resist the PPS.

In addition to the main constructs of the research model, a number of control variables related to the characteristics of patients were included in this study in order to account for the impacts of these variables on patients’ intentions to resist the PPS. These variables are age, sex, education and levels of technical skills. Figure 1 illustrates the research model of this study.

Figure 1. The Research Model
Methodology

Instrument Development

Existing validated scales were adopted for this study. The survey items used for the model were derived mainly from ISPCT and the TPB. All items were modified to fit the context of the study. Measurement items were anchored on five-point Likert scales (1 = strongly disagree, 5 = strongly agree). The instrument was reviewed by IS researchers before the study. The final version of the questionnaire was developed for the main study as shown in Table A1 of the Appendix.

Sample and Data Collection

The sample for this study was collected from patients of a large public hospital in the Northwest region of USA. Data were collected using two methods. First, hard copies (paper based) of the survey were handed out to each patient who walks in to the front desk of the hospital’s main building were all major circulations take place. Second, a link to the survey was sent to all patients who are registered with the PPS. Also, data collection was divided into two phases: a pilot study and a main study. For the pilot study, data were collected from patients of the dermatology unit at the hospital, a total of 113 responses were collected. After conducting Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), it was necessary to edit few of the items to address issues related to the psychometric properties of the factors. After refining the survey items based on the pilot study results, data were collected for the main study from patients of the entire hospital, but patients who filled the first survey before (i.e. for the pilot study) were specifically asked not to fill in the survey for the second time. Main study data were collected in one day using the printed surveys, and the online responses came in within 3 days. The total estimated number of surveys distributed (printed and online) was 600 surveys. The total responses were 338 (56%). After discarding all missing data, only 265 (44%) responses were useable. Table 1 shows descriptive statistics of respondents.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>167 (63.01%)</td>
</tr>
<tr>
<td>Female</td>
<td>98 (36.90%)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>40 (15.09%)</td>
</tr>
<tr>
<td>31–40</td>
<td>93 (35.09%)</td>
</tr>
<tr>
<td>41–50</td>
<td>77 (29.05%)</td>
</tr>
<tr>
<td>51–60</td>
<td>31 (11.70%)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>24 (09.05%)</td>
</tr>
<tr>
<td>Total</td>
<td>265 (100%)</td>
</tr>
</tbody>
</table>

Table 1. Demographics

Instrument Validation

To validate the survey instrument, the psychometric properties of the survey were assessed by conducting EFA and CFA tests. Additionally, Cronbach’s α was evaluated for reliability. The CFA of the main study’s data revealed that all items had a significant loading greater than (0.7), and all constructs had Cronbach’s α values exceeding (0.8).

Results

Structural Equation Modeling (SEM) was used to test the research model. The details of SEM structural path including standardized path coefficients, and significance of the paths based on p-value are summarized in Table 2, and the amount of variances explained (R2) are presented in Table 3. Be careful
with the use of gender-specific pronouns (*he, she*) and other gendered words (*chairman, manpower, man-months*). Use inclusive language that is gender-neutral (*e.g., they, s/he, chair, staff, staff-hours, person-years*).

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Relationship</th>
<th>Path Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1+</td>
<td>ISPA → ISA</td>
<td>0.72*</td>
</tr>
<tr>
<td>H2+</td>
<td>GISA → ISA</td>
<td>0.64*</td>
</tr>
<tr>
<td>H3-</td>
<td>ISA → PT</td>
<td>-0.39*</td>
</tr>
<tr>
<td>H4-</td>
<td>ISA → ATT</td>
<td>-0.44*</td>
</tr>
<tr>
<td>H5+</td>
<td>PT → ATT</td>
<td>0.29**</td>
</tr>
<tr>
<td>H6+</td>
<td>ATT → IR</td>
<td>0.38*</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01

Table 2. Results of Hypotheses Testing

<table>
<thead>
<tr>
<th>Construct</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Threat</td>
<td>0.19</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.38</td>
</tr>
<tr>
<td>Intention to Resist PPS</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Table 3. SEM Reported Amount of Variance Explained

Because the ISA construct was conceptualized as a second-order construct shaped by ISPA and GISA, it was necessary to evaluate the weights of the first order constructs; it was found that they are significant (*t1 = 0.47 and t2 = 0.58*), suggesting that each first order construct significantly contributes to the underlying overall factor (*Bulgurcu, Cavusoglu, and Benbasat 2010*). Additionally, pseudo F-test was conducted (*Gefen, Straub, and Boudreau 2000, Mathieson, Peacock, and Chin 2001*), and the results show that the contributions of all factors were significant in explaining the variance in Patients’ intention to resist the PPS.

Based on the significant path coefficients, all hypotheses were supported. Approximately 47.3 percent of the variance was explained for intention to resist the PPS. While model constructs explain 45.5 percent of the variance, the control variable (age) explained only an additional 1.8 percent. Other control variables (Sex, Education, and Technical Knowledge) had no significant influence on intentions to resist the PPS.

Overall, the research model of this study was strongly supported by its findings. Based on data collected from 265 patients, all the posited hypotheses were supported. Findings of this study confirms the influence of patients’ security awareness on reducing their intentions to resist the PPS. However, this influence is fully mediated through attitude.

The ISA construct was conceptualized as a second-order construct shaped by ISPA and GISA. The findings show that weights of the first order constructs are significant, which supports the conceptualization of the construct as well as hypotheses 1 and 2. It is found that ISA has significant direct effect on perceived threat. Higher levels of ISA were found to reduce patient’ perceived threats. Additionally, consistent with the proposed research model, higher levels of ISA were found to reduce patients’ attitude toward resisting the PPS. Similarly, ISA had a negative direct impact on attitude and played a major role in influencing perceived threat.

Findings also indicated that perceived threat had direct significant impact on attitude. When patients perceived threats associated with the use of the PPS, they reported higher levels of attitude towards resisting the PPS. Additionally, higher levels of attitude were associated with higher levels of intention to resist the PPS.
PPS. This confirms the existing literature that highlighted the direct impact attitude has on behavioral intention (Ajzen 1991, Bulgurcu, Cavusoglu, and Benbasat 2010, Davis, Bagozzi, and Warshaw 1989).

The only control variable with a significant impact was age. This suggests that the older the patient is, the more likely he/she will intend to resist the PPS. This is consistent with existing literature about the relation between aging and resistance (Hough and Kobylanski 2009, McCarthy 2002, Prendergast and Roberts 2009, Wang 1999).

Contributions

This study examined the impact of information security awareness on minimizing perceived cyber risks and threats associated with the use of PPS. The study addresses a research gap in the IS literature. Very limited work has been conducted on patients’ interactions with HIT and fewer on the effects of information security awareness on mitigating threat perceptions. Additionally, the study is one of few that reveals the role of attitude as a mediator between intention and its antecedents, especially in the healthcare context. Many studies concerned with technology adoption followed the work of Davis et al. (1989) by discarding attitude and testing the impact directly on intentions. This work also contribute to practice. Understanding PPS resistance is important for healthcare organizations that want to leverage their technical capital. Knowing how these behaviors may be minimized through applying information security awareness remedies will be of great value to healthcare organizations.

Limitations

This study has a number of limitations. First, the study is linear in nature, as the respondents selected are patients from a single healthcare organization that use the same PPS, and they are giving their responses to the same information security policy availed by the hospital. Future research is encouraged to use exploratory studies to visit different hospitals availing similar information security policies for risk mitigation. In addition, the two constructs from TPB: normative believes and self-efficacy were not included in the research model. While technical knowledge was controlled for in this study, but it is believed that interesting results may still emerge from include the self-efficacy variable in the model.

REFERENCES


Twenty-fourth Americas Conference on Information Systems, New Orleans, 2018
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APPENDIX

<table>
<thead>
<tr>
<th>Items</th>
<th>Source</th>
<th>Questions</th>
<th>Mean</th>
<th>STD</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISPA</td>
<td>Bulgurcu et al. 2010</td>
<td>I know the rules and regulations prescribed by the cyber-risk management insurance policy of my hospital.</td>
<td>3.93</td>
<td>1.21</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I understand the rules and regulations prescribed by the cyber-risk management insurance policy of my hospital.</td>
<td>4.11</td>
<td>1.20</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I know my responsibilities as prescribed in the cyber-risk management insurance policy of my hospital.</td>
<td>3.75</td>
<td>1.43</td>
<td>0.94</td>
</tr>
<tr>
<td>GISA</td>
<td>Bulgurcu et al. 2010</td>
<td>Overall, I am aware of the potential security threats and their negative consequences.</td>
<td>4.13</td>
<td>1.71</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I have sufficient knowledge about the cost of potential security problems.</td>
<td>3.79</td>
<td>1.73</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I understand the concerns regarding information security and the risks they pose in general.</td>
<td>3.38</td>
<td>1.20</td>
<td>0.89</td>
</tr>
<tr>
<td>Perceived Threat (PT)</td>
<td>Samhan 2016</td>
<td>Using the PPS increases my possibility of being a victim of a cyber-attack.</td>
<td>3.07</td>
<td>1.90</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I consider using the PPS to be dreadful.</td>
<td>3.39</td>
<td>1.18</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is risky to use the PPS.</td>
<td>3.26</td>
<td>1.97</td>
<td>0.95</td>
</tr>
<tr>
<td>Attitude (ATT)</td>
<td>Ajzen 1991</td>
<td>To me, resisting the PPS is</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unnecessary...Necessary</td>
<td>4.16</td>
<td>1.23</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unbeneficial...Beneficial</td>
<td>4.52</td>
<td>1.63</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unimportant...Important</td>
<td>4.12</td>
<td>1.53</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Useless...Useful</td>
<td>4.34</td>
<td>1.84</td>
<td>0.88</td>
</tr>
<tr>
<td>Intentions to Resist PPS (IR)</td>
<td>Ajzen 1991, Samhan 2016</td>
<td>I intend to resist the PPS in the future.</td>
<td>4.36</td>
<td>0.51</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I intend to oppose the new way of working with the PPS in the future.</td>
<td>4.49</td>
<td>0.55</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I do not agree with using the PPS.</td>
<td>4.58</td>
<td>0.41</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Table A1. Instrument Loadings