Clinician Acceptance of Electronic Medical Records (EMRs): Relating Personality Factors to Continuance Intention

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Dedication

For G-ma and G-pa Mac, Mom & Dad, Megan, and Torre

Abstract

Many models currently exist for evaluating acceptance and continued use of technology. However, none of these models are healthcare specific, nor do they involve aspects of users' personality. Although the five-factor model (FFM) of personality has been effectively used in psychology and human resources and management research to predict attitudes, cognitions, and behaviors, it has not been effectively integrated into a technology acceptance model. This paper proposes a new model of technology acceptance and continued use for clinicians. Survey results from 244 medical and dental residents and fellows were used to analyze the relationships between personality factors and the technology acceptance constructs of performance expectancy, effort expectancy, social influence, and continuance intention. Clinicians scored highest in agreeableness, conscientiousness and openness to experience and lowest in neuroticism. Neuroticism was negatively related to effort expectancy. Agreeableness was positively related to both continuance intention and social influence. The results of this study demonstrate the further need for research in the area of personality and technology acceptance, as well as the need for healthcare specific models.

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List of Constructs and Abbreviations

- **Performance Expectancy (PE):** degree to which an individual believes using the system will help to attain gains in job performance (Venkatesh, 2003).
- **Effort Expectancy (EE):** degree of ease associated with system use (Venkatesh, 2003).
- **Social Influence (SI):** the degree to which an individual perceives that important others believe he/she should use the new system (Venkatesh, 2003).
- **Facilitating Conditions (FC):** the degree to which one believes that organizational and technical infrastructures exist for system support (Venkatesh, 2003).
- **Anxiety:** the degree of apprehension, or fear, when the user is faced with the possibility of using computers (Venkatesh, 2003).
- **Continuance Intention (CI):** the intention of a user to continue using an information system post-adoption (Bhattacherje, 2001).
- **Extraversion**: being sociable, gregarious and ambitious.
- **Agreeableness**: a compassionate interpersonal orientation.
- **Conscientiousness**: intertwined with the degree of organization, persistence, and motivation in a goal-directed behavior.
- **Neuroticism**: emotional instability and is often characterized by insecurity, anxiousness, and hostility.
- **Openness to Experience**: able to have flexible thoughts and tolerate new ideas.

INTRODUCTION

Electronic Medical Records, or EMRs, are the most fundamental piece of health information technology (HIT). Because of their cost, difficulty to implement (both technically and culturally), and on-going support issues EMRs have become a hot topic of research in Health Informatics and IS literature over the last decade. In its landmark and often cited report to Err is Human (2000), The Institute of Medicine (IOM) reported acute and widespread preventable errors were prevalent in United States healthcare delivery systems. The IOM (2001) later attributed the insufficient quality of care to: the growing complexity of science and technology, a poorly organized delivery system, constraints on exploiting the revolution in information technology, and an increase in chronic conditions. The first three of the four underlying reasons provided by IOM can be addressed through improvements in technology such as the implementation of EMRs with Clinical Decisions Support Systems (CDSS) and Computerized Physician Order Entry (CPOE). The remaining problem, an increase in chronic conditions, could be better managed utilizing fully implemented EMRs. For example, many EMRs provide clinical decision support for chronic conditions such as diabetes by prompting physicians to order routine labwork such as the HbA1C. Some proven benefits of EMRs include the reduction of errors, improvement in clinical decision making during patient visits, and increased access to information in real time (Harrison and Palacio, 2006).

Acknowledging these potential benefits, Congress passed the American Recovery and Reinvestment Act (ARRA) of 2009 which allotted $19.2 billion for Health Information Technology (HIT) including financial incentives to use electronic health records and grants and loans for HIT solutions (American Recovery and Reinvestment Act of 2009). Subtitle A-Promotion of Health Technology of the ARRA, targets the use of an electronic health record for each individual in the United States by 2014 (American Recovery and Reinvestment Act, 2009). In addition, Medicare and Medicaid reimbursements will also be reduced for hospitals without EMR systems by 2015 (Terhune, Epstein, & Arnst, 2009). While these government mandates, target setting, and funding appear on the surface to be helpful in the campaign for better HIT, it doesn't directly address the real issues physicians and healthcare systems face with implementation of EMRs. In addition to the cost burden, the perception that EMRs are very divergent from current practice is a noted problem (Schoen, Davis, Osborn, & Blendon, 2000). Unlike other fields where the introduction of a piece of technology mimics the workflow of users, a poorly matched EMR can often cause physicians and nurses to alter the way they perform their duties. Depending on the system selected, it can be a very poor fit for the users and environment and cause a loss in productivity and therefore revenue.

Because the introduction of any technological system into a workplace can be disruptive and costly, scholars have developed theories of technology acceptance and continued use in order to measure the impact of and make recommendations on implementation strategies. Until recently very few researchers have been interested in technology

acceptance in healthcare. And although researchers have begun examining and testing traditional technology acceptance models, there are no domain specific models for physicians or nurses. Additionally, the traditional models being tested leave out factors directly related to the individual, such as personality. In order to truly understand the human-computer interaction and resulting technology acceptance, more attention should be paid to individual characteristics and how they affect technology acceptance.
The few research notes that exist in the literature relating to technology acceptance and personality are not in the realm of HIT or specifically, EMR use. Although it is somewhat recognized that cognitive aspects such as anxiety and self-efficacy have been correlated with technology acceptance theories, the pioneering research study which examined the direct relationship between personality and technology acceptance (Deveraj et al., 2008) is lacking generalizability to healthcare since the research subjects were MBA students and EMRs were not studied. The lack of domain specific models and personality specific information for which to design these models leaves a gap in the field of technology acceptance in healthcare.

The research presented here intends to contribute knowledge in this area by examining the relationship between personality on technology acceptance and continuance intention by incoming medical and dental residents and fellows in the University of Minnesota Graduate Medical Education program (GME) and at Hennepin County Medical Center (HCMC) in Minneapolis, Minnesota. The University of Minnesota and HCMC were selected because of their large number of incoming residents/fellows of various

specialties attending one day orientations to their programs. Additionally, residents and fellows were pinpointed as a key demographic because of their similar ages and years of experience with EMRs. Because of their similar ages, these residents and fellows are also considered to be digital natives. Digital natives refers to the individuals who grew up during the last few decades of the 20th century, and thus were always surrounded by computers, videogames, digital music players, video cameras, and cell phones. Digital Natives parallel process and multi-task, preferring graphics before text rather, prefer random access like hypertext, function best when networked, thrive on instant gratification and frequent rewards, and most importantly want their information really fast (Prensky, 2001). By selecting digital natives, it helps decrease the effect that different levels of experience with technology could potentially have. By selecting these two locations, the residents/fellows were expected to have similar exposure to a smaller number of EMRs. Similar EMR experience decreases the likelihood that a wide variety of EMR exposure would be a confounding variable. The medical and dental residents and fellows are also a key demographic to study because these new clinicians will be driving the market in their own personal practice as well as steering the directions of hospitals or dental clinics where they are employed in years to come. In fact, O'Neill, Talbert and Klepack (2009) found that out of 485 physicians surveyed in Kentucky, almost half (45%) of those in their thirties had fully or partially implemented EMRs compared with 15% of physicians aged 60 and above.

The outcome of interest in this research is how the personality factors affect clinician acceptance and continuance intention of the EMR. It is important to examine clinician

acceptance of the EMR because these front-line care providers are in the best position to observe the effects of its use (Weiner et al., 1999). Technology readiness has been found to be the strongest predictor of adoption in EMRs, and an increased level of comfort has led to an increase in adoption rates (Abdolrasulnia et al., 2008; Arsenault, Cudney, & Luchsinger, 2008). While this research has documented one of the predictors of EMR adoption, it has failed to explain its continued use. Bhattacherjee (2001) notes that more important than the acceptance of a technology is its continued use. Acceptance does not guarantee continued use, and therefore being able to convince end users to continue using a particular piece of technology has become an important issue in HCI research (see Bhattacherjee, 2001; Bhattacherjee, Perols, & Sanford, 2008; Hong, Thong, & Tam, 2006; Lee & Tsai, 2010).

BACKGROUND

ELECTRONIC MEDICAL RECORDS (EMR)

The IOM defines an Electronic Health Record as a system offering the following capabilities:

1) "Longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or health care provided to an individual;

2) Immediate electronic access to person- and population-level information by authorized, and only authorized, users;

3) Provision of knowledge and decision-support that enhance the quality, safety, and efficiency of patient care; and

4) Support of efficient processes for health care delivery." (Committee on Data Standards for Patient Safety, 2003)

Although the terms EHR and EMR are often used interchangeably, they are not synonyms. The National Health Alliance for Information Technology (2008) describes the differences: "EMR: An electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization. EHR: An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization."

Despite the clear benefits of utilizing EMRs, it is estimated that only 17% of U.S. physicians and 8 to 10% of U.S. hospitals have a basic electronic health record system, and a smaller number have or use all-inclusive HIT systems that reach their full ability (Blumenthal, 2009). Reasons contributing to this slow adoption of modern information and communication technology in healthcare include the perceptions that it is too expensive, very unusable, and unlike current practice (Schoen, Davis, Osborn, & Blendon, 2000). Physicians in smaller, independent practices (approximately 60% of US physicians) biggest concerns with HIT relate to the large up-front investments, loss of productivity, and ongoing technical support issues (Chiasson, 2007). Healthcare

providers are also now concerned with the flexibility of HIT systems, if they are 'fit for purpose', and have varying levels of confidence and experience with IT (Ward et al., 2008). The literature further indicates that proper education and training are required in order to achieve user acceptance of HIT systems.

Unsuccessful EMR implementations are another reason why some physicians and healthcare organizations have been cautious regarding purchase and implementation. Depending on the source and definition of failure, Polack reported an EHR failure rate of 30-50% (2009). In a highly publicized article, the University of Pittsburgh Children's Hospital attributed a delay in care and a doubled number of patient deaths to their five month old computerized physician order entry (CPOE) system (Han et al., 2005).

One of the earlier research studies on technology acceptance and HIT applied TAM to assess emergency services physicians' and nurses' perceptions of a prototype PDA support system (Chang et al., 2004). This research is notable because it is one of the first studies where the researchers validated the content validity of the TAM survey items relative to HIT. Unfortunately, the researchers did not examine the relationships among the TAM constructs, so their work was applicable only to their future implementation of the PDA system because of the information gathered related to user perceptions.

Later, Seeman and Gibson (2009) compared the degree to which TAM and TPB would explain variance in hospital workers' acceptance of the EMR. They found that one theory was not better than the other, and in fact the best explanatory power was obtained

by a linear combination of the variables from both theories. Moreover, the constructs of TPB (behavioral control, social influence, and attitude) play a significant role in EMR acceptance. They suggested that based on their evidence, technology acceptance in healthcare should not be limited to a single model.

UNIFIED TECHNOLOGY ACCEPTANCE AND USE THEORY (UTAUT)

The current models of technology acceptance have grown to become accepted and applied among scholars in domains including healthcare and medical informatics. Multiple iterations of these models over time have included additional constructs from social theory and have integrated better predictive modeling. The most recent model, Unified Technology Acceptance and Use Theory or UTAUT, merges eight other models into a unified theory. The UTAUT was studied in six organizations and found to explain roughly 70% of the variance in intention of end-users to utilize information systems (Venkatesh et al., 2003).

UTAUT integrates eight of the previous user acceptance theories including Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM) and (TAM2), Innovation Diffusion Theory (IDT), Motivational Model (MM), Model of PC Utilization (MPCU), and Social Cognitive Theory (SCT). The linking similarity between all of these models is the dependent variable of intent to use or actual usage. Each of these contributing models will be furthered described in the

following section and later each individual theory's involvement in the survey and subsequent hypotheses will be detailed.

Theory of Reasoned Action (TRA)

The theory of reasoned action is an accepted model in social psychology used to explain any human behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). It has been one of the most fundamental and influential theories of human behavior (Venkatesh et al, 2003). TRA was published two years prior to Albert Bandura's research on SET, or Self-Efficacy Theory (Bandura, 1986). SET is derived from Social Cognitive Theory (SCT) which examines the process of knowledge acquisition through observation (Bandura, 1977).

The two core constructs of TRA are *attitude toward behavior* (ATB) and *subjective norm* (SN). The construct ATB is defined as "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein & Ajzen 1975, p. 216). The definition of SN is "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975, p. 302). Davis et al. (1989) validated the application of TRA to individual acceptance of technology. They found that the variance explained was consistent with other studies that had utilized TRA in the context of other behaviors.

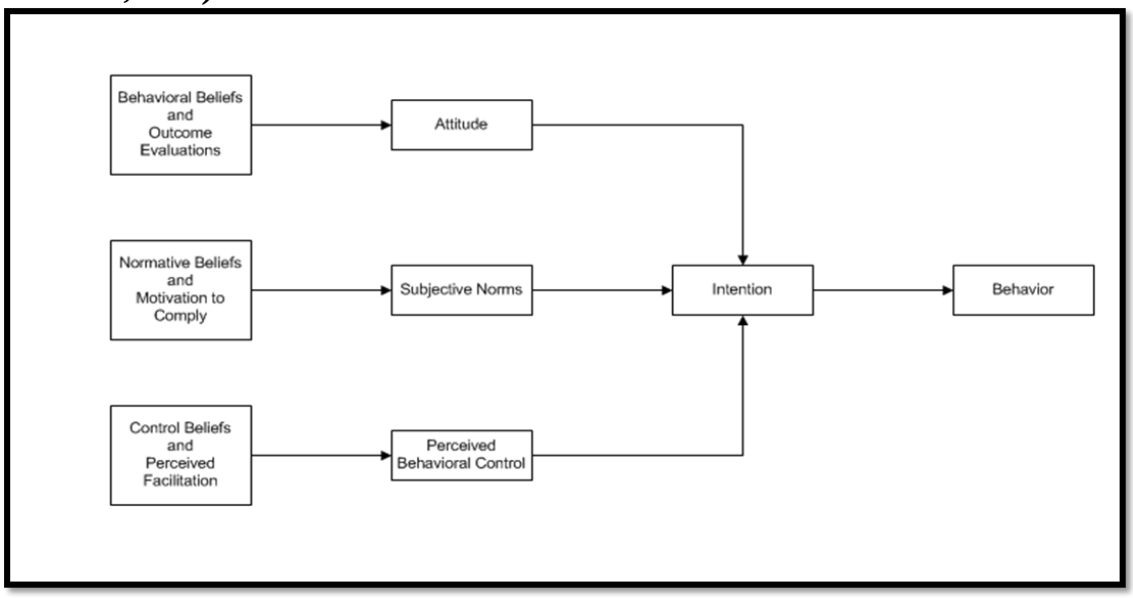
Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) is an expansion of the theory of reasoned action (TRA), which also uses SET. The key assumption of TPB is that humans are rational, and will systematically evaluate any information presented to them. The performance of a specific behavior is determined by the individual's intention to perform the behavior. This intention is determined by a person's attitude and subjective norm. The individual's attitude toward this specific behavior is also determined by the person's belief of what the consequences of performing the behavior are, multiplied by evaluation of those consequences. Lastly, an individual's subjective norm is a multiplicative function of their normative beliefs and the person's motivation to comply. The assumption is also made in TRA that all other factors influence behavior indirectly through attitude, subjective norms, or relative weights (Davis, Bagozzi, & Warshaw, 1989).

TPB originated due to the restrictions of the prior model in dealing with behaviors over which people have incomplete volitional control. As in TRA, a central aspect in TPB is the individual's intent to perform a given behavior, such as EMR use. This intent or these intentions are said to reveal the motivational factors that affect or influence a behavior. From these intentions you can deduce how hard people are willing to attempt a behavior, how much of an effort they are planning to exert in order to perform the behavior. As a general rule, the stronger the intention is to employ a behavior; the more likely it will occur. The behaviors included when discussing this theory are only those that are within volitional control.

Figure 1 depicts the Theory of Planned Behavior in a diagram. In the diagram, behavior is determined by *intention* (I) to perform the behavior. *Attitude* toward behavior (A), *subjective norms* (SN), and *perceived behavioral control* (PBC) determine behavior. An individual's perception of social pressure to perform a behavior is SN. Perception of control over performance of a behavior is PBC. It is important to note that both A and I are defined the same way for TAM.

Figure 1: Theory of Planned Behavior (TPB) (Adapted from Davis, Bagozzi, & Warshaw, 1989)



Technology Acceptance Model (TAM)

The technology acceptance (TAM) model is the first theory developed for information systems, specifically for people in business (Davis, 1989). Three main differences between TAM and TPB have been generally noted. The first example is their differences in generality. A second is that TAM does not include any social variables explicitly.

Third, both models treat the behavioral controls differently (Mathieson, 1991). Figure 2 shows an adaptation of the TAM model.

Successful implementation of an IS is greatly affected and often impeded by user acceptance (Gould, Boies, & Lewis, 1991; Nickerson, 1981). Performance benefits expected from newly implemented IS are greatly diminished or nonexistent when users refuse to accept a system. TAM is often used to address why users accept or reject a system, and how user acceptance is affected by system characteristics (Davis, 1993).

An end-user's attitude about using a system has been demonstrated to greatly affect whether or not the user will utilize the system. The user's attitude is a function of two core constructs: *perceived usefulness* (PU) and *perceived ease of use* (EU), which has a causal effect on PU (Davis, 1993). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). EU is "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320). Both PU and EU are directly influenced by the design of a system, and the design features have an indirect effect on attitude toward using and actual usage behavior.

Empirical testing of TAM suggests that it has the ability to predict intention. Attitude or the user's evaluation of the system's desirability, and PU influence the user's intention (I) to use the system. In its early days of use and testing, TAM was found to predict use of a

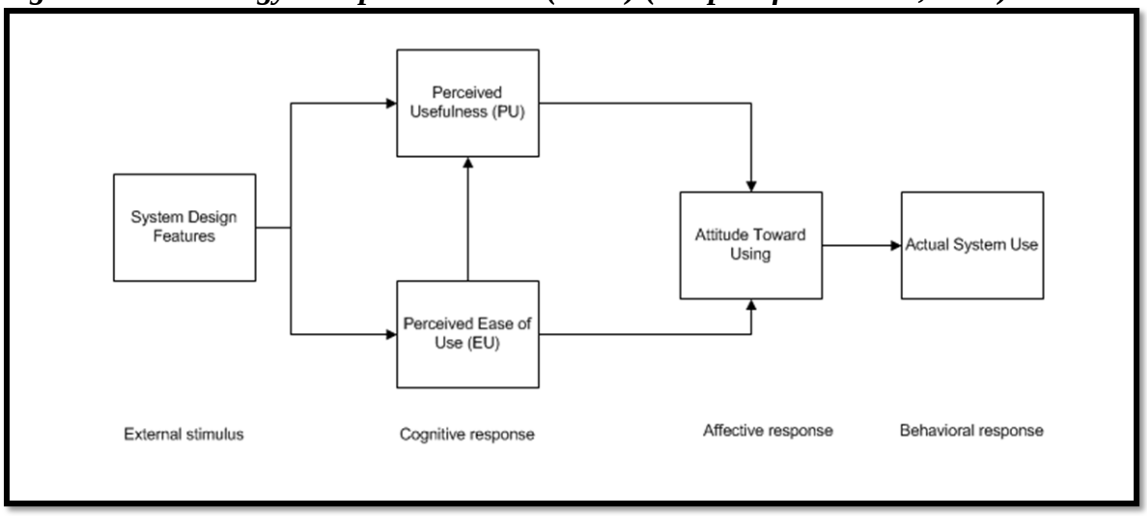
word processing package (Davis et al, 1989) and EU and PU were significantly correlated with use of an office automation package, a text editor, and two graphics packages (Davis, 1989).

Since then, TAM has been used in numerous studies with similar results, validating the theory (Adams et al., 1992, Agarwal and Prasad, 1997, Gefen and Straub, 1997, Gefen and Straub, 2000, Hendrickson et al., 1993, Igbaria et al., 1997 and Szajna, 1996). In addition to this wide body of literature, research has also demonstrated that TAM is applicable to a wide array of technology (Gefen et al., 2003 and Gefen and Keil, 1998). TAM has recently been applied to technology acceptance in healthcare. Researchers used TAM to assess ambulatory care physicians' pre-implementation expectations about EMR's PU (Dansky, Gamm, Vasey, & Barsukiewicz, 1999). They found that computer experience and organizational support were both positively correlated with PE. Valuing close patient relationships and computer anxiety were both negatively correlated with PE. Later, Dillon et al. (2005) examined nurses' attitudes 30-90 days prior to EDMR implementation. They hypothesized that attitude had a direct effect on system use and adoption. This is contrary to research conducted by Venkatesh et al. (2003), which established that attitude is not a good predictor of usage behavior. Not surprisingly, the Dillon et al. model only accounted for 44% of the variability, indicating some additional factors were not accounted for.

TAM research has been traditionally conducted through use of a survey tool. Although the types of studies change, the survey constructs used in the literature have minimal

differences. These investigational models are usually adapted from relevant prior studies, and minor changes to words are made to fit them to the proper context (Huang & Chuang, 2007).

Figure 2: Technology Acceptance Model (TAM) (Adapted from Davis, 1989)



Combined TAM-TPB or C-TAM-TPB and TAM2

Taylor and Todd (1995) developed the Combined TAM-TPB, or C – TAM – TPB. This theory combines TPB with the core construct of perceived usefulness from TAM. The core constructs of C-TAM-TPB are *attitude toward behavior*, *subjective norm, perceived behavioral control*, and *perceived usefulness*. The first three are adapted from TRA and TPB, while perceived usefulness is adapted solely from TAM.

In a second iteration of the TAM model known as TAM2, *subjective norm* is also included as a core construct. It is adapted from the TRA and TPB models as an

additional predictor of intention in the case of mandatory settings (Venkatesh and Davis 2000).

Innovation Diffusion Theory (IDT)

Innovation Diffusion Theory, or IDT, has its roots in sociology. Beginning in the 1960's IDT has been used to study a wide range of innovations from basic agricultural tools to more complex organizational innovation (Tornatzky and Klein, 1982). Moore and Benbasat (1991) wanted to adapt the characteristics of innovations for information systems. Thus, they cultivated a set of constructs that could be used to examine technology acceptance among individual users. These constructs include *relative advantage, ease of use, image, visibility, compatibility, results demonstrability,* and *voluntariness of use*. *Relative advantage* is "the degree to which an innovation is perceived as being better than its precursor" (p. 195). *Ease of use* relates to "the degree to which an innovation is perceived as being difficult to use" (p. 195). *Image* is "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (p. 195). Simply understood, *visibility* is how much an individual can envision others using the system in the organization. *Compatibility* is "the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters" (p. 195). *Results demonstrability* is "the tangibility of the results of using the innovation, including their observability and communicability" (p. 203). *Voluntariness of use* is "the degree to which use of the innovation is perceived as being voluntary or of free will" (p. 195). Later, Moore and Benbasat (1996) found support for the predictive validity of their constructs.

Motivational Model (MM)

Psychological research has generally supported motivation theory as an explanation for behavior (Venkatesh et al, 2003). Within this body of research, motivational theory has been examined and adapted for specific contexts, including technology acceptance. The two core constructs are *intrinsic* and *extrinsic* motivation. *Extrinsic motivation* is defined as the perception that users will want to execute a behavior "because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions." *Intrinsic motivation* is the perception that users will perform a behavior "for no apparent reinforcement other than the process of performing the activity per se" (Davis et al. 1992, p. 1112).

Davis et al. (1992) applied motivational theory to understand new technology adoption and use. In harmony with prior research they found that both extrinsic and intrinsic motivation were key drivers of an individual's intention to perform the behavior, in this case the usage of technology.

The Model of PC Utilization (MPCU)

In 1991, Thompson et al. published an alternative to TRA and TPB entitled the Model of PC Utilization (MPCU). This theory is based on H.C. Triandis' (1977) theory of human behavior. The Triandis' theory shows a distinction between beliefs that link emotions to the act and those that link the act to future consequences. The argument is that behavioral intentions are determined by feelings people have toward the behavior. Thompson et al.

(1991) brought the Triandis' theory, accepted thus far only in psychological literature, to the IS realm. This new theory implies that the usage of a personal computer is influenced by the individual's feelings (affect) toward using PCs, social norms in the work place concerning PC use, habits associated with computer usage, the individual's expected consequences of using a PC, and facilitating conditions in the environment conducive to PC use (Thompson, 1991).

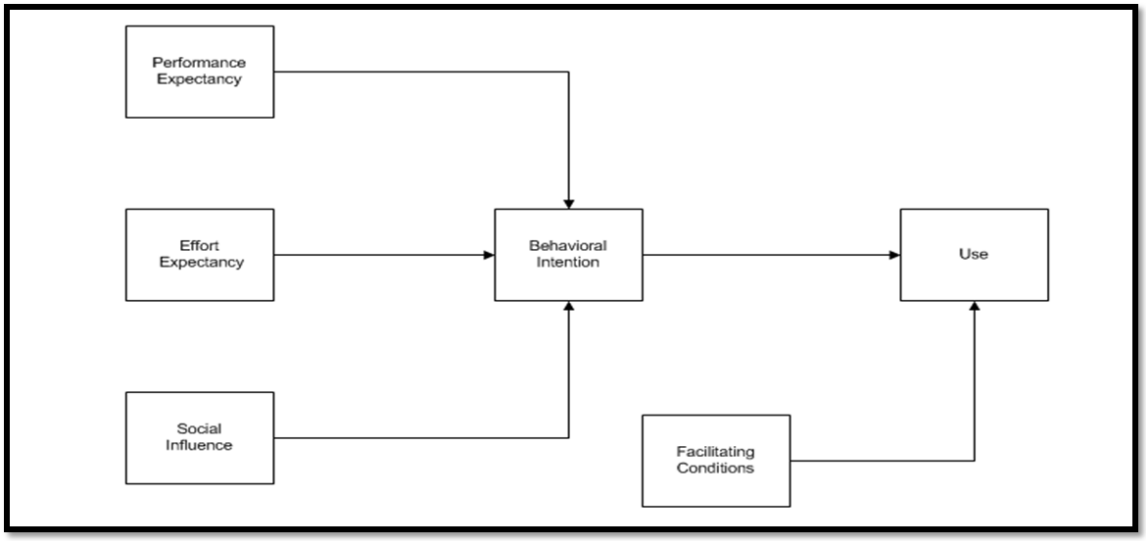
The core constructs of MPCU are: *job-fit, complexity, long-term consequences, affect toward use, social factors,* and *facilitating conditions* (Thompson et al. 1991). *Job-fit* is "the extent to which an individual believes that using a technology can enhance the performance of his or her job" (p. 129). *Complexity* refers to "the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 128). "Outcomes that have a pay-off in the future" are *long-term consequences* (p. 129). *Affect towards use* is from Triandis' theory, and is defined as "feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act" (p. 127). *Social factors* are also derived from Triandis as "the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations" (p. 126). Objective factors in the setting that observers agree make an act simple to complete are known as *facilitating conditions*. Thompson gives the example "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (p. 129).

Social Cognitive Theory

Social cognitive theory is known as one of the most influential theories of human behavior (see Bandura 1986). Bandura (1986) advanced a view of human performance that designates a central role to cognitive, vicarious, self-regulatory, and self-reflective processes. Instead of being reactive organisms shaped by environment or biology, individuals are viewed as self-organizing, proactive, self-reflecting and self-regulating. Human functioning is viewed as the product of personal, behavioral, and environmental influences. Bandura altered the label of his theory from social learning to social "cognitive" to secede from other social learning theories of the time and highlight the role that cognition plays in an individual's ability to compose reality, self-regulate, encode information, and perform behaviors. It is important to note that all of these abilities would have great implications in information systems acceptance and use.

In 1995, Compeau and Higgins applied Bandura's SCT to the information systems and computer utilization. Their original model utilized usage as a dependent variable. The core constructs are: *outcome expectations-performance* which deal with job related outcomes; *outcome expectations- personal* which deal with the individual esteem and sense of accomplishment; *self-efficacy judgment* which is interpretation of one's ability to utilize a technology to accomplish a job or task; *affect* or an individual's liking for a particular behavior; and *anxiety evoking* or anxious/emotional reactions when it comes to performing the behavior (Compeau and Higgins, 1995).

Figure 3: Unified Technology Acceptance and Use Theory (UTAUT) (Adapted from Venkatesh, 2003)



Applying UTAUT

Although the previously discussed models have made valuable contributions to the literature, UTAUT is the penultimate model because of its ability to utilize the best practices from each model of research (Venkatesh, 2003). Not only does UTAUT explain intention to use, it also simultaneously determines subsequent usage behavior. This is an important difference to note when healthcare organizations are making multi-million dollar investments in pieces of technology. There are four key constructs in the UTAUT theory: performance expectancy, effort expectancy, social influence, and facilitating conditions. UTAUT proposes that behavioral intention and subsequent use are affected by these four key constructs, and moderated by experience with the system

(i.e., time), voluntariness, gender, and age. The four key constructs are direct determinants of usage intention and behavior (Venkatesh, 2003). The UTAUT model can be seen in Figure 3.

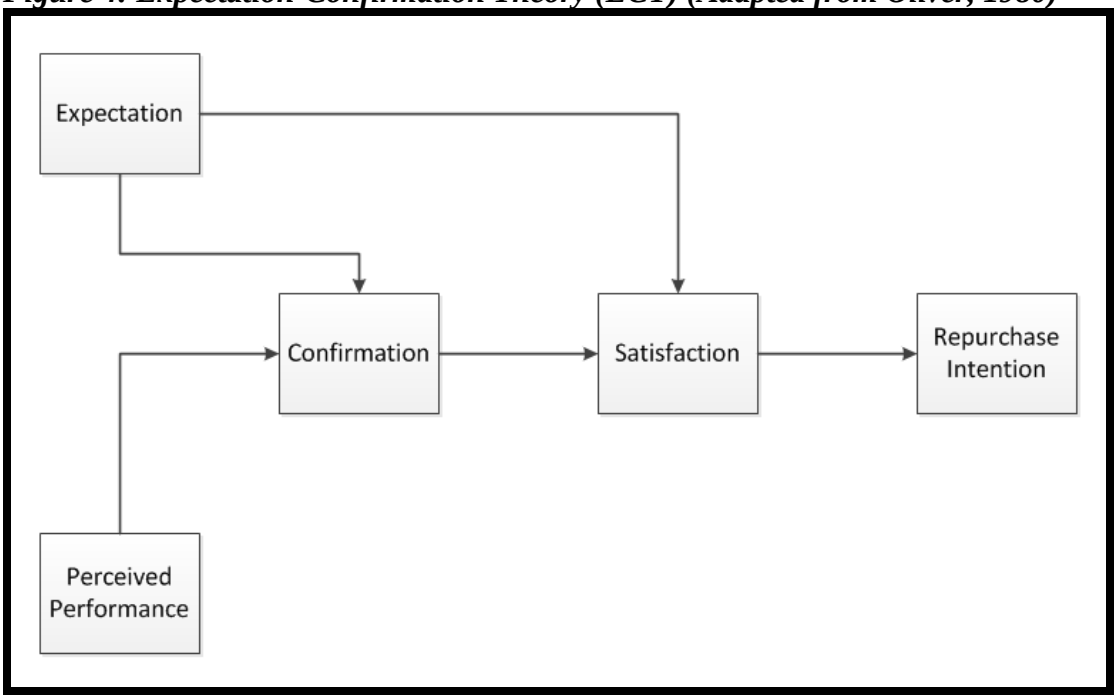
Few studies have applied adaptations of UTAUT to evaluate acceptance of HIT (Dansky, Gamm, Vasey, & Barsukiewicz, 1999; Dillon, Blankenship, & Crews, 2005). However, the work was preliminary and lacking questions related to patient safety, an important aspect of healthcare. This is clearly a gap in the HIT literature as the UTAUT model utilizes the best aspects of previously validated models. The only aspect lacking from UTAUT is the combination of the person, or personality characteristics that may influence acceptance.

CONTINUANCE INTENTION

The concept of *continuance intention* (CI) is based on Expectation-Confirmation theory utilized in the consumer behavior literature to study consumer satisfaction, post-purchase behavior, and service marketing (Anderson and Sullivan, 1993; Dabholkar et al. 2000; Oliver 1981; Oliver 1993; Patterson et al. 1997; Tse and Wilton 1988). Repurchase intentions are developed in ECT by the following: 1) Prior to purchase, consumers form their initial expectation of a product or service, 2) Accept and use of the product or service, 3) Assess its perceived performance compared to their original expectation to see if their expectation is confirmed, 4) Form satisfaction or affect based on their confirmation (Oliver, 1980). If a customer is satisfied they will form a repurchase

intention. Dissatisfied consumers will discontinue using the product. See Figure 4 for an adapted representation of ECT. Note that Expectation is the only pre-consumption variable, and the rest are considered post-consumption variables.

Figure 4: Expectation-Confirmation Theory (ECT) (Adapted from Oliver, 1980)

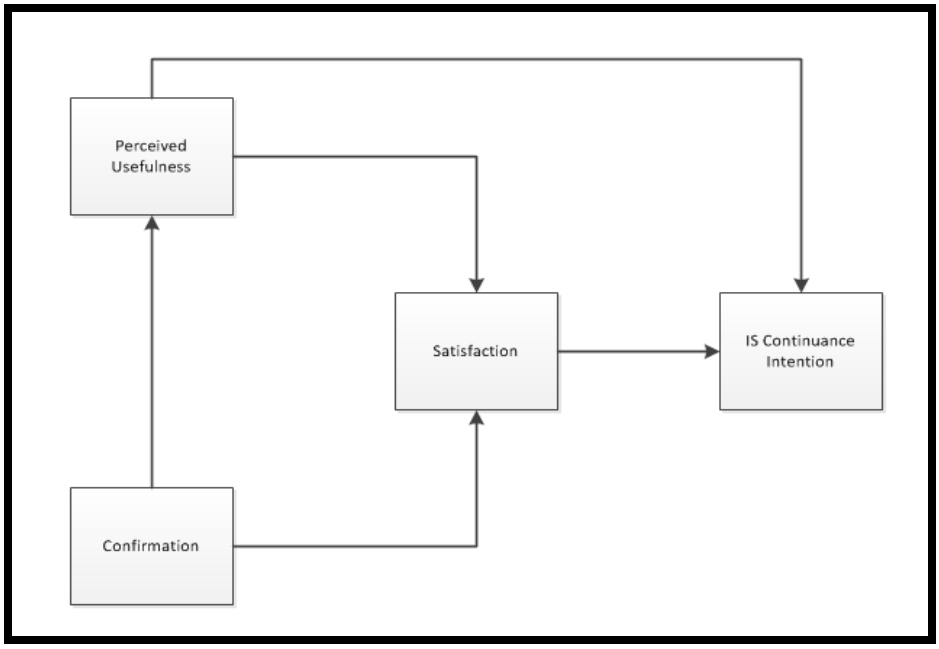


The IS continuance intention was initially measured by adapting two items from Mathieson's (1991) behavioral intention to accept IS scale to measure partcicipant's intention to continue using an online banking division (OBD). The third item was intended to measure discontinuance intention of OBD. Figure 5 shows Bhattacherjee's (2001) Post-Acceptance Model of IS Continuance.

Roca, Chiu, & Martínez (2006), examined the relationships between EDT and TAM variables in the same model. They studied user of an e-learning system in an attempt to explain their decision on whether or not to continue using the IS. They found that the

users' CI is determined by satisfaction. In their study satisfaction was jointly determined by perceived usefulness, information quality, confirmation, service quality, system quality, perceived ease of use and cognitive absorption. This study contributes to the literature by being the first to incorporate CI/EDT and TAM into a combined model.

Figure 5: Post-Acceptance Model of IS Continuance (Adapted from Bhattacherjee, 2001)



THE FIVE FACTOR MODEL OF PERSONALITY

Personality is rarely taken into consideration when analyzing technology acceptance. In fact, cognitive style has historically not been considered when designing decision support systems (Huber, 1983; Robey, 1983; Zmud, 1979). This landscape may be changing with the increase in personality-related research in the organizational and social psychology literature.

Personality has been a much researched and very controversial field, often lacking a general consensus. In one of his books describing the need for a taxonomy of personality

psychology, Allport wrote that "each assessor has his own pet units and uses a pet battery of diagnostic devices" (1958, p. 258). All of these different approaches have formed a confusing and often conflicting array of methodologies. Within the last 20 years, the field has finally begun to agree on a general taxonomy of personality traits, known commonly as the "Big Five" personality dimensions. Instead of representing a single theoretical perspective, these dimensions were derived from analyses of the natural-language terms people use to describe themselves and others (John & Srivastava, 1999). The Big Five taxonomy does not replace the other theoretical perspectives, but instead merges personality descriptions.

The history of the Big Five begins with the lexical study of Allport and Odbert (1936) of the personality-relevant terms in an unabridged English dictionary. Their list reached almost 18,000 terms and included terms that could be used to "distinguish the behavior of one human being from that of another" (Allport & Odbert, 1936, p. 24). Next, Cattell (1943, 1945a,b) reduced the 18,000 term list to 4,500 trait terms. Limited by the data analytics of his time, he then reduced this trait list to 35 variables, eliminating more than 99 percent of the terms (John & Srivastava, 1999). Cattell eventually identified 12 personality factors, which became part of his 16 Personality Factors Questionnaire or 16PF (Cattell, Eber, & Tatsuoka, 1970).

The Big Five were discovered in Cattell's variable list. First, Fiske (1949) simplified 22 of Cattell's variables that were derived from self-ratings, ratings by peers, and ratings by

psychological staff members. Tupes and Christal (1961) utilized Fiske's work and found five relatively strong and recurrent factors. This five-factor structure has been replicated multiple times in research, notably by Norman (1963) who initially labeled the factors: (I) Extraversion or Surgency (talkative, assertive, energetic), (II) Agreeableness (good-natured, cooperative, trustful), (III) Conscientiousness (orderly, responsible, dependable), (IV) Emotional Stability versus Neuroticism (calm, not neurotic, not easily upset), (V) Culture (intellectual, polished, independent-minded).

The current Five-Factor Model (FFM) is comprised of five broad dimensions of personality originating in the previously described literature. The current labeled dimensions are (I) Extraversion, (II) Agreeableness, (III) Conscientiousness, (IV) Neuroticism, and (V) Openness to Experience. Extraversion is often described as being sociable, gregarious and ambitious. Agreeableness means that an individual has a compassionate interpersonal orientation. Conscientiousness is intertwined with the degree of organization, persistence, and motivation in a goal-directed behavior. Neuroticism is understood as emotional instability and is often characterized by insecurity, anxiousness, and hostility. Finally, openness to experience is the ability to have flexible thoughts and tolerate new ideas. These are thought to include most, if not all, personality traits (Digman, 1996). In 1991, it was demonstrated that both Openness to Experience and Extraversion were valid predictors of the training proficiency criterion across occupations that were studied (Mount & Barrick). This was just a portion of research evidence that indicated that job performance may have a link to personality.

Paul T. Costa, Jr. and Robert R. McCrae developed the NEO-Five Factor Inventory (NEO-FFI) in 2004, with 60 items, 12 per domain or factor as a shortened version of their Revised NEO Personality Inventory, or NEO PI-R. John, Donahue, & Kentle (1991) then developed the Big Five Inventory (BFI), a slightly shorter version of the NEO-FFI with only 44 questions, which has been validated in multiple languages.

SPECIFIC AIMS AND HYPOTHESES

For many years, researchers have studied how and why users prefer to use certain information systems (IS) over others. What they have failed to study is what impact personality has on their choices and ultimately their acceptance and continued use of an IS. The major goal of this study is to determine whether personality has an influence on a physician's intention to continue to use an EMR that can be accounted for by a more integrated version of the UTAUT model that incorporates personality. Below are specific aims to be accomplished.

Specific Aim 1 (SA1): To demonstrate a relationship between four of the Big Five personality constructs and EMR continuance intention.

Specific Aim 2 (SA2): To develop a more integrated model of technology acceptance and continuance intention that incorporates the personality constructs.

To address the specific aims outlined above, it was necessary to formulate specific hypotheses about expected outcomes of this investigation. In order to specifically address the effect of the personality constructs on EMR CI, it was necessary to formulate the

hypotheses from the deconstructed model of UTAUT. This allows the researcher to better identify which personality factors of the Big Five will most affect each construct of UTAUT.

Prior UTAUT research has validated the three direct determinants of intention to use (performance expectancy, effort expectancy, and social influence) as well as the two direct determinants of usage behavior (intention and facilitating conditions). Unlike UTAUT, usage behavior is not utilized in this study but is replaced with Continuance Intention. The physicians and dentists invited to participate in the survey are residents and fellows in Graduate Medical Education (GME) programs. Because the residents/fellows do not have an option as to whether or not to use the EMR in their GME programs, their measured EMR usage rate would be 100 percent and therefore useless. Based on prior research, it is reasonable to assume that the following statements will also be true for EMR usage and thus there is no scientific need to revalidate the constructs (Venkatesh et al. 2003).

- *Performance expectancy* will influence behavioral intention to use the EMR
- *Effort expectancy* will influence behavioral intention to use the EMR
- *Social influence* will positively influence behavioral intention to use the EMR
- *Facilitating conditions* will have a significant influence on usage behavior
- *Behavioral intention* will have a significant positive influence on usage.

Using these prior validated UTAUT constructs, the following hypotheses were developed in relation to the Big Five personality traits:

H1A: Individuals with higher *conscientiousness* will show a stronger relationship between *performance expectancy* and *continuance intention*.

H1B: Individuals with higher *conscientiousness* will have a stronger relationship between *social influence* and *continuance intention*

H2A: Individuals with higher extraversion will show a stronger relationship between *social influence* and *continuance intention*

H2B: *Extroversion* will be positively associated with *performance expectancy*.

H3A: *Neuroticism* will be negatively associated with *performance expectancy*.

H3B: *Neuroticism* will be negatively associated with *effort expectancy*.

H4A: *Openness to experience* will be positively associated with *performance expectancy.*

H4B: *Openness to experience* will be positively associated with *effort expectancy*.

H5A: *Agreeableness* will be positively associated with *performance expectancy*.

H5B: Individuals with higher agreeableness will show a stronger relationship between *social influence* and *continuance intention*.

EXPERIMENTAL DESIGN AND DATA COLLECTION

Instrument Construction

Historically in technology acceptance research, a survey tool is utilized. In this study, survey questions from the UTAUT instrument (Venkatesh, 2003) and IS Continuance Intention (Bhattacherje, 2001) have been adapted for application to clinicians and EMR use. Performance Expectancy (PE) is "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh, 2003). For clinicians, utilizing the EMR could increase their productivity by allowing

them to accomplish tasks more quickly or see an increased number of patients. In Table 1, the original questions for Performance Expectancy, the constructs they are derived from and the definitions, and the revised questions utilized in this survey are displayed. The final version of the survey that was used is available in Appendix I**.**

Table 1: Performance Expectancy

Revised Question	**Original Question**	**Construct**	**Definition**
I have found the EMR to be more useful in my job than using paper-based records.	I would find this technology to be useful in my job.	Perceived Usefulness (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a particular system would enhance his or her job performance.
I accomplish tasks such as prescribing medications and ordering labs more quickly with the EMR.	Using this technology enables me to accomplish tasks more quickly.	Relative Advantage (Moore and Benbasat 1991)	The degree to which using an innovation is perceived as being better than using its precursor.
Using the EMR increases my productivity, therefore I am able to see more patients in a shorter amount of time.	Using the technology increases my productivity.	Relative Advantage (Moore and Benbasat 1991)	The degree to which using an innovation is perceived as being better than using its precursor.
Using the EMR increases efficiency, and therefore increase revenue to my healthcare facility.	If I use the technology, I will increase my chances of getting a raise.	Outcome Expectations (Compeau and Higgins 1995b; Compeau et al. 1999)	Outcome expectations relate to the consequences of the behavior.

Effort Expectancy is known as "the degree of ease associated with the use of the system" (Venkatesh, 2003). For clinicians, this construct relates to the user experience, and how

easy they find utilizing the EMR in their practice to be. In Table 2, the construct of Effort Expectancy is further explained.

Table 2: Effort Expectancy

Revised Question	Original Question	Construct	Definition
My interaction with the EMR system is clear and understandable.	My interaction with the technology would be clear and understandable.	Ease of Use (Moore and Benbasat 1991)	The degree to which using an innovation is perceived as being difficult to use.
It was easy for me to become skillful at using the EMR.	It would be easy for me to become skillful at using the technology.	Perceived Ease of Use (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a system would be free of effort.
I have found the EMR to be easy to use.	I would find the technology easy to use.	Perceived Ease of Use (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a system would be free of effort.
Learning to operate the EMR is easy for me.	Learning to operate the technology is easy for me.	Perceived Ease of Use (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a system would be free of effort.

Table 3 further explains the construct of Social Influence. Social influence is "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh, 2003). Clinicians can be socially influence by their peers or their administrators.

Facilitating Conditions are "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system"

(Venkatesh, 2003). For a physician, facilitating conditions may be the compatibility of the system, such as whether or not the EMR and lab or radiology systems are compatible or if the user has to change systems to view results. It may also be whether or not the

Table 3: Social Influence

Revised Question	Original Question	Construct	Definition
People who influence my behavior, such as my supervisor or my peers, promote the use of the EMR.	People who influence my behavior think that I should use the technology.	Subjective Norm (Ajzen 1991; Davis et al. 1989; Fishbein and Azjen 1975; Mathieson 1991; Taylor and Todd 1995a, 1995b)	The person's perception that most people who are important to him think he should or should not perform the behavior in question.
Hospital Administration has been helpful by promoting the advantages of the EMR system.	The senior management of this business has been helpful in the use of the technology.	Social Factors (Thompson et al. 1991)	The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations.
In general, the hospital administration has supported the implementation and use of the EMR system.	In general, the organization has supported the use of the technology.	Social Factors (Thompson et al. 1991)	The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations.

physician perceives that they possess the knowledge or the hospital provides resources necessary to use the EMR successfully. See Table 4 for additional information on Facilitating Conditions.

Table 4: Facilitating Conditions

Revised Question	**Original Question**	**Construct**	**Definition**
I have the resources necessary to use the EMR.	I have the resources necessary to use the system.	Perceived Behavioral Control (Ajzen 1991; Taylor and Todd 1995a, 1995b)	Reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions.
I have the knowledge necessary to use the EMR system.	I have the knowledge necessary to use the system.	Perceived Behavioral Control (Ajzen 1991; Taylor and Todd 1995a, 1995b)	Reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions.
The EMR is not compatible with other systems I use. (reverse coded)	The system is not compatible with other systems I use.	Perceived Behavioral Control (Ajzen 1991; Taylor and Todd 1995a, 1995b)	Reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions.

Table 5 explains the construct of Computer Anxiety. Anxiety is defined as "the degree of an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers," (Venkatesh, 2003). A physician may feel computer anxiety from using the EMR in general, or being fearful of making mistakes or losing information.

Table 5: Computer Anxiety

Revised Question	**Original Question**	**Construct**	**Definition**
I feel apprehensive about using the EMR.	I feel apprehensive about using the system.	Anxiety (Social Cognitive Theory, Bandura 1986; Compeau and Higgins, 1995)	Evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer).
It scares me to think that I could harm a patient or lose their information by hitting the wrong key.	It scares me to think that I could lose a lot of information using the system by hitting the wrong key.	Anxiety (Social Cognitive Theory, Bandura 1986; Compeau and Higgins, 1995)	Evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer).
I feel the need to constantly recheck my work because I am afraid of making mistakes.	I hesitate to use the system for fear of making mistakes I cannot correct.	Anxiety (Social Cognitive Theory, Bandura 1986; Compeau and Higgins, 1995)	Evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer).

The final construct used is Continuance Intention (CI), or the intention of a user to continue using an information system post-adoption (Bhattacherje,2001). Many of the residents may go on to establish private practices where the use of an EMR will be an option. Table 6 further explains the construct. Although Anxiety is not included as a

construct in any of the hypotheses, it was felt that it was necessary to include it as Computer Anxiety could potentially impact other constructs.

Table 6: Continuance Intention

Revised Question	Original Question	Construct	Definition
I will continue to use an EMR in my own practice rather than discontinue its use.	I intend to continue using OBD rather than discontinue its use.	IS Continuance Intention (Bhattacherje, 2001)	Intention of a user to continue using an information system
I will continue using the EMR rather than alternative means (paper charts)	My intentions are to continue using OBD than use any alternative means (traditional banking).	IS Continuance Intention (Bhattacherje, 2001)	Intention of a user to continue using an information system
I would like to discontinue using the EMR. (reverse coded)	If I could, I would like to discontinue my use of OBD. (reverse coded)	IS Continuance Intention (Bhattacherje, 2001)	Intention of a user to continue using an information system

The survey questions utilized to measure the Big Five were extracted from the NEO-Five Factor Inventory, or NEO-FFI (Costa & McCrae, 1992). Because of its original length of 60 items, the survey needed to be modified by taking a subset of these previously validated questions. A minimum of three questions for a given construct was used in order to meet Nunnally's (1978) suggested norm of at least three items per construct. See Table 7 for the personality constructs and questions.

Table 7: Personality Constructs and Questions (Adapted from Costa & McCrae, 1992)

Construct	**Question**
Openness	I am intrigued by the patterns I find in art and nature.
	Once I find the right way to do something, I stick to it.
	I have a lot of intellectual curiosity.
Neuroticism *(reverse coded)*	I am not a worrier.
	I rarely feel fearful or anxious.
	I rarely feel lonely or blue.
	I am seldom sad or depressed.
Agreeableness	I generally try to be thoughtful and considerate.
	Most people I know like me.
	I would rather cooperate with others than compete with them.
Conscientiousness	I am efficient and effective at my work.
	I am pretty good about pacing myself so as to get things done on time.
	I have a clear set of goals and work toward them in an orderly fashion.
	I work hard to accomplish my goals.
Extraversion	I really like most people I meet.
	I really enjoy talking to people.
	I like to have a lot of people around me.

Data Collection

The University of Minnesota (UMN) Graduate Medical Education (GME) program orientation days were held on June 17th, 2011 and July 1st 2011. The Hennepin County Medical Center (HCMC) orientation was held on June 20th, 2011. At the UMN GME orientations, a booth was set up in the common vendor area. At the HCMC orientation, a booth was set up outside of the payroll room. The physicians/dentists attending any of the

orientations were able to voluntarily stop by the booth between their planned sessions to participate. The study was distributed on paper, and no identifying information was collected on the survey. Participants submitted a separate registration card after completing the survey to be eligible for a drawing to win an iPad2. After the third and final orientation session, a registration card was randomly selected and an iPad2 was awarded to a study participant.

RESULTS

Descriptive Statistics

A total of 244 participants took part in the study. The majority of the participants were male (142, 58.2%). The participants were pursuing training in 21 specialties. In order to simplify their demographics, the specialties were split into Medicine, Surgery and Dentistry categories. The split of the medical specialties into broad categories of medicine and surgery is based on the now time honored concept that medicine can be split into cognitive and procedural specialties. Procedural specialties are one's in which the practitioners primarily "do things" with their hands such as operate and one's in which the practitioners primarily "think" about their patient's conditions. The former are surgical and the latter medical specialties. The following specialties were classified as medicine: Family and Internal Medicine, Dermatology, Emergency Medicine, Oncology, Nephrology, Neurology, Pediatrics, Physical Medicine and Rehabilitation (PMR), Psychiatry and Radiology. Surgery specialties are: Anesthesia, Ear Nose and Throat (ENT), General Surgery, Obstetrics and Gynecology (OB/GYN), Ophthalmology,

Orthopedics, Otolaryngology, Pathology, and Podiatry. Dentistry contained the following specialties: General Dentistry, Oral and Maxillofacial Surgery, and Pediatric Dentistry.

Based on this categorization, most of the participants were specialized in medicine (176, 72.1%). The greatest number of participants followed the traditional medical education path, receiving a Bachelor's degree and then an MD (199, 81.6%). The majority of participants were white (186, 77.2%). Only one participant had a disability—diplopia (0.4%). Frequencies and percentages for participant demographics are presented in Table 8.

Table 8: Frequencies and Percentages for Participant Demographics

Demographic	***n***	**%**
Gender		
Male	142	58.2
Female	102	41.8
Medical specialty		
Medicine	176	72.1
Surgery	56	23.0
Dentistry	12	4.9
Education		
MD	199	81.6
MD, PhD	9	3.7
DO	15	6.1
MBBS	5	2.0
DDS	14	5.7
DPM	2	0.8
Race		
American Indian or Alaskan Native	3	1.2
Asian	39	16.2
Black	4	1.7
Native Hawaiian or Other Pacific Islander	1	0.4
White	186	77.2
Mixed	8	3.3

Disabilities			
	None	243	99.6
	Diplopia	1	0.4

The youngest participant was 23 years old. The oldest was 48 years old. The average participant was 29.59 years old (*SD* = 4.33). Participants ranged in weight from 45 kg to 136 kg (*M* = 73.47, *SD* = 14.86). Participants ranged in height from 150 cm to 203 cm (*M* = 174.23, *SD* = 9.91). Means and standard deviations for participant demographics are presented in Table 9.

Table 9: Means and Standard Deviations for Participant Demographics

Demographic	**M**	**SD**
Age	29.59	4.33
Weight (kg)	73.47	14.86
Height (cm)	174.23	9.91

Participants were asked for the vendor names of the EMRs they have used and for how long they have used it. The majority of the participants have worked, or work with EPIC (166, 68.0%) and on average the participants used the EPIC EMR for 2.15 years (*SD* = 1.22). The majority of participants have not worked with the Veteran's Administration EMR known as VistA (215, 88.1%). The participants that worked with VistA used it for an average of 2.16 years (*SD* = 1.69). Most participants have not worked with FCIS (221, 90.6%), but for those that have worked with it for an average of 2.40 years (*SD* = 1.25). Likewise, most have not worked with Allscripts (221, 90.6%), but for those have used it worked with it for an average of 2.27 years (*SD* = 1.34). Eighty-nine participants have worked with a wide variety of other products (36.5%) and on average, they have

used those products for 3.24 years (*SD* = 2.70). Frequencies, percentages, means, and standard deviations for products used are presented in Table 10.

Table 10: Frequencies, Percentages, Means, and Standard Deviations for Products Used

Product	***n***	**%**	***M* of years of use**	***SD* of years of use**
EPIC	166	68.0	2.15	1.22
Vista	29	11.9	2.16	1.69
FCIS	23	9.4	2.40	1.25
Allscripts	23	9.4	2.27	1.34
Other	89	36.5	3.24	2.70

Research Variables

The personality and technology acceptance constructs were initially handled separately. First, the means for the personality constructs were calculated. Openness was assessed by taking the mean of the personality questions 1 through 3. Neuroticism was assessed by taking the mean of personality questions 4 through 7 after they were reverse-coded. Agreeableness was assessed by taking the mean of personality questions 8 through 10. Conscientiousness was assessed by taking the mean of personality questions 11 through 14. Extraversion was assessed by taking the mean of personality questions 15 through 17.

Next, means were calculated for the technology acceptance constructs. Performance expectancy was assessed by taking the mean of technology acceptance questions 1, 13, 4, and 6. Effort expectancy was assessed by taking the mean of technology acceptance questions 7, 8, 18, and 20. Social influence was assessed by taking the mean of technology acceptance questions 3, 10, and 21. Continuance intention was assessed by

taking the mean of technology acceptance questions 9, 16 and 17. Cronbach alpha reliability was run on the subscales. Based on George and Mallery's (2003) guidelines for reliability, all subscales had at least an acceptable reliability (> .70) with *continuance intention* and *effort expectancy* having good (> .80) reliability. Table 11 shows the mean, standard deviation, Cronbach alpha and number of items in each scale.

Table 11: Mean, Standard Deviation, and Cronbach Alpha Reliability for Research Subscales

Subscale	***M***	***SD***	**Number of items**	**Cronbach α**
Conscientiousness	4.30	0.54	4	.75
Extraversion	3.92	0.69	3	.73
Neuroticism	2.88	0.85	4	.79
Openness	4.37	0.51	3	.75
Agreeableness	4.54	0.45	3	.78
Continuance Intention	4.54	0.64	3	.82
Social Influence	3.87	0.65	3	.72
Performance Expectancy	4.09	0.73	4	.79
Effort Expectancy	4.07	0.68	4	.87

Correlations

Pearson correlations were conducted utilizing the subscale means from Table 11. Listwise deletion was used to eliminate cases where missing values may occur. No missing values were located, and thus the N=244. Please see Table 12 for correlation statistics.

- *Conscientiousness* was positively correlated ($p<0.01$) with *extraversion*, *agreeableness* and *effort expectancy*. *Conscientiousness* was also positively correlated with *performance expectancy* ($p<0.05$).

- *Extraversion* was positively correlated with *agreeableness* ($p<0.01$) and *effort expectancy* ($p<0.05$). *Extraversion* was negatively correlated with *neuroticism* ($p<0.01$).
- *Neuroticism* was also negatively correlated with *effort expectancy* ($p<0.05$).
- *Openness* was positively correlated ($p<0.05$) with *agreeableness*, *social influence*, and *effort expectancy*.
- *Continuance intention* was also positively correlated ($p<0.01$) with *social influence*, *performance expectancy* and *effort expectancy*.
- *Social influence* was also positively correlated ($p<0.05$) with *performance expectancy* and *effort expectancy*.
- *Performance expectancy* and *effort expectancy* were also significantly correlated ($p>0.05$).

Preliminary Regressions

Prior to testing the structural equation model, four regressions were conducted to assess if the independent variables (*conscientiousness, extraversion, neuroticism, openness,* and *agreeableness*) predicted the dependent variables (*continuance intention, social influence, performance expectancy,* and *effort expectancy*). One regression was conducted for each of the dependent variables. The results of the first regression with the independent variables predicting continuance intention was significant, F (5, 238) = 5.06, p = .011, with agreeableness being a significant predictor of continuance intention. The results of the second regression were significant, F (5, 238) = 2.93, p = .014, with no

predictors on their own significantly predicting social influence. The results of the third regression were approaching significance, F (5, 238) = 2.23, p = .052, with agreeableness as a significant predictor of performance expectancy. The results of the fourth regression were significant, F (5, 238) = 3.99, p = .002, with neuroticism significantly predicting effort expectancy. Results for all three regressions are presented in Table 13.

Table 12: Correlations[a]

		Conscien	Extraver	Neurotic	Openness	Agreeable	Cont. Int.	Social Infl.	Perf. Exp.	Effort Exp.
Conscien	Pearson Correlation	1	.299**	-.039	.107	.325**	.113	.118	.142*	.180**
	Sig. (2-tailed)		.000	.546	.095	.000	.079	.065	.027	.005
Extraversion	Pearson Correlation	.299**	1	-.181**	-.028	.321**	.041	.050	.014	.134*
	Sig. (2-tailed)	.000		.005	.666	.000	.526	.441	.826	.036
Neurotic	Pearson Correlation	-.039	-.181**	1	-.094	-.023	-.094	-.119	-.015	-.162*
	Sig. (2-tailed)	.546	.005		.142	.721	.142	.063	.812	.012
Openness	Pearson Correlation	.107	-.028	-.094	1	.151*	.121	.151*	.107	.153*
	Sig. (2-tailed)	.095	.666	.142		.018	.060	.018	.097	.017
Agreeable	Pearson Correlation	.325**	.321**	-.023	.151*	1	.204**	.163*	.164*	.131*
	Sig. (2-tailed)	.000	.000	.721	.018		.001	.011	.010	.041
Cont. Int.	Pearson Correlation	.113	.041	-.094	.121	.204**	1	.272**	.602**	.593**
	Sig. (2-tailed)	.079	.526	.142	.060	.001		.000	.000	.000
Social Infl.	Pearson Correlation	.118	.050	-.119	.151*	.163*	.272**	1	.365**	.255**
	Sig. (2-tailed)	.065	.441	.063	.018	.011	.000		.000	.000
Perf. Exp.	Pearson Correlation	.142*	.014	-.015	.107	.164*	.602**	.365**	1	.581**
	Sig. (2-tailed)	.027	.826	.812	.097	.010	.000	.000		.000
Effort Exp.	Pearson Correlation	.180**	.134*	-.162*	.153*	.131*	.593**	.255**	.581**	1
	Sig. (2-tailed)	.005	.036	.012	.017	.041	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Listwise N=244

Table 13: ***Results for the Four Regressions with the Independent Variables Predicting the Dependent Variables***

Dependent variable	**Independent variable**	***B***	***SE***	**β**	***t***	***p***
Continuance intention	Conscientiousness	0.06	0.08	0.05	0.80	.426
	Extraversion	-0.05	0.06	-0.05	-0.72	.470
	Neuroticism	-0.07	0.05	-0.09	-1.40	.164
	Openness	0.10	0.08	0.08	1.19	.237
	Agreeableness	**0.27**	**0.10**	**0.19**	**2.73**	**.007**
Social influence	Conscientiousness	0.08	0.08	0.07	1.00	.318
	Extraversion	-0.03	0.07	-0.03	-0.42	.674
	Neuroticism	-0.08	0.05	-0.11	-1.68	.094
	Openness	0.14	0.08	0.11	1.75	.081
	Agreeableness	0.19	0.10	0.13	1.88	.062
Performance expectancy	Conscientiousness	0.15	0.09	0.11	1.56	.119
	Extraversion	-0.07	0.08	-0.06	-0.89	.372
	Neuroticism	-0.01	0.06	-0.01	-0.19	.846
	Openness	0.10	0.09	0.07	1.10	.274
	Agreeableness	**0.23**	**0.11**	**0.14**	**1.97**	**.050**
Effort expectancy	Conscientiousness	0.16	0.09	0.13	1.89	.060
	Extraversion	0.06	0.07	0.06	0.86	.391
	Neuroticism	**-0.11**	**0.05**	**-0.13**	**-2.09**	**.038**
	Openness	0.16	0.09	0.12	1.89	.059
	Agreeableness	0.07	0.10	0.05	0.71	.478

Structural Equation Model

The full SEM model was run based on Figure VI. Following an iterative process of model trimming to determine best fit, standardized beta weights were examined for very weak (< 0.03) beta weights that were not significant (Kline, 2005). This resulted in the paths from *neuroticism* to *performance expectancy* and *agreeableness* to *effort expectancy* to be removed, as well as the path from *conscientiousness* to *social influence*. The model achieved good fit, χ^2 (10) = 19.35, p = .036, RMSEA = 0.06, RMSEA 90% CI [0.02, 0.11], CFI = 0.97, TLI = 0.91, and therefore was able to be examined for significant paths.

Hypothesis 1A looked at the paths from *conscientiousness* to *continuance intention* and *performance expectancy*. The path from *conscientiousness* to *continuance intention* was not significant, Estimate = -0.05, p = .499. The path from *conscientiousness* to *performance expectancy* was also not significant, Estimate = 0.11, p = .118. Since both paths were not significant, null hypothesis 1A cannot be rejected. Hypothesis 1B looked at the paths from *conscientiousness* to *social influence* and *performance expectancy*. The path from *conscientiousness* to *social influence* had to be removed in order to achieve a good model fit. The path from *conscientiousness* to *performance expectancy* was also not significant, Estimate = 0.11, p = .118. Since both paths did not have significance, null hypothesis 1B cannot be rejected.

Hypothesis 2A looked at the paths from *extraversion* to *social influence* and *continuance intention*. The path from *extraversion* to *social influence* was not significant, Estimate = 0.03, $p = .660$. The path from *extraversion* to *continuance intention* was not significant, Estimate = -0.04, $p = .463$. Since both paths did not have significance, null hypothesis 2A cannot be rejected. Hypothesis 2B looked at the paths from *extraversion* to *performance expectancy*. The path from *extraversion* to *performance expectancy* was not significant, Estimate = -0.08, $p = .185$. Since the path did not have significance, null hypothesis 2B cannot be rejected.

Hypothesis 3A looked at the path from *neuroticism* to *performance expectancy*. The path had to be removed in order to achieve a good model fit. Therefore, null hypothesis 3A cannot be rejected. Hypothesis 3B looked at the path from *neuroticism* to *effort expectancy*. The path was significant, Estimate = -0.09, $p = .017$. This suggests that for every one point increase in *neuroticism*, *effort expectancy* tended to decrease by 0.09 points. Null hypothesis 3B can be rejected in favor of the alternative hypothesis—*neuroticism* is negatively related to *effort expectancy*.

Hypothesis 4A examined the path from *openness* to *performance expectancy*. The path was not significant, Estimate = 0.10, $p = .244$. Since the path was not significant, null hypothesis 4A cannot be rejected. Hypothesis 4B examined the path from *openness* to *effort expectancy*. The path was not significant, Estimate = 0.12, $p = .165$. Since the path was not significant, null hypothesis 4B cannot be rejected.

Hypothesis 5A examined the path from *agreeableness* to *effort expectancy*. The path had to be removed in order to achieve a good model fit. Therefore, null hypothesis 5A cannot be rejected. Hypothesis 5B examined the paths from *agreeableness to continuance intention* and *social influence*. The path from *agreeableness* to *continuance intention* was significant, Estimate = 0.20, $p = .010$. This suggests that for every one point increase in *agreeableness*, *continuance intention* tended to increase by 0.20 point. The path from *agreeableness* to *social influence* was also significant, Estimate = 0.22, $p = .019$. This suggests that for every one point increase in *agreeableness*, *social influence* tended to increase by 0.22 points. Since both paths were significant, null hypothesis 5B can be rejected in favor of the alternative hypothesis—individuals with higher *agreeableness* tended to have higher *continuance intention* and *social influence*. Results of the final SEM model are presented in Table 14. Figure 6 shows estimates and significance for the final model.

Table 14: Final Path Results for SEM Model

Hypothesis	**Independent variable**	**Dependent variable**	**Estimate**	**SE**	***P***
1a	Conscientiousness	Continuance Intention	-0.05	0.07	.499
1a	Conscientiousness	Performance Expectancy	0.11	0.07	.118
1b	Conscientiousness	Continuance Intention	-0.05	0.07	.499
1b	Conscientiousness	Social Influence	-	-	-
2a	Extraversion	Continuance Intention	-0.04	0.05	.463
2a	Extraversion	Social Influence	0.03	0.06	.660
2b	Extraversion	Performance Expectancy	-0.08	0.06	.185
3a	Neuroticism	Performance Expectancy	-	-	-
3b	**Neuroticism**	**Effort Expectancy**	**-0.09**	**0.04**	**.017**
4a	Openness	Performance Expectancy	0.10	0.09	.244
4b	Openness	Effort Expectancy	0.12	0.09	.165
5a	Agreeableness	Effort Expectancy	-	-	-
5b	**Agreeableness**	**Continuance Intention**	**0.20**	**0.08**	**.010**
5b	**Agreeableness**	**Social Influence**	**0.22**	**0.09**	**.019**

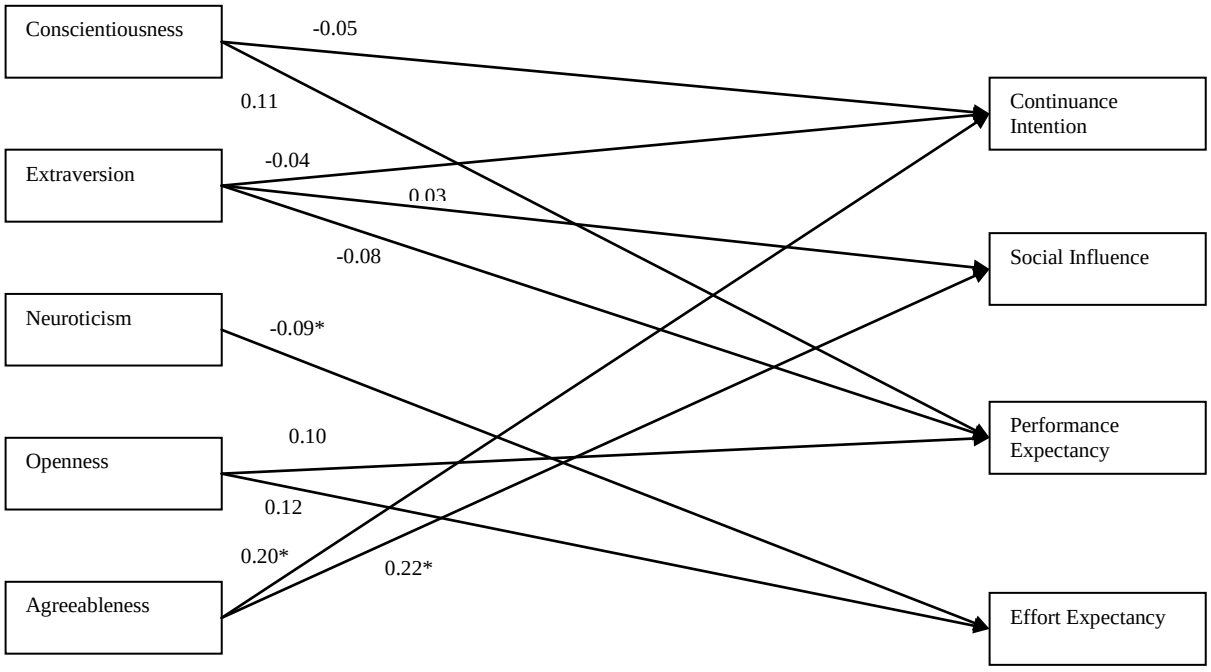


Figure 6: **Final SEM model with path estimates. *$p < 0.05$.**
Note. χ^2 (10) = 19.35, p = .036, RMSEA = 0.06, RMSEA 90% CI [0.02, 0.11], CFI = 0.97, TLI = 0.91

DISCUSSION

In order to better understand the strengths and weaknesses of the proposed model, the first section will discuss the correlations and preliminary regressions. Next we will examine each of the hypotheses separately, and then finally return to the model as a whole.

Many statistically significant correlations were found among the various constructs. *Conscientiousness* was positively correlated ($p<0.01$) with *extraversion*, *agreeableness*,

effort expectancy and *performance expectancy* ($p<0.05$). *Conscientiousness* is intertwined with organization, persistence, and motivation in a goal-directed behavior. The conscientious individual also has a need for achievement (Costa et al. 1991). Therefore a conscientious person would find technology implementations to be both useful (*performance expectancy*) and easy to use (*effort expectancy*) in order to perform optimally at their jobs. Because extraverts are often described as being ambitious, the correlation between *extraversion* and *conscientiousness* is explainable. Agreeable people are also often accommodating and cooperative, which goes along with the conscientious persons need for organization toward accomplishing a goal.

Extraversion was positively correlated with *agreeableness* ($p<0.01$) and *effort expectancy* ($p<0.05$) while being negatively correlated with *neuroticism* ($p<0.01$). Individuals high in *extraversion* are social, active, and outgoing and value interpersonal relationships (Watson and Clark, 1997). Because agreeable individuals value interpersonal interaction and teamwork they share similarities with extraverts. In addition, the correlation between extraversion and effort expectancy could also be explained by their outgoing nature and the decreased likelihood that they would be intimidated by the amount of effort required to learn a new piece of technology. Finally, the negative correlation between extraversion and neuroticism is to be expected since neurotics have a tendency to experience unpleasant emotions easily. These negative emotions include anger, anxiety, depression, and vulnerability – none of which are traits of extraverted individuals known for their energy and positive emotions. In addition, *Neuroticism* was also negatively

correlated with *effort expectancy* ($p<0.05$). Neurotics may not be able to put forth the effort required to learn a new HIT system due to high levels of anxiety they often experience. This was further demonstrated in the fourth regression, where *neuroticism* was found to be a significant predictor of *effort expectancy*.

Openness was positively correlated ($p<0.05$) with *agreeableness, social influence*, and *effort expectancy*. People who score highly on *openness* are intellectually curious, intelligent problem solvers, and enjoy a variety of experiences. This would coincide with the agreeable persons' optimism and desire for teamwork or cooperation.
Those who score highly on social influence are influenced by their peers and supervisors to try new pieces of technology. The more open a person is to new experiences, the more likely they could be socially influenced to try new things.

Agreeableness was positively correlated ($p<0.01$) with *continuance intention*. In the first regression, *agreeableness* was found to be a significant predictor of *continuance intention*. The agreeable person is often willing to compromise their interests for the greater good, so that may include electing to continue utilizing an EMR for the benefit of patients and the healthcare system. Agreeableness was also positively correlated ($p<0.05$) with *social influence, performance expectancy* and *effort expectancy*. The agreeable person may be easily socially influence because of their desire for social harmony, and willingness to cooperate. The agreeable person may find technology

implementations to be useful (*performance expectancy*) because they value getting along with others and the EMR is important to the organization. In agreement with the correlation, the third regression showed that agreeableness was a significant predictor of performance expectancy. Agreeable persons may also find an EMR to be easy to use (*effort expectancy*) based on their desire to cooperate by investing the time necessary to learn the tools.

Continuance intention was also positively correlated ($p<0.01$) with *social influence*, *performance expectancy* and *effort expectancy*. *Continuance intention* is the intent of a person to continue using a piece of software. People who intend to continue using the EMR could have been socially influenced to do so. Additionally, they may have been encouraged to continue using the EMR because they felt that they had the technology would help them in their job performance (*performance expectancy*) and that it was easy to use (*effort expectancy*). The relationship between performance expectancy and continuance intention has also been demonstrated in other research involving use of mobile devices (Carlsson, et.al. 2006).

Social influence was also positively correlated ($p<0.05$) with *performance expectancy* and *effort expectancy*. Individuals high in social influence may pick up from their hospital or dental administration the importance of using HIT, and the benefits it may have on their work productivity and success. They may also be influenced by their peers to believe that the effort required learning the new system is minimal. Finally,

Performance expectancy and *effort expectancy* were also significantly correlated ($p>0.05$) as has been demonstrated in other research (Marchewka, 2007).

Table 15: Hypotheses and Results

Hypothesis Number	Hypothesis	Result
H1A	Individuals with higher *conscientiousness* will show a stronger relationship between *performance expectancy* and *continuance intention* .	Fail to reject null hypothesis
H1B	Individuals with higher *conscientiousness* will have a stronger relationship between *social influence* and *continuance intention*	Fail to reject null hypothesis
H2A	Individuals with higher extraversion will show a stronger relationship between *social influence* and *continuance intention*	Fail to reject null hypothesis
H2B	*Extroversion* will be positively associated with *performance expectancy* .	Fail to reject null hypothesis
H3A	*Neuroticism* will be negatively associated with *performance expectancy* .	Fail to reject null hypothesis
H3B	***Neuroticism* will be negatively associated with *effort expectancy* .**	**Reject the null hypothesis**
H4A	*Openness to experience* will be positively associated with *performance expectancy.*	Fail to reject null hypothesis
H4B	*Openness to experience* will be positively associated with *effort expectancy* .	Fail to reject null hypothesis
H5A	*Agreeableness* will be positively associated with *performance expectancy* .	Fail to reject null hypothesis
H5B	**Individuals with higher agreeableness will show a stronger relationship between *social influence* and *continuance intention* .**	**Reject the null hypothesis**

Next, we are going to examine each of the hypotheses. The first hypotheses (H1A) stated that individuals with higher conscientiousness will show a stronger relationship between PE and CI. The next hypothesis (H1B) stated that individuals with higher conscientiousness will have a stronger relationship between social influence and continuance intention. It is necessary to first examine the individual constructs of conscientiousness, performance expectancy, continuance intention, and social influence prior to examining the paths. The conscientious person has a need for achievement,

order, and persistence (Costa et al. 1991). According to Barrick and Mount (2000), these traits emerge as intrinsic motivation at work and high levels of job performance. We would expect to see both physicians and dentists scoring high on *conscientiousness* because of the extremely difficult nature of medical school, not to mention the high level of job performance required to make it through to residency. *Conscientiousness* (*mean=4.30, sd=0.54*) was high for the sample of clinicians, satisfying the first part of the hypotheses. The sample of clinicians also scored highly on PE (*mean=4.09, sd=0.73*) indicating that those surveyed believed that using an EMR would help him or her to attain gains in job performance. The sample also scored very high on CI (*mean=4.54,sd=0.64*) indicating that they intended to continue utilizing EMRs in their careers and in private practice. *Social influence* (SI) (mean=3.87, sd=0.65) scores indicated that those surveyed only have no opinion or somewhat agree that they are influenced by their peers and hospital administrations. This may not be that surprising considering that we know from the literature that professional autonomy is important to many physicians. For example, research has shown that perceived threat to professional autonomy from EMR/CPOE systems has a significant, negative direct influence on perceived usefulness of an IT and on intention to use that IT (Walter & Lopez, 2008). Because the constructs for *conscientiousness*, PE, CI and SI were statistically reliable proceeding with the path model for these first two hypotheses was appropriate.

When considering the path model, it would seem likely that people high in *conscientiousness* would make a connection between using IT and being more efficient and perform at a higher level at work. Similar personality research conducted by

Deveraj, Easley and Crant (2008) found that *conscientiousness* moderated the relationship between *perceived use* (PU) and intention to use technology. Since the construct of *performance expectancy* from UTAUT is considered to be synonymous with PU from TAM/TAM2 it was reasonable to expect similar results between studies. However, the relationships between these conscientiousness and CI and PE were not significant (*p=0.499;0.118*). Also of note is the fact that the path from conscientiousness to social influence had to be removed in order to achieve a good model fit. Venkatesh et al. (2003) found that the effect of *social influence* on *intention to use* differed depending on *voluntariness*. In mandatory settings, such as a hospital using an EMR, *social influence* was a significant predictor of *intention to use*, however in voluntary settings, such as private practice, it was not. More importantly he found that in mandatory settings, the role of *social influence* diminished over time and was insignificant once users had three months of experience using the system. In this study, the EMR users had a mean average use time of EMR systems ranging from 2.15 to 3.24 years. Although the standard deviations are quite large for all systems (1.22-2.70 years), all of the participants had used an EMR for more than three months. Therefore, it is reasonable to assume that social influence had in fact diminished over time and had become insignificant.

The next two hypotheses tested were (H2A) individuals with higher *extraversion* will show a stronger relationship between *social influence* and *continuance intention*, and (H2B) *extraversion* will be positively associated with *performance expectancy*. First we will examine the individual constructs. Individuals high in *extraversion* are social,

active, and outgoing and value interpersonal relationships (Watson and Clark, 1997). *Extraversion* (*mean=3.92, sd=0.69*) was somewhat high for the physicians/dentists surveyed meaning they are somewhat extraverted as a population. As indicated previously, CI was very high and SI was only somewhat high. The theory of reasoned action (TRA) identifies *extraversion* as a personality trait that will have an effect on one's beliefs about a particular behavior, such as EMR use. Barrick and Mount (1991) found that more extraverted persons are high performers in jobs requiring a social component, like management or sales. Practicing medicine usually involves seeing patients, and therefore a social component is present. However, *extraversion* is also associated with effectiveness in a team setting (Barrick et al. 2001). This could sometimes apply to medicine if a team of doctors is consulting on a particular case. However, in today's healthcare model a single doctor considered a family medicine or general practitioner handles the majority of care for a single person and may make referrals to specialists if needed. Note that the largest proportion of physicians surveyed was classified as Medicine, the majority of which were family or internal medicine specifically. As with the previous hypotheses (H1A&B), all constructs were reliable and therefore the path model was tested. The path from *extraversion* to SI was not significant (Estimate = 0.03, p = .660) nor was the path from *extraversion* to CI (Estimate = -0.04, p = .463). Additionally, the path from extraversion to PE was not significant (Estimate = -0.08, p = .185). The simplest explanation for this lack of significance is that the sample was simply not high enough on *extraversion* as a personality construct.

The next set of hypotheses is: (H3A) *neuroticism* will be negatively associated with *performance expectancy* and (H3B) *neuroticism* will be negatively associated with *effort expectancy*. Persons low in neuroticism is generally stable and well-adjusted. Similar to extraversion, TRA identified neuroticism as another personality variable that would affect beliefs about behavior. It was expected that these clinicians would be low in neuroticism based on the stability and level of adjustment required to pursue a career in medicine or dentistry. As expected, *neuroticism* was somewhat low (mean=2.88, sd=0.85) for the clinicians surveyed. Effort expectancy (*mean=4.07, sd=0.68*) scores were similar to the scores for PE (*mean=4.09, sd=0.73*) meaning that the physicians surveyed found the EMR to be relatively easy to use in practice. As with prior constructs, these were found to be reliable and the path model was generated. The path from neuroticism to PE had to be removed in order to achieve a good model fit and therefore the null hypothesis for 3A cannot be rejected. Hypothesis 3B looked at the path from neuroticism to effort expectancy. The path from neuroticism to effort expectancy was significant (Estimate = -0.09, p = .017). Neuroticism is negatively related to effort expectancy. Clearly these two findings are contrary to one another. PE and Neuroticism were likely negatively related because neurotic personalities are likely to view technological advances in their work as threatening and stressful. Therefore, they would not perceive it to be useful. While this may still be true, it cannot be demonstrated in the context of this research model. The statistically significant negative relationship between neuroticism and EE is valid because neurotics can be expected to consistently respond to and evaluate a stimulus negatively.

The fourth set of hypotheses is: (H4A) *openness to experience* (OE) will be positively associated with *performance expectancy* and (H4B) OE will be positively associated with *effort expectancy*. Individuals who are high on OE will seek out new and varied experiences and value change (McCrae and Costa 1997). The clinicians surveyed scored high on OE (*mean=4.37, sd=0.51*), meaning they are open to change, such as using an EMR over paper charts. OE was a reliable construct. The path from OE to PE was not significant (Estimate = 0.10, p = .244). Similarly, the path from OE to EE was not significant (Estimate = 0.12, p = .165). As mentioned before, an example of change could be switching from paper charts to an EMR. Because the physicians surveyed were residents and fellows it is likely that they have never had to use paper charts in practice and therefore no change would be present. Also important to note is that Deveraj, Easley and Crant (2008) did not find a statistically significant relationship between openness to experience and perceived usefulness in their study of MBA students. In their study it was noted that the openness dimension had an impact on intention to use beyond perceptions of usefulness or ease-of-use. Perhaps this is true with the sample of physicians, that the concept of OE is too complex to be demonstrated in a linear relationship.

The last set of hypotheses is: (H5A) *agreeableness* will be positively associated with *performance expectancy* and (H5B) individuals with higher *agreeableness* will show a stronger relationship between *social influence* and *continuance intention*. People who score high in agreeableness are accommodating and cooperative. Barrick and Mount's

meta-analysis suggests that agreeableness has significant predictive validity in jobs requiring extensive interpersonal interaction and teamwork, especially helping and cooperating (2001). Clinicians surveyed were very high in agreeableness (*mean=4.54, sd=0.45*). This is not surprising if one considers the interpersonal interaction between a patient and their physician to be significant to patient care. However, despite the construct being reliable the path from *agreeableness* to PE had to be removed in order to achieve a good model fit. Of note is that Deveraj and Easley (2008) did find a significant relationship between agreeableness and PU in their study. So although it did not work in this research model, the relationship should be further investigated. The path from agreeableness to continuance intention was significant (Estimate = 0.20, p = .010). The path from agreeableness to social influence was also significant (Estimate = 0.22, p = .019). This demonstrated that individuals with higher agreeableness tended to have higher continuance intention and social influence. In other words, more agreeable persons were more likely to use EMRs in their own practice and more likely to be influenced by their peers and the hospital administration. This assumption makes sense if one believes that agreeableness would have the strongest relationship to IT acceptance when that technology fosters things such as collaboration, cooperation, and task accomplishment. It is possible that the EMR is seen by agreeable physicians to foster collaboration since it makes communication between specialties easier by providing a single portal to lab results and other findings. Additionally, the use of an EMR does require some level of cooperation between a physician and his/her nursing team in order

to accomplish tasks. Those who are high on agreeableness may find the EMR to be more of a collaboration tool that requires cooperation than those who are not.

One major gain from this study is the ability to use the information gathered here to develop guidelines for HIT implementation and training. The administration of a simple battery of personality questionnaires, such as the 17 utilized in this study can provide insight into the types of individuals the system trainers will be working with. The short version of a personality questionnaire would take minutes to complete, while providing valuable insight to those organizing system training. For example, the group of clinicians surveyed in this study scored highest in *agreeableness*, *conscientiousness* and *openness to experience* and lowest in *neuroticism*. That would indicate that the majority of these clinicians would benefit most from a training environment where collaboration and teamwork are involved. They would likely benefit least from self-training, or working with an individual trainer in a one on one situation. On the other hand, if a healthcare organization were to find that a large number of clinicians scored highly on *neuroticism* they could structure training specifically to address those cognitive issues. These types of people would benefit more from individualized training, longer training sessions, and even strategies to reduce anxiety related to system use. The healthcare administration could go so far as to use individual questionnaires to separate their training groups to focus on the specific needs of those who score highest on agreeableness, and separate those from the more neurotic group. I would recommend that any organization, whether conducting pre-system implementation training or simply

the hiring and training of new staff, should assess these basic personality constructs in order to have a more helpful and successful training environment.

Based on the data collected in this study, there are numerous opportunities for future research. Since personality is not stable over time, it would be beneficial to survey age cohort groups of physicians in a similar manner. You may find that residents/fellows are the most agreeable because of their inherit need to please in order to be successful. However, you may find that older populations, such as those who have been in practice for 30 or more years score lower on *agreeableness* and perhaps more highly on *neuroticism*. By gathering this information, training and system implementation could be adapted to suit different age categories.

Another research opportunity would be to survey nurses. Since nurses are typically considered to be the front line staff of a healthcare organization they have a high level of interaction with any HIT system. Not only could gathering personality information on nurses be helpful with HIT system implementation and training but it could also provide other benefits. Some of these benefits could include pairing nurses with certain personality characteristics with physicians of similar characteristics and studying whether or not there are improvements in productivity, job satisfaction, and teamwork.

Demographics such as gender, race and ethnicity could also have an effect on personality scores. Future research could attempt to compare equal samples of males and females on personality and technology acceptance constructs to see if the healthcare model would

vary based on gender. The same would apply to both race and ethnicity. Various cultures value personality traits such as *agreeableness* and *conscientiousness* differently. It would be of value to know how these differences may also affect the creation of a healthcare specific model. It might be beneficial to replicate this study at a non-United states hospital and compare the differences.

As mentioned earlier in this document, the construct of *Openness to Experience* is complex and may not be able to be demonstrated effectively in a linear model. Because of this, I would propose removing it from the model and working instead with the other remaining constructs. It might also be beneficial to deconstruct the model entirely, and focus on specific factors of UTAUT and more simple relationships to single personality constructs. If these can be demonstrated, the model could be applied directly to clinicians who score highly on those traits. Training could then also be tailored more specifically to understand whether or not for example an extraverted person would need additional support to appreciate the usefulness of a system (PE) or the ease of use of a system (EE).

Additional changes to the UTAUT model may also be necessary. For example, this survey looked at EMR use. Do clinicians view the EMR as a tool that helps them to make decisions or simply as a tool for documentation instead of a chart? Although the clinicians surveyed here scored highly on *performance expectancy* meaning that they felt the EMR assisted them to make gains in job performance that does not necessarily mean it is a tool that helps them to make decisions. Perhaps, there needs to be an additional construct created to assess whether or not the HIT system meets their desires for

improved job performance. Not whether or not they feel that it simply improves job performance because it makes documentation easier and faster. They may be satisfied with the current EMR in that respect, but may also be longing for additional clinical decisions support or improved diagnostic tools.

Prior to this study, nothing was known in the literature related to the personality of physicians and technology acceptance. For gathering this information alone, this study is landmark. In addition, it adds to the sparse research in the area of personality and technology acceptance. Though the majority of hypotheses failed to be accepted, this study highlights the difference between clinicians and other groups of persons such as MBA students in the Deveraj, Easley and Crant (2008) study, thus supporting the need for a healthcare specific model. As opposed to abandoning the relationship between personality and technology acceptance this study provides groundwork for improving the research in HIT and provides many opportunities for future research.

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APPENDIX I: THE FRONT OF THE SURVEY

Demographics

1. Age: _____ **2. Gender** (circle one): M / F

3. Electronic Medical Record (EMR)/Electronic Health Record Experience (EHR):

Name of Product	Years of Use

4. Medical Specialty: _____

5. Education (e.g., BS/MS/PhD/MD/PharmD/)- *Please list all*: _____

6. Ethnicity (circle one): Hispanic or Latino / Not Hispanic or Latino

7. Race (check all that apply): ☐ American Indian or Alaska Native ☐ Asian
☐Black or African American ☐ Native Hawaiian or Other Pacific Islander ☐ White

8. Weight: _____ lbs. **9. Height:** _____ feet _____ inches

9. Please list any disabilities you may have: _____

How I am in general

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which **you agree or disagree with that statement.**

1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly

1. _____ I am intrigued by the patterns I find in art and nature.
2. _____ Once I find the right way to do something, I stick to it.
3. _____ I have a lot of intellectual curiosity.
4. _____ I am not a worrier.
5. _____ I rarely feel fearful or anxious.
6. _____ I rarely feel lonely or blue.
7. _____ I am seldom sad or depressed.
8. _____ I generally try to be thoughtful and considerate.
9. _____ Most people I know like me.
10. _____ I would rather cooperate with others than compete with them.
11. _____ I am efficient and effective at my work.
12. _____ I am pretty good about pacing myself so as to get things done on time.
13. _____ I have a clear set of goals and work toward them in an orderly fashion.
14. _____ I work hard to accomplish my goals.
15. _____ I really like most people I meet.
16. _____ I really enjoy talking to people.
17. _____ I like to have a lot of people around me.

APPENDIX II: THE BACK OF THE SURVEY

How I feel about Electronic Medical Records (EMR)

Directions: Here are a number of statements that may or may not apply to you. For example, do you agree that you are someone who *finds the EMR to be easy to use*? Please select the number for each statement to indicate the extent to which **you agree or disagree with that statement.**

1 Disagree Strongly	2 Disagree a little	3 Neither agree nor disagree	4 Agree a little	5 Agree strongly

1. _____ I have found the EMR to be more useful in my job than using paper-based records.
2. _____ I feel apprehensive about using the EMR.
3. _____ Hospital Administration has been helpful by promoting the advantages of the EMR system.
4. _____ Using the EMR increases my productivity; therefore I am able to see more patients in a shorter amount of time.
5. _____ Using the EMR system is somewhat intimidating to me.
6. _____ Using the EMR increases efficiency, and therefore will increase revenue to my healthcare facility.
7. _____ It was easy for me to become skillful at using the EMR.
8. _____ I have found the EMR to be easy to use.
9. _____ I would like to discontinue using the EMR.
10. _____ People who influence my behavior, such as my supervisor or my peers, promote the use of the EMR.
11. _____ I feel the need to constantly recheck my work because I am afraid of making mistakes.
12. _____ I have the knowledge necessary to use the EMR.
13. _____ I accomplish tasks such as prescribing medications and ordering labs more quickly with the EMR.
14. _____ I have the resources necessary to use the EMR.
15. _____ The EMR is not compatible with other systems I use.
16. _____ I will continue to use an EMR in my own practice rather than discontinue its use.
17. _____ I will continue using the EMR rather than alternative means (paper charts)
18. _____ Learning to operate the EMR is easy for me.
19. _____ It scares me to think that I could harm a patient or lose their information by hitting the wrong key.
20. _____ My interaction with the EMR system is clear and understandable.
21. _____ In general, the hospital administration has supported the implementation and use of the EMR system.