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DIGITAL HEALTH RECORDS AND PRIVACY CONCERNS: OVERCOMING KEY BARRIERS TO ADOPTION

Social, Behavioral and Organizational Aspects of Information Systems

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Abstract

Electronic health records (EHRs) constitute a significant technological advance in the way medical information is stored, communicated, and processed by the multiple parties involved in the delivery of health care. However, there is widespread concern that privacy issues may impede the diffusion of this technology. In this study, we integrate the Concern for Information Privacy (CFIP) construct with the Elaboration Likelihood Model (ELM) to examine attitude persuasion regarding the use of EHRs when concerns about privacy of information are present in patients. We draw from attitude and attitude persuasion literatures to develop hypotheses that individuals can be persuaded to support the use of EHRs, even in the presence of significant privacy concerns, if appropriate messages about the value of EHRs are imparted to the recipient. Using an experimental methodology, we randomly assign two different types of respondents (high and low involvement) to two different treatments (strong and weak argument quality) and assess the impact of CFIP on the relationship between these variables and attitude change. We find that an individual's CFIP interacts with argument quality and issue involvement to affect attitudes toward the use of EHRs. The research reported here makes four main contributions. From a theoretical perspective it extends the ELM to include a key construct affecting persuasion which has not been examined in prior literature – that being CFIP. Second, it focuses on EHRs which are a new and emerging technology that have the potential to radically alter the way health care is managed by consumers and providers. Third, findings from this study hold important pragmatic value for driving public policy decisions related to public perceptions and attitudes toward the use of EHRs, including but not limited to the crafting of national messages and education. Finally, while further testing is required, we believe that the moderating effect of CFIP may be useful in other contexts in which personal information is controlled or processed.

Keywords: Privacy, ELM, EHR, CFIP, attitude

Theoretical Background

Electronic health records (EHR) that capture patient information in digital format are an important emerging technological innovation that offer the potential to dramatically transform the health care system. Although the practitioner literature surrounding the adoption of EHRs is growing, no study has examined a key component of the adoption equation – what happens if health systems, and providers adopt EHR systems, but patients refuse to allow their medical information to be digitized? Prior research has shown that there are significant concerns surrounding the privacy of many types of personal information when the Internet is used as a medium for transferring information (Malhotra et al. 2004) or when information is gathered and used in an organizational context (Smith et al. 1996; Stewart et al. 2002).

In this study we pose the question: how can individuals be persuaded to change their attitudes toward electronic health records in the presence of privacy concerns? Prior research has examined the behavioral aspects of adoption

and usage of technology in some detail drawing upon multiple theoretical perspectives such as the Technology Acceptance Model, Theory of Reasoned Action, and Diffusion of Innovation (e.g. Agarwal et al. 1998; Davis 1989; Fishbein et al. 1975; Rogers 1995; Venkatesh et al. 2003). Most of these models, however, assume that the respondent has developed a well-formed attitude toward the target technology, and there is typically little or no discussion of the fact that the individual could be persuaded to change his or her attitude about technology.

In the psychology literature, the elaboration likelihood model (ELM) provides a theoretical perspective on how attitude can be modified. We integrate the CFIP construct into ELM to examine attitude persuasion regarding the use of EHRs in health systems when concerns about privacy of information are present in patients. We develop hypotheses that individuals can be persuaded to support the use of EHRs, even in the presence of significant privacy concerns, if an appropriate message about the value and safety of EHR systems is imparted to the recipient. The ELM forms the theoretical framework for this study and provides the conceptual lens for investigating attitude and persuasion.

Elaboration Likelihood Model

When a message is presented to various individuals in different contexts, the recipients will vary in how much cognitive energy they devote to the message (Petty et al. 1986a). These variations in cognitive elaboration, *ceteris paribus*, affect the success of the message's influence. According to Petty and Cacioppo (1986a, p. 6), the two factors that must be present in a recipient for elaboration to occur are ability and motivation. The ELM suggests that when elaboration is high, the recipient is experiencing a central route of persuasion, but when elaboration is low, a peripheral route is present (Petty et al. 1986a). When elaboration is low, influence typically acts through very simple decision criteria and cues such as celebrity endorsements, charisma, or the attractiveness of the sender. Individuals use these cues either because they do not want to devote the necessary cognitive energy to elaboration or they are unable to expend the effort (Petty et al. 1986a). It has also been noted that non-experts rely less on argument quality (AQ) and instead focus on what have traditionally been known as peripheral cues¹ such as the credibility of the source (Lord et al. 1995; Petty et al. 1981b).

Several factors such as AQ, issue involvement (II), and source credibility have been shown to affect information influence but under conditions of high elaboration likelihood, AQ is identified as the critical determinant (Petty et al. 1986a). Our interest is in the outcome variable, attitude change (AC), and we seek to examine the factors that will influence such change.

Privacy

With the advent of the Health Insurance Portability and Accountability Act (HIPAA), privacy and security of health information has been elevated to the forefront of medical informatics research (Lazarou et al. 1998). Much evidence suggests that privacy and security of health information is of focal concern for individuals (Bodenheimer et al. 2003; Cantor 2001; Harris-Interactive et al. 2002; Masys et al. 2002; Shortliffe 1999; Westin 2003).

Theories of privacy are limited: much of today's research relies on Altman (1975) and Westin's (1967) work. Altman's work examined privacy in the context of how people regulate access to themselves, while Westin's work focuses on the types and functions of privacy. More recent work (Culnan 1993; Smith et al. 1996; Stewart et al. 2002) has been conducted examining individuals' concern for information privacy (CFIP). Drawing from these literatures, our conceptualization of information privacy is that it is a belief that is malleable in response to internal and external stimuli (Altman 1975; Westin 1967).

Concern for Information Privacy

Smith et al. (1996) developed and tested the CFIP construct to measure attitudes and beliefs about individual information privacy related to use of personal information in a business setting. Their conceptualization argues that CFIP is composed of four distinct, yet correlated latent factors, labeled *Collection, Errors, Unauthorized Access,*

¹ Petty and Wegener (1999) argue that it is the degree of elaboration, not the variable, which determines the route of persuasion.

and *Secondary Use*. Stewart and Segars (2002) expanded upon the Smith study and not only empirically validated the multi-dimensional nature of the CFIP construct but also found support for the hypothesis that a 2nd-order factor structure is empirically valid, thus confirming the complexity of individual's CFIP.

Summary

The ELM specifies a set of theoretical mechanisms that yield attitude change. Central to this theory is the notion of persuasion. In the context of digital health information, it is widely acknowledged that a critical barrier to widespread diffusion is the individual's concern about privacy. Will these privacy concerns hinder the adoption of EHR systems or can people be persuaded to accept the technology if proper messages are conveyed? We explore this research question using ELM as the theoretical framework.

Electronic Health Record Systems

As noted above, an electronic health record captures medical information about a specific individual in electronic form. EHR *systems* are the software platforms that physician offices and hospitals use to create, store, update, and maintain EHRs for patients. This distinction is subtle but important due to the fact that these terms are often used interchangeably. We also make the distinction because our research questions are dependent on the respondent understanding the subtle differences. For example, using the definitions provided by others (e.g. Garets 2005), an EHR could simply be a Word[®] document that is maintained by a patient and stored on his or her home computer. In this case, privacy concerns would not be of central importance. Our interest is in the use of EHR systems by health providers and how patients react to the fact that their EHR is stored in these systems and can be made available via Internet connections².

Research Model and Hypotheses

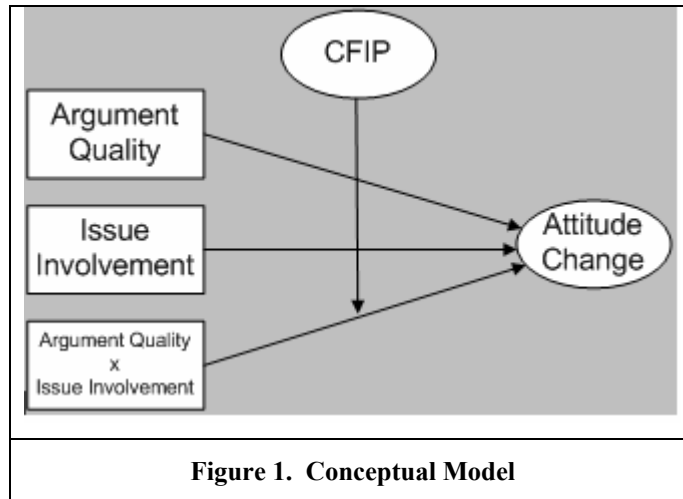
The overall research model, as shown in Figure 1 below, incorporates the CFIP construct and positions it within an ELM framework. As suggested in the model, the key outcome of interest is AC. Prior ELM studies have identified several variables that can influence AC, including but not limited to our primary antecedents of AQ, II, and the interaction of the two.

Attitude Change

An attitude has been defined as a 'complex mental state involving beliefs and feelings and values and dispositions to act in certain ways,' ("Attitude" 2006) and 'positive or negative views of an "attitude object": a person, behavior, or event,' (Bernstein et al. 2000). Fishbein and Ajzen (1975) suggest that attitudes influence behavior via their influence on intentions. In addition, they conclude that attitude toward *using* a system is more predictive of behavior than attitude toward the technology artifact itself (Fishbein et al. 1975).

We hypothesize below that there are several determinants of attitude change.

² From this point forward in the document, we use the term EHR to signify an EHR System, unless explicitly stated.



Argument Quality

AQ refers to a subject's perception that a message's arguments are strong and cogent as opposed to weak and specious (Petty et al. 1986b). While Petty et al. (1981a) argue that persuasion is influenced by several factors including AQ, Fishbein and Ajzen (1981) suggest that message content is the most significant predictor of AC, rather than source credibility, attractiveness, or other cues. Therefore we test:

H1: AC will be greater in individuals presented with strong AQ messages versus weak AQ messages

Issue Involvement

Issue involvement has been defined as the extent to which recipients perceive that a message topic is personally important or relevant (Johnson et al. 1989; Petty et al. 1979; Petty et al. 1986a; Petty et al. 1990). We argue that those who have experience and/or knowledge of medical records in the health care setting will have well-formed and strong beliefs about EHRs and they in turn will believe that the message topic is personally relevant.

H2: AC will be greater in high II individuals than in low II individuals.

AQ x II

Individually, the AQ-Attitude and II-Attitude links have been explored in detail in prior studies. AQ is often used as a treatment variable in ELM studies and it has been suggested that it should be used simply as a methodological tool to examine the impact of other variables on cognition (for further discussion see Petty et al. 1986b; Petty et al. 1993).

ELM argues that people are more motivated to devote the cognitive effort required to evaluate the true merits of an issue or product when involvement is high rather than low. Increased II enhances persuasion with strong messages but inhibits persuasion with weak messages (Petty et al. 1984; Petty et al. 1981a; Petty et al. 1983). Yet some studies find support for this hypothesis only in relation to messages that contain strong persuasive arguments and not weak arguments (Axsom et al. 1987; Burnkrant et al. 1984; Johnson et al. 1989). As issues become increasingly more important, the receiver is more likely to exert the cognitive effort to thoughtfully consider the message (Petty et al. 1986a; Petty et al. 1981b). Receivers that are highly involved with the message issue are likely to engage in extensive elaboration, while those that are not involved will be less likely to be engaged in elaboration and more likely to be influenced by peripheral cues (Petty et al. 1981b; Stamm et al. 1994). The quantity of messages has also been found to be a predictor of AC under conditions of low involvement (Petty et al. 1984).

Following from these findings, under conditions of both low and high involvement, we posit that strong quality arguments will elicit greater ACs than weak quality arguments. We therefore test:

H3: AQ positively influences the effect of II on AC.

The Moderating Effect of CFIP

It has been suggested in prior research that CFIP is related to personality traits such as sensitivity to trust, paranoia, and social criticism (Smith et al. 1996). Others argue that previous personal experiences may influence one's CFIP (Culnan 1993; Stone et al. 1990). No work we are aware of, aside from descriptive opinion-poll surveys, has empirically investigated the privacy concerns associated with using EHRs. As a first step to addressing this gap, we investigate the existence of a moderating effect of CFIP between the AQxII interaction and AC and hypothesize the following:

H4: CFIP will be a significant moderator of the relationship between the AQxII interaction term and AC.

Methodology

Study Design

We tested the research hypotheses using an experimental methodology. We compared two purposively selected groups (involvement: high/low)³ and two argument qualities (weak/strong), and individuals were assessed on a third variable – CFIP (low/high). At the beginning of the Web-based survey, the subjects were asked several questions about their familiarity with EHRs. To ensure that respondents understood our use of the term EHR, we provided a detailed description of technology and also included pictures of five types of EHRs. We made it clear in the survey that our questions were related to EHR systems that stored medical records on a Web-based platform that could be accessed by multiple clinicians and possibly, by the patient or caregiver. After random assignments, the strong AQ group received a manipulation in the form of six strong AQ messages endorsing the use of EHRs and highlighting some of the facts surrounding medical errors and the connection between health information technology and reduced errors. The messages were pre-tested to confirm which generated the strongest responses. The second group received a manipulation where the four messages were weak, consisting of user endorsements, anecdotal evidence, and opinions. Our final sample was 366 subjects (102 high-involvement, 264 low-involvement).

Operationalization of Variables

Attitude toward the use of EHRs is assessed using a 7-point semantic differential scale (Karwoski et al. 1938; Osgood et al. 1957). We conducted a pre-manipulation attitude evaluation using these multidimensional assessments of attitude, and aggregated the results into a composite measure to simplify the analysis. After the subject completed the attitude evaluation, s/he was given the treatment consisting of either a strong or a weak message and then a post-manipulation attitude examination was conducted. Again, we constructed a composite measure and then subtracted the pre- from the post-attitude to calculate the AC construct.

An objective method of assessing involvement is used in this study. We assess high and low involvement using several factors including: 1) does the respondent currently use an EHR in a health setting, 2) does the respondent work in the health care industry, 3) and does the respondent have good or excellent knowledge of EHRs. If any of the questions are answered affirmatively, the respondent is assumed to be high involvement. Therefore, II is a psychological state that exists in the respondent by virtue of their current position and knowledge and we do not make this a random assignment.

Finally, we measure CFIP using a modified scale developed by Smith, Milberg and Burke (1996). We made minor changes to their instrument to reflect privacy concerns relative to health data instead of corporate data by replacing the word *corporations* with *health care entities* – defined as “any and all parties involved in the health care process, such as doctors, hospitals, clinics, health insurance providers, payers, pharmacies, etc.” In an effort to control for differences in sample size, we divide the sample into two levels of CFIP. We categorized the highest 25 percent as

³ For high-involvement individuals, we worked with the organizers of an HIT stakeholder conference and collected the email addresses of 129 of their members. The ‘general’ group of subjects was a pseudo-random sample of people who opted-in to an online survey sample list provided by Zoomerang™.

privacy fundamentalists and the lowest 20 percent as privacy unconcerned based on their aggregate scores on CFIP. Using this dichotomized sub-group approach, we test for the moderating effect of CFIP (Stone-Romero et al. 1994).

Analysis and Results

To test hypothesis 1, we used ANOVA with AQ as the fixed factor and AC as the dependent variable, while controlling for gender. Our results showed that strong AQ messages elicited greater AC than weak messages ($M_{strong}=0.55, n=241; M_{weak}=0.20, n=125; p=0.000; F(1, 365)=13.02$), supporting H1. We then tested the effect of involvement on AC while controlling for gender and found that AC was greater in high-involvement individuals ($M_{high}=0.71, n=102; M_{low}=0.31, n=264; p=0.000; F(1, 365)=14.16$). Therefore H2 is also supported.

We hypothesized that the quality of arguments would positively influence the relationship between II and AC. To test this, we first categorized the sample into subgroups based on their position in the AQxII matrix. Using ANOVA, we tested the relationship and our results showed a significant overall interaction effect ($F(3, 365)=10.72, p=.000$). We further explored this relationship with respect to the differences between strong and weak quality arguments and the effect that each had under both low and high II. To test our hypotheses, we used planned post-hoc multiple comparisons. We found that there was a significant difference in AC between weak and strong AQ when II was low (mean difference=0.34; $p=0.018; b>a$; see Figure 2). We also found a significant difference under high II conditions (mean difference=0.50; $p=0.021; d>c$), therefore, we can conclude that strong arguments elicit greater AC under both low and high II, and H3 is supported.

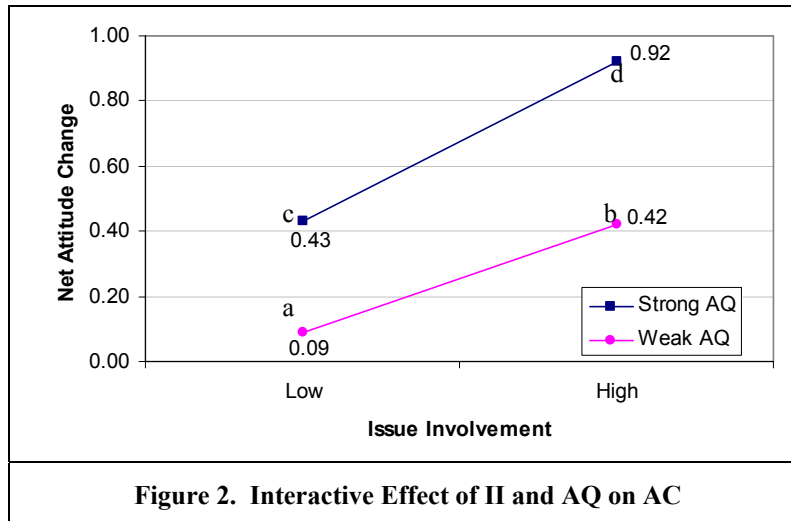


Figure 2. Interactive Effect of II and AQ on AC

Note: AC scores represent the difference between pre- and post-manipulation beliefs about the use of EHR systems. The attitudes were measured on three seven-point semantic differential scales anchored at 1 and 7 (Bad-Good, Foolish-Wise, Unimportant-Important).

Finally, our primary interest in this study was evaluating the impact that privacy concerns have on the relationship between AQxII and AC. We hypothesized a moderated relationship between the interaction term and the dependent variable. We operationalized this as a 2 x 2 (Weak/Strong AQ x Low/High II) factor model and as noted earlier we dichotomized CFIP to examine its effect on the interaction. Our analysis showed that the three-way interaction was significant ($F(7, 329)=5.63, p<.001$), demonstrating that CFIP does in fact moderate the relationship between AQ x II and AC and thus confirming hypothesis 4.

Limitations

Prior to reflecting on the implications of our findings, we discuss the limitations of the research. Although we attempted to educate the subject about EHR systems, it is possible that some respondents did not understand the technology. Because EHRs are not part of the lexicon of most people, there is the chance that some people formed their own mental construal of the artifact which was not accurate. Our operationalization of II has removed some of

the concerns with the construct such as the assurance that the manipulation has taken effect, but we have also introduced new issues. For example, our classification based on job and/or knowledge of EHRs may not truly represent the involvement that an individual feels relative to the impact that EHR use may have. Our sample included only those subjects who had access to the Internet for completion of the survey. Since this study was conducted as a pseudo-experiment in which we compared groups of individuals, we do not believe the tech-bias causes undue concern. Caution should be taken that these results may not be applicable to a population of individuals who do not use computers or the Internet.

Discussion

The broad objective of this work was to examine the influence that privacy concerns have on people's attitudes toward an emerging technology that holds great potential for transforming the way healthcare is managed and delivered but is not yet well-understood or broadly utilized. As discussed, there is cause for concern that privacy issues may impede the diffusion of an information technology that has been demonstrated to reduce errors and decrease costs. We explored whether people's attitudes about the use of EHRs were malleable and if appropriately crafted messages would create more positive attitudes. While replete with anecdotal and opinion poll data related to privacy and medical information, our literature review revealed a very limited amount of extant academic research discussing information privacy. Our research revealed several interesting findings as discussed below.

Key Findings

Consistent with prior research, we find that people's attitudes can be modified in a favorable way. In addition, a striking finding of this study is that the relationship between privacy concerns, AQ, and II is highly complex. The three-way interaction between information privacy concerns, argument quality, and issue involvement in influencing attitudes merits further investigation. Our results also add to a growing body of literature in support of the concept that CFIP is an important construct in belief structures of individuals as they relate to the institutional use of personal information. Equally important, this result provides evidence that privacy concerns are important issues to consider as related to beliefs about the use of EHRs. To the extent that people believe their medical information is vulnerable when input into an EHR, it is imperative that assurances about security and value are communicated to the individual since people with high privacy concerns are more difficult to persuade.

Results also show that in addition to having more favorable pre-manipulation attitudes toward the use of EHRs, high II individuals demonstrated a statistically significant increase in pre-to-post attitude, over low II individuals, especially when strong messages were presented. Simply put, it is easier to persuade high II individuals of the value of EHRs than it is to persuade low II individuals. This may be due to a lack of understanding, or misunderstanding, of the uses of EHRs by low II respondents. It may be the case that the uninformed are unnecessarily concerned about functions and features of EHRs, which may or may not exist. For example, evidence from this study also revealed that respondents had great concern about their employer finding out about personal medical information if their data were located in an electronic, Internet accessible database. Relative to privacy concerns, we found that most respondents, even those with greater than normal concerns for privacy, reacted positively to strong messages. This demonstrated that privacy, while an important barrier, is nonetheless not insurmountable.

Conclusion and Extensions

While information systems' researchers have made substantial progress in examining behavioral aspects associated with technology adoption, very little of this work has been integrated into the practice of healthcare. In addition, although privacy of information is becoming more topical, the privacy of medical information has not been studied in a rigorous way. There are very strong, visceral feelings about this type of highly personal data and it behooves researchers to examine the barriers to IT adoption in the presence of such concerns. We also believe that concern for privacy of all types of personal information will become increasingly important in the near future as more and more information is digitized. This being the case, information privacy should be examined in multiple contexts and domains. The national media exposes breaches in private digital information on a regular basis and it is becoming apparent that diverging views are emerging in the population. We are suggesting that a 'privacy calculus' is emerging such that people will assess the risks of a breach of privacy versus the benefits of having personal information in a digital format which could be useful in specific situations. Considerable work remains with respect

to the investigation of the variances in beliefs related to privacy concerns and in particular, whether public opinion will impact the use of information technology that has been developed to store and maintain personal information.

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