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Factors Influencing Patients’ Perceptions toward Electronic Medical Record (EMR) Use: A Conceptual Model

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ABSTRACT
Despite the rapid technological advancements in the last decade, the adoption of electronic medical record (EMR) systems by hospitals and healthcare providers are far less than expected (Ford, Menachemi, and Phillips, 2006; Hsiao, Hing, Socey, and Cai, 2010). Although a large number of previous studies focused on the adoption and use of EMR systems from the healthcare professionals’ perspectives, there is little research that examined this issue from the perspectives of patients. This study proposes a conceptual model that incorporates users’ characteristics, their personality traits, their perceptions on privacy and security, social influence, and a number of external factors, which influence patients’ perceptions toward EMR use. The proposed research model provides additional insights to the technology adoption and EMR adoption research.

Keywords (Required)
Healthcare, Electronic Medical Record (EMR), Personality Traits, Technology Adoption, Users’ Perception, EMR Use

INTRODUCTION
The rapid technological advancements and innovations in the last decade have transformed the healthcare industry. The adoption of EMR systems in healthcare is a key to this change. The EMR system provides timely and accurate medical information and thus it is viewed as a solution for efficient and quality healthcare (Venkatraman, Bala, Venkatesh, and Bates, 2008). Today, hospitals and healthcare professionals are using EMR systems for storing and managing patients’ health information, scheduling patients, sending prescriptions to pharmacy, and using EMR as complete workflow systems to manage their daily activities (Fischer, 2007; Miller and Sim, 2004). However, despite these benefits, the rate of adoption of EMR systems by the healthcare organizations is far too slower than previously expected (Ford et al., 2006; Hsiao et al., 2010).

Several recent studies (Anderson and Agarwal, 2011; Miller and Sim, 2004; Ossoff, Thomason, and Appleton, 2010; Shortliffe, 1999) have attempted to investigate the adoption of EMR systems from the perspectives of hospitals and healthcare providers. However, there is little research examining these issues from the perspective of patients. In this paper, we investigate factors that influence the EMR adoption and try to have better understanding of this issue from the perspective of patients, the ultimate beneficiaries of the EMR adoption.

The remainder of this paper is organized as follows. In the next section, we discuss about EMR systems along with the benefits and barriers of EMR adoption and use. In the following section, we propose a conceptual model of users’ perceptions on EMR use as well as discussions about constructs and the research hypotheses. In the discussion section, we present the theoretical implications of the study. We conclude the paper with the limitations and directions for future research.

EMR IN HEALTHCARE
The earliest use of EMR systems was started when health practitioners used programs to store and retrieve patient records in 1958 (Stead, 1989). Although the concept of EMR systems existed since the mid nineteenth century, these systems and their associated benefits did not catch organizations’ attention until the last decade. Some of the cited benefits for using EMR systems by organizations and patients are discussed in the following.
Organizational Benefits of EMR Adoption

The sharp rise in healthcare costs in recent years is one key factor for replacing the traditional health record keeping systems with the EMR systems. It is estimated that EMR systems could save healthcare professionals over $70 billion, Medicare about $23 billion, and private payers about $31 billion per year (Hillestad, Bigelow, Bower, Girosi, Meili, Scoville, and Taylor, 2005). In addition, healthcare professionals will be able to provide coordinated care, routinely measure the quality of treatments, and significantly reduce medical errors (Hillestad et al., 2005; Miller and West, 2007), leading to improve patient safety, facilitate management of chronic conditions, and improve hospitals efficiencies (Sprague, 2004).

Patients’ Benefits from EMR Use

EMR systems can benefit patients for scheduling appointments, sending secure messages to providers, ordering medications, accessing medical history, and obtaining various healthcare tips and educational information (Miller and Sim, 2004). Other benefits include receiving laboratory test results electronically (McDonald, 1997), receiving reminders about chronic/preventive care services such as diabetic services, immunizations, and flu vaccinations (Miller and West, 2007), and lowering the communication barriers between patients and caregivers (Tang, Ash, Bates, Overhage, and Sands, 2006).

Another benefit is using e-prescription which increases safety of medication use, provides automated warnings, and reduces the use of costlier version of medications (Fischer, 2007). Previous studies indicated that the most up-to-date patient information at the time of writing the prescription reduces adverse drug events by 25% per year (Fischer, 2007). E-prescribing also reduces number of trips to pharmacy and avoids long waiting time while the prescription is filled, thus it significantly saves time and hassle.

Barriers to EMR Adoption

Acknowledging the wide range of benefits using EMR systems, government issued an executive order in 2004 to implement these systems nationwide and to provide all citizens with access to their health records within next ten years (Ford et al., 2006). In addition, federal government initiated a $50 billion plan in 2009 to offer incentives to hospitals and healthcare organizations who make meaningful use of EMR systems (Jha, 2010). Despite these efforts, the rate of adoption by hospitals and healthcare professionals are far too slower than it was previously expected (Hsiao et al., 2010). A recent National Center for Health Statistics (NCHS) study shows that the use of fully functional EMR systems in US hospitals and healthcare facilities have only reached to around 10% in early 2010 and will take until 2024 for approximately 87% of all healthcare facilities to fully adopt the EMR systems (Ford et al., 2006).

Previous studies that have investigated barriers for EMR adoption found that lack of standardization, concerns about privacy and security, confidentiality, and physicians and healthcare workers resistance are some of the key issues (Shortliffe, 1999). Other issues such as high initial cost and uncertain financial benefits (Miller and Sim, 2004), training (Ossoff et al., 2010), boundary risks, and emotions (Anderson and Agarwal, 2011) also play an important role for EMR adoption.

RESEARCH MODEL AND HYPOTHESES

Understanding factors influencing users’ perceptions and intentions to use an information technology is an important ongoing research topic for past few decades (Davis, 1989; Fishbein and Ajzen, 1975; Lu, Yao, and Yu, 2005; Venkatesh and Morris, 2000). Researchers from multiple disciplines such as Information System, Psychology, and Sociology have attempted to look into this issue from different perspectives. In Figure 1, we propose a theoretical model that incorporates a number of factors influencing the patients’ perceptions toward EMR use – users’ personality traits, individual characteristics, perceived usage benefits, perceived privacy/security concerns, social influence, and other external factors such as organizational size, reputation and government regulations.

Users’ Personality Traits

Since the introduction of five-factor model (FFM) and their applications by McCrae and John (1992), these personality traits have continued to attract researchers across all discipline in order to explain the adoption and use of new technology. In the field of healthcare, a number of studies also focused on the personality traits to find their effects on the use of health information system (Bansal, Zahedi, and Gefen, 2010). The FFM includes Neuroticism, Agreeableness, Conscientiousness, Extraversion, and Openness to Experience. However, previous studies found that Conscientiousness and Extraversion do not
have significant influence on users’ intention to use technology (Devaraj, Easley, and Crant, 2008; Korzaan and Boswell, 2008). Thus, we only include three of the FFM in this study – Neuroticism, Agreeableness, and Openness to Experience.

### Neuroticism
Neuroticism tends to be associated with negative emotional state. McCrae and John (1992) described Neuroticism as anxious, self-pitying, tense, touchy, unstable, and worrying. Individuals with high neuroticism tend to be anxious, nervous, high strung, and tense (Korzaan and Boswell, 2008) whereas individuals with low neuroticism tend to be emotionally stable and well-adjusted (Devaraj et al., 2008). Therefore, individuals with neurotic personality have the tendency to keep themselves away from technology as they view the technology as a threat to them. Results from a number of previous studies linked neuroticism with high computer anxiety (Korukonda, 2007; Korzaan and Boswell, 2008). Therefore, we argue that a patient with highly neurotic trait is too skeptical about his or her personal health information being stored in the EMR systems. Thus, we propose the following hypothesis.

**Hypothesis 1:** A Patient’s neuroticism negatively influences the patient’s perception toward EMR use.

### Agreeableness
Agreeableness tends to be accommodating and trusting others. McCrae and John (1992) and Barrick and Mount (1991) described agreeableness as appreciative, generous, sympathetic, trusting, courteous, flexible, cooperative, and tolerant. Individuals with highly agreeable characteristic are more likely to be compliant and accommodating to different situations. They are more likely to adopt new technology as they concentrate more on the positive and cooperative dimensions of the technology (Devaraj et al., 2008). Another characteristic of Agreeableness is a high degree of altruism, concerns for others and a strong desire to aid others (Devaraj et al., 2008; McCrae and John, 1992). Therefore, we argue that a patient with high agreeableness is more likely to accept EMR systems as they focus on the positive aspects of the new technology not only for their own good but for the benefit of others as well. Thus, we propose the following hypothesis.

**Hypothesis 2:** A patient’s agreeableness positively influences the patient’s perception toward EMR use.
Openness to Experience

Openness to experience tends to be viewed as the willingness to accept new tasks or technologies without much reservation. McCrae and John (1992) and Barrick and Mount (1991) described openness as being imaginative, curious, broad minded, intelligent, and artistically sensitive. Individuals who score high on openness are more likely to view new technology as a means for great advancement and less likely to pay attention to the negative dimensions of technology (Korzaan and Boswell, 2008). Thus, highly openness individuals are more likely to have positive attitudes toward adopting new technology (Devaraj et al., 2008). Therefore, we argue that a patient with high openness more likely to view the EMR use an opportunity for improvement and is willing to adopt it. Thus, we propose the following hypothesis.

Hypothesis 3: A patient’s openness to experience positively influences the patient’s perception toward EMR use.

Individual Characteristics

Individual characteristics such as age, gender, education, and computer experience play very important roles influencing users’ perceptions toward a particular technology (Davis, 1989; Dickerson and Gentry, 1983; Dickerson, 2003; Frenkel, 1990; Im, Bayus, and Mason, 2003). Thus, these individual characteristics are included to hypothesize how these factors influence users’ (patients) perceptions toward EMR use.

Gender

Previous studies found that men have been associated with active users of technology while women have been depicted as passive users (Van Slyke, Comunale, and Belanger, 2002). Adult females are more likely to use the technology as communication tools whereas adult males are more likely to use it for information, entertainment, and commerce purposes (Jackson, Zhao, Kolenic III, Fitzgerald, Harold, and Von Eye, 2008). Findings from other studies suggest that women do not trust the security of information system (Dickerson, 2003), and women tend to experience higher anxiety than men in using computers (Frenkel, 1990; Lowe and Krahn, 1989). Based on these studies, it can be inferred that women tend to have negative perceptions toward EMR use. Therefore, we propose the following hypothesis.

Hypothesis 4: A female patient has more negative perception toward EMR use than a male patient.

Age

Age plays an important role for technology adoption and diffusion. Im et al. (2003) found age to be a significant predictor of new product ownership for consumer electronics. Some studies indicated that younger individuals are the early adopters of personal computers (Dickerson and Gentry, 1983) and younger consumers are most likely to adopt new technology such as internet banking (Sathye, 1999) compared to the older individuals. A study by Morris and Venkatesh (2000) indicated that younger workers’ decisions are more strongly influenced by attitude toward using new technologies than older workers. Thus, we argue that younger patients will have positive attitudes toward EMR systems than the older patients. Therefore, we propose the following hypothesis.

Hypothesis 5: A patient’s age level negatively influences the patient’s perception toward EMR use.

Education

Individuals’ level of education also plays an important role for technology adoption and diffusion. Previous studies found that individuals with higher level of education are the early adopters of technological innovations such as personal computers (Dickerson and Gentry, 1983), and Internet banking (Sathye, 1999). Thus, we argue that highly educated patients will have positive attitudes toward EMR systems and are more likely to adopt. Therefore, we propose the following hypothesis.

Hypothesis 6: A patient’s education level positively influences the patient’s perception toward EMR use.

Computer Experience (Self-Efficacy)

Computer experience (self-efficacy) refers to individuals’ confidence of their ability to use a system or to perform a behavior in diverse environments (Compeau and Higgins, 1995). A number of studies suggest that self-efficacy significantly influences individuals’ intention to adopt information systems. A study by Henderson, Deane, and Ward (1995) found that administrative/clerical staffs with more computer experiences had significantly higher level of self-efficacy whereas nurses with little computer related skills showed low level of self-efficacy. Hence, individuals with more computer experiences will
possess higher level of self-efficacy and they are more likely to have positive perceptions toward information technology (Venkatesh and Davis, 1996) and more likely to try out new technology. Therefore we propose the following hypothesis.

**Hypothesis 7:** A patient’s computer experience positively influences the patient’s perception toward EMR use.

**Privacy/Security Concerns**

The term *privacy* is described as limiting the access to an individual’s personal information (HIPAA, 1996) and the right and desire of a person to control the disclosure of personal information (Rindfleisch, 1997). Concerns about privacy and security play very important roles in technology adoption, especially with sensitive personal data. Privacy concerns in healthcare can have negative consequences such as patients’ tendency to avoid healthcare and physicians’ reluctance to enter complete patient records (Rindfleisch, 1997). The digitization of electronic personal health information create increased concerns about privacy due to secondary use of data, errors, and unauthorized access (Smith, Milberg, and Burke, 1996). These increased concerns of information privacy intensify the fear of misuse which in turn increases anxiety (Korzaan and Boswell, 2008).

The term security is defined as “the protection of information and information systems from unauthorized access, use, disclosure, disruption, modification or destruction in order to provide confidentiality, integrity, and availability” (Kahn and Sheshadri, 2008). Security concerns are increasing as access to personal health information using electronic system is increasing (Huston, 2001). The delivery of accurate and timely health information is mostly depended upon the security of the system (Conklin and McLeod, 2010) and systems without security are at great risks of unauthorized access and data being stolen. Hence, systems that lack security will make users anxious about releasing personal health information and will reduce their desire to use EMR system. Therefore, we propose the following hypothesis.

**Hypothesis 8:** A patient’s privacy and security concerns negatively influence the patient’s perception toward EMR use.

**Perceived Benefits**

The widely accepted theory of technology adoption, the Technology Acceptance Model (TAM) posits that user acceptance is determined by two key factors of perceived benefits – perceived usefulness and perceived each of use (Davis, 1989). In this study, we consider accessibility as a construct for perceived benefits.

**Accessibility**

Accessibility is considered to be a very important factor for wide use of a technology. Karahanna and Straub (1999) suggest that accessibility of a system influences perceptions of the system ease-of-use. The more accessible a system is to users, less effort it will require and more convenient for them to use the system. Therefore, we propose the following hypothesis.

**Hypothesis 9:** Accessibility to EMR systems positively influences patient’s perception toward EMR use.

**Social Influence**

Social influence refers to change in actions, attitudes, or beliefs of a person influenced by another person’s or group’s action, attitude, or belief (Kelman, 2001). Human beings are naturally influenced by family members, co-workers, relatives, and friends. A number of studies used subjective norm as the construct for social influence and showed that it has been playing an important role in technology adoption and innovation diffusion process (Fishbein and Ajzen, 1975; Lu et al., 2005; Venkatesh and Morris, 2000). Socially influenced individuals adopt their attitudes, behaviors, and beliefs according to their surrounding social context (Salancik and Pfeffer, 1978). They are persuaded by others word of mouth and likely to consider external opinions as evidence of reality into their overall decision making process. Socially influenced individuals tend to be more compliant and accepting to their surroundings (Kelman, 1961), hence they are more likely to try out new technology (Schepers and Wetzes, 2007). Therefore we propose the following hypothesis.

**Hypothesis 10:** Social influence positively influences a patient’s perception toward EMR use.

**External Factors**

There are several external factors that influence individuals’ trusts and their willingness to adopt a technology. Consumers’ trusts in many cases depend on whether the organization can provide assurance to potential customers regarding firms’
security and privacy protection. Organization size, their reputation, and government regulations enforcing organizations in protecting their consumers are some of the factors to consider.

**Organization Size**

Employees in larger organizations tend to have greater focus on firms’ goals (England and Lee, 1973), hence gain stronger and greater level of consumer trusts. Thong and Yap (1995) argue that organization characteristics such as firm size plays an important role for IT adoption. Larger organizations tend to have more resources and expertise than smaller ones and they are the early adopters of new technologies, hence build greater consumer trusts about technologies. Therefore we propose the following hypothesis.

*Hypothesis 11: Organization size positively influences the patient’s perception toward EMR use.*

**Organization/Physicians Reputation**

Reputation is a strategic asset that is build over time and firms with high reputation have greater advantage because of high consumer trusts. In prior research, reputation found to be a significant factor for gaining trust for an organization (Xie, Teo, and Wan, 2006). Earp and Baumer (2003) show that consumers have higher level of trusts and are more willing to provide their personal information such as Social Security and credit card numbers to a well reputed site compared to a less reputed site. A study by Hibbard, Stockard, and Tusler (2005) show that hospitals reputation has a significant impact on public image. Thus, good reputation increases users trust and we propose the following hypothesis.

*Hypothesis 12: An organization/physician’s reputation positively influences the patient’s perception toward EMR use.*

**Government Regulations**

The role of government and its regulations have been playing significant roles over the years to establish and retain consumer trusts on organizations and on their associated technologies. At various times, government introduced regulations such as fair information practices and HIPAA privacy rules to protect consumers’ trust. Government regulations not only help to set the minimum standards but in fact enhance consumers’ trusts (Tang, Hu, and Smith, 2008). Therefore we propose the following hypothesis.

*Hypothesis 13: Government regulations positively influence the patient’s perception toward EMR use.*

**DISCUSSIONS AND IMPLICATIONS**

This study focused on understanding perceptions toward EMR use from the view of patients. A number of theoretical implications can be drawn from this study. There are many prior studies that focused on EMR adoption from the perspectives of hospitals and healthcare professionals. This study attempts to understand the EMR adoption from the patients’ point of view. In this study, we have also considered factors from multiple dimensions that could influence users’ perceptions toward EMR usage including some personality traits from the five-factor model from the field of personality traits research and applied in the field of Information Systems in technology adoption research. We believe that the proposed conceptual model in this study would increase our understanding of the barriers of EMR systems adoption, especially from the perspective of patients.

There are also practical implications that can be drawn from this study. The proposed conceptual model in this study would assist hospitals and healthcare practitioners to identify factors that hinder EMR systems adoption and help them to initiate education and training programs for their patients who are skeptical about using these systems.

**CONCLUSIONS, LIMITATIONS, AND DIRECTIONS FOR FUTURE STUDIES**

Since the introduction of EMR in the healthcare industry, a large number of researchers have zoomed on the issue of EMR adoption. These researchers focused on factors such as costs, physicians’ resistances, and technological shortfalls. However, their studies failed to consider the role of patients into theoretical models. Since patients are the ultimate beneficiaries of the benefits from the EMR adoption, understanding patients’ perspectives is extremely important for successful adoption of EMR. Thus, our study explored the issue of EMR adoption from the patients’ perspective, which we believe will shed light on understanding this complex issue.
Like all other studies, this study is not without limitations. Although our goal was to consider factors influencing the users' (patients) perceptions toward EMR use from multiple dimensions, there are other factors such as security dimensions that could be relevant but not included in our research model. Future studies can be aimed to enhance our conceptual model by exploring other unknown factors that are relevant for EMR adoption. In future, we hope to empirically validate the hypotheses presented in this paper.

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