A comparison of EHR technology receptivity and acceptance in a Northwest university psychology training clinician population

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Abstract
This is a preliminary exploration of electronic health record system implementation acceptance in a graduate student clinical psychologist population. A survey was conducted with a small sample (n=15) of student clinicians at a northwestern university pre- and post-implementation of an EHR system. This survey incorporated measures of a qualitative and quantitative nature. Theoretical constructs explored include technology acceptance, anxiety, self-efficacy, and personality factors that might influence the clinician's relationship to the EHR system pre- and post-implementation. Overall, there was an increase in negative attitudes towards EHR post-implementation. Clinicians were more likely to find the EHR system useful and feel confident about their abilities in EHR use if they were older and had more experience with computers and EHR systems. Significant findings are minimal and not generalizable due to the small sample size, but do lend support for previous findings in healthcare research around meaningful use and EHR acceptance.

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Abstract

This is a preliminary exploration of electronic health record system implementation acceptance in a graduate student clinical psychologist population. A survey was conducted with a small sample (n=15) of student clinicians at a northwestern university pre- and post-implementation of an EHR system. This survey incorporated measures of a qualitative and quantitative nature. Theoretical constructs explored include technology acceptance, anxiety, self-efficacy, and personality factors that might influence the clinician’s relationship to the EHR system pre- and post-implementation. Overall, there was an increase in negative attitudes towards EHR post-implementation. Clinicians were more likely to find the EHR system useful and feel confident about their abilities in EHR use if they were older and had more experience with computers and EHR systems. Significant findings are minimal and not generalizable due to the small sample size, but do lend support for previous findings in healthcare research around meaningful use and EHR acceptance.

Keywords: EHR, TAM, mental health, implementation, self-efficacy
Dedication

To Dot, for the millions of distractions and nibbles you gave me as I typed away.

Without you, I would have taken this paper too seriously and would have never finished!
Acknowledgments

Thank you to my chair, Lisa Christiansen, who heard my comment in class and proposed we turn it into a research project. Thanks to Shawn Davis, my reader, who has continued to provide an abundance of enthusiasm and expertise necessary for this endeavor. Finally, thank you to my family and friends, who repeatedly offered to help in any way needed to help me complete this milestone. It takes a village, and without all of you, I would not be crossing this significant milestone.
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A Comparison of EHR Technology Receptivity and Acceptance in a Northwest University Psychology Training Clinician Population

Electronic Healthcare Records are defined as “a repository of information regarding the health of a subject of care in computer processable form” (Blumenthal et al., 2006). This is distinguishable from Electronic Medical Records (EMR), a term that is often used interchangeably with EHR but really defines a more limited electronic database used within an organization without capability to transfer patient information electronically to outside networks (Garets & Davis, 2006; Shank, Willborn, Pytlikzillig, & Noel, 2011). The healthcare profession is adapting rapidly to the increasing reliance by all industries on technology, and the United States is on the forefront of changing to a united electronic health record system database which will unite private and managed healthcare under one communication umbrella (Brooks & Grotz, 2010; Jha, Doolan, Grandt, Scott, & Bates, 2008; Jha et al., 2009). Solo-practicing healthcare workers, such as MD’s and PhD level healthcare professionals, are among the slowest group to adopt EHR systems (Jha et al., 2006; Simon et al., 2007). It has been observed that within the healthcare profession, the mental healthcare specialty has been slower than others to utilize and integrate EHR technology (Fetter, 2009; Gans, Kralewski, Hammons, & Dowd, 2005; Jha et al., 2006; Miller & Sim, 2004; Shank et al., 2011).

The mental healthcare profession is a unique specialty within healthcare that will either adapt to the healthcare profession’s increasing reliance on technology or be overwhelmed and stunted with catching up when all other specialties have mastered EHR implementation (Shank et al., 2011). It is still unclear why mental health professionals
remain behind the curve in increasing reliance on EHR technology (Wiley-Paton & Malloy, 2004), but there is some evidence that client confidentiality, time investment, and financial costs are a few of the external barriers to EHR acceptance in mental healthcare (Miller & Sim, 2004; Shank et al., 2011). Part of understanding the problem for mental healthcare workers and their response and acceptance/rejection of technology is through comparison to their peers in other healthcare professions. As literature comparing healthcare student groups (by profession) and their internal reactions to newly implemented EHR systems is almost nonexistent (Shank et al., 2011), the goal of this project was to examine EHR technology receptivity in mental healthcare clinicians, specifically through a convenience sample of psychology doctoral student clinicians at a northwest university training clinic who were in their second year of graduate school and first year of clinical training. Similar to other studies in healthcare specialties and technology receptivity, a program evaluation through electronic survey was conducted pre- and post-implementation of an EHR database in the student clinic. The pre- and post-implementation survey included measures that were both quantitative and qualitative. This study evaluated the internal barriers of clinicians towards technology as the clinic underwent EHR implementation.

**Review of the Literature**

In the United States, healthcare is rapidly transforming due to the public’s increased reliance on managed care (Baker, Song, Jones, & Ford, 2008; Blumenthal et al., 2006) political agendas (Elmore, 2011; Finnegan & Hamid, 2009), and technology advancements (Raitoharju, 2005). A poll conducted by the Wall Street Journal (Bright,
suggests that there is increasing public support for a better and more efficient healthcare system and technology is the base to make this happen. In response to the EHR favorable political scene, healthcare administrators, clinicians, and patients alike are starting to believe and be willing to invest in EHRs as first major step in improving patient privacy and treatment compliance in addition to lowering overall healthcare costs (Bright, 2007; Elmore, 2011).

**External barriers to EHR implementation**

The mental healthcare clinician, especially the solo practitioner, encounters multiple barriers to meaningful use of EHR technology. At the individual clinician level, the start-up costs are staggering in implementation and maintenance of true EHR systems (versus electronic EMRs) and are estimated around $25,000 per physician with most competent software systems (Boonstra & Broekhuis, 2010; Brooks & Grotz, 2010). Unfortunately, the barriers continue at the macro level also as government subsidies (i.e., HITECH) created to support EHR development and dissemination are conditionally awarded only if EHR systems have multiple safeguards in place to keep mental health records separate and protected from the medical record. Financial incentive programs for mental healthcare practices that might lower the external financial barriers to EHR implementation (e.g., hardware and software investment, technology training, maintenance, etc.) are non-existent as of the writing of this paper. This complicated multi-layered process of protecting mental health information adds at least a psychological barrier to enticing mental healthcare clinicians to join the EHR movement (Salomon et al., 2010).
While the logic and concern around patient privacy is warranted in EHR meaningful use debate (i.e., social stigma is much higher for those with mental illness versus a diagnosed physical problem), the present strategy of addressing mental healthcare primarily by exclusion from federal research and resources has serious implications for the mental healthcare professionals’ standing in the healthcare community. From research and funding come policies and laws to support and specify how healthcare professionals and patients are protected and recognized in this emerging healthcare revolution.

Although there are general theories on why the profession of mental health is so far behind the technology curve, it is still not established why mental health professionals show so little interest in the EHR race to connect to the impending global network. There seems to be a lack of personal imperative to achieve technological competence with the EHR system (Chismar & Wiley-Patton, 2003; Coyle, Doherty, Matthews, & Sharry, 2007; Croteau & Vieru, 2002; Shank et al., 2011; Stein & Milne, 1999). There is one preliminary study (Shank, 2011) that suggests (largely from qualitative data) that, similar to general healthcare professional concerns (Miller & Sim, 2004), client confidentiality (i.e., privacy), regular time commitment, and, most of all, confounding financial commitment for the typical single-practitioner business could be some of the external barriers to EHR acceptance in mental healthcare.

External barriers can influence and add to internal barriers. The title “mental healthcare practitioner” includes a wide variety of education levels and specialties and is interchangeable with “behavioral health practitioner.” A mental healthcare practitioner
can be a psychiatrist, psychiatric nurse, psychologist, social worker, drug and alcohol
counselor, or family therapist. A mental healthcare practitioner’s education ranges from
as little as no higher education (e.g., drug and alcohol counselor) to as much as 8 or more
years of post-graduate training in the case of a psychiatrist. Since the amount of
education has been shown to be inversely correlated to technology acceptance and use
(Davis, 1993; Shank et al., 2011), this wide range of educational training adds a new
layer of complexity to understanding the barriers of EHR implementation for mental
healthcare workers.

Other healthcare groups are more easily studied and organized around EHR
implementation because of the uniform education in that specialty (e.g., physicians,
nurses, etc.). For example, because psychiatric nurse practitioners have a similar level of
base education, their organization routinely reviews political and educational trends and
offers competency recommendations to maintain competitive within healthcare. In 2009,
a review of information technology competencies was published providing
encouragement and explanations for why mental health lags in EHR implementation and
recommending specific motivations, resources, and strategies which psychiatric nurse
practitioners could engage in to upgrade their technology skills (Fetter, 2009). Such
social pressures and norms presented within a specific profession may influence the
resultant attitudes of members of that profession towards changes such as EHR
implementation.

The present study will assess and compare the internal psychological barriers of
mental healthcare clinicians in training and their reactions towards EHR technology
implementation at a northwest university psychology training clinic. Internal barriers specific to mental health professionals implementing EHRs are largely unknown as there has been very little research in general on the profession’s use of EHRs. Below, internal barriers of general healthcare professionals’ EHR use will be reviewed.

**Internal barriers for healthcare professionals’ EHR use**

As ever greater financial and other resources are allocated to IT systems in healthcare, the factors which influence staff attitudes towards them become increasingly significant if the investment is to be worthwhile. If information systems underpinned by new technologies are to play a significant role in the expansion of evidenced-based practice, then the human factors of those who will use them needs to receive as much consideration as the technologies themselves. (Ward, Stevens, Brentnall, & Briddon, 2008, p. 94)

Attitudes and beliefs are widely accepted as the main internal barriers towards technology acceptance and use (Davis, 1989). *Attitude* is the settled emotional state one experiences about an object, whereas *belief* is the cognitive justification and basis for one’s behavior, which often parallels the attitude (Ajzen, 2002). To date, literature on internal barriers of attitudes and beliefs of healthcare workers is in its beginning stages and somewhat contradictory.

Nurses’ attitudes towards EHR systems were surveyed pre- and post-implementation at a large medical center (Laramee, Bosek, Shaner-McRae, & Powers-Phaneuf, 2012). It was found that nurses felt more adverse towards EHR at 6 months post implementation and their negative perceptions did not decrease even after 18 months. In a different study without the pre- and post- design, nurses’ attitudes were overall favorable towards the EHR system being used (Moody, Slocumb, Berg, & Jackson, 2004).
According to the theory of planned behavior, beliefs can be separated into three categories: behavioral, normative, and control (Ajzen, 2002). Behavioral beliefs reflect the individual’s beliefs about what will happen by behaving a certain way. Attitude is closely connected to behavioral beliefs. Normative beliefs categorize the individual’s awareness of social expectations and the appropriate motivation to comply. Finally, control beliefs involve what the individual sees as support and barriers to enacting a behavior.

In an attempt to measure both beliefs and attitudes, the Technology Acceptance Model (TAM) was developed. When all three types of beliefs (behavioral, normative, and control) are favorable towards a behavior, intention results and action follows, moderated only by both external barriers that might impede the behavior and internal barriers such as attitudes (Perceived Ease of Use) and beliefs (Perceived Usefulness) to predict successful technology implementation.

**Technology Use Constructs**

While most research in the area of technology implementation has focused on the successfulness of technology in accomplishing the tasks for which it was intended (Wiley-Paton & Malloy, 2004), a smaller segment has viewed technology implementation outcomes from the user perspective (Holden & Karsh, 2010). In healthcare this would mean how a clinician perceives the user friendliness of the software and their own capabilities to use it effectively to improve their performance with patients. The TAM helps both in explaining (see Figure 1 for a simplified model of the TAM) and
predicting how the consumer will ultimately fare with the technology (Holden & Karsh, 2010).

\[ \text{Perceived Usefulness} \rightarrow \text{Intention to Use} \]

\[ \text{Perceived Ease of Use} \rightarrow \text{Intention to Use} \]

*Figure 1: Technology Acceptance Model (Holden and Karsh, 2010)*

The most recent version of TAM was used to see if intention (i.e., self-report) to use the technology translated to actual technology use (Szajna, 1996). The TAM includes content questions on ease of use, usefulness, and intention to use (see Figure 2 for how these factors related). The method was a longitudinal experimental design that included 61 male and female graduate business students who were given a hands-on software program demonstration and a pre-implementation survey; subsequently, they were allowed free use of the software over 15 weeks. Following the semester, participants were given a post-survey with the same revised TAM questions. Data were also collected on how much intention to use resulted in self-perceived amount of use and actual use.
Consistent with other studies previously using the TAM, Perceived Ease of Use predicts perceived Usefulness, which in turn predicts Intention to Use and Self-Report. The findings highlighted the discrepancy between perceived versus actual software use. The author suggested that research incorporating the TAM should include a way to objectively measure actual technology use instead of relying on self-reported use, as most studies have done. However, many studies (including the present) use convenience samples of individuals who do not have a choice in how much they interact with the software. Therefore, there must be a different way to explain successful technology acceptance and use.

The technology acceptance and use construct has been expanded to include computer self-efficacy. Self-efficacy is a belief in one's capabilities to produce a result. Compeau and Higgins (1995) developed a measure of computer self-efficacy by first comprehensively reviewing related measures and literature. A 10-item task-focused measure was then developed, incorporating elements of previous measures (e.g., task difficulty, specific task steps) and drawing from Social Cognitive Theory literature,
which covers cognitive, environmental, and behavioral influences. In the main study on Computer Self-Efficacy, 2000 male and female employees were randomly selected from a Canadian business periodical address list, with a response rate of 53%. Findings indicated that individual’s outcome expectations, computer self-efficacy, and self-reported amount of computer use was positively correlated with others’ computer use and encouragement within their work group. These results indicated the importance of measuring computer self-efficacy as a factor influencing technology acceptance and use. The contrasting attitude (or emotion) to Computer Self-Efficacy (a belief) is Computer Anxiety, which is shown to be inversely related (Venkatesh, 2000).

The relationships between Computer Self-Efficacy and Computer Anxiety were explored by Venkatesh (2000) to further explain Perceived Ease of Use (an attitude). Computer Anxiety was framed as a type of “emotion” towards technology and was predicted to decrease as the user’s perceptions (attitudes and beliefs) of the technology were challenged and changed.

![Figure 3: Computer Self-Efficacy (Venkatesh, 2000)](image)

The connections between TAM and personality are also well established (Buchanan, 2001; Devaraj, Easley, & Crant, 2008a). As traits are more stable than
attitudes and beliefs, it follows that understanding a constellation of traits influencing the user’s perceptions could have significant predictive value in user acceptance. The five-factor personality measure correlates steady trait self-endorsed items. The factors are: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

The five factors have been explored in relationship to how individuals scoring high in these areas might relate to EHR technology (Devaraj, Easley, & Crant, 2008b). With openness or openness-to-experience, an individual high on this scale might find the prospect of new technology learning and mastery as a positive opportunity to grow because they are less threatened by new experiences. In the case of a person scoring high on conscientiousness, the individual would probably take new technology seriously; either carefully master it so that they might improve their performance at work, or outright refuse to learn it, if they feel their values are threatened by the product.

Extraverted individuals tend to be competitive in the work environment and have a propensity to yield easily to social pressures. Therefore, someone high in extraversion might be easily influenced by the political atmosphere around new technology integration. An agreeable individual is also strongly influenced by social pressures, and might be motivated to use new technology if they feel like their social connections are benefited (e.g., increased communication and connection through technology). Finally, a person scoring high on neuroticism would most likely tend to negatively react to any kind of work environment challenges. These individuals will be least likely to accept and be successful with new technology.
Personality and the TAM have been studied with alternate models and personality questionnaires. For example, Godoe and Johansen (2012) created a survey using the TAM and Technology Readiness Index (TRI). Results showed that individuals scoring high in personality factors such as optimism and innovativeness scored higher in positive perceptions of the technology. Personality characteristics were not only correlated with the TAM but were found to be predictive of actual technology use. The beginning of a similar study was published explaining plans to use the personality survey, a TRI, and two technology use models: the TAM and a second model of technology acceptance to measure external factors (e.g., social influences) on a large hospital’s staff (n=4800) (Devolder, Pynoo, Duyck, & Sijnave, 2008). As of the writing of this paper, the final results of the study were not found.

The TAM is the oldest and most researched of technology theories but was not originally intended for healthcare technology (Chismar & Wiley-Patton, 2003). The above modifications (Figures 2 and 3) help explain and predict the modern healthcare user’s internal barriers towards meaningful EHR use. It is suspected that the mental healthcare clinician’s technology receptivity and acceptance has not been researched to date due to the scarcity of financial incentives both at the private research (e.g., white papers) and governmental levels (N. Shank, telephone interview, 2011, July 29).

This completes the review of known factors, both internal and external, around why mental healthcare clinicians might not be viably interested in acquiring and learning EHR systems; financial barriers (external) and the fact that we know little about what does and does not work about EHRs with mental healthcare clinicians (internal). While
there are some studies comparing healthcare clinician professions’ technology receptivity and assimilation (Paré, Sicotte, & Jacques, 2006; Raitoharju, 2005), there have been none found to date that specifically compare mental health with other healthcare professions in the area of EHR technology integration. The findings of this study will hopefully aid in formulating specific types of technology trainings for those in the mental healthcare profession and add to the growing information on general healthcare clinician technology receptivity.

**Research Questions**

No specific directional hypotheses have been formed due to the newness of this area of research. There is not enough literature specific to EHRs and the population being studied to formulate answerable hypotheses. Research questions to be explored are listed below according to measures.

**Computer Anxiety Rating Scale**

Will there be significant changes in computer anxiety based on implementation?

**Computer Self-Efficacy Measure**

Will mental healthcare clinicians show greater computer self-efficacy over time, evidenced by significant increase on scores of Computer Self-Efficacy from pre-implementation to post-implementation?

**Perceived Usefulness and Ease of Use**

How do mental healthcare clinicians perceive the usefulness and ease of use of EHR technology and how does this influence their anticipated successfulness of the EHR program?
Five Factor Personality Questionnaire

Are there any correlations between personality factors and the other constructs measured (i.e., anxiety, self-efficacy, anticipated usefulness, and ease of use)?

Other Questions

How do the student clinician’s ratings (positive or negative) overall change pre-and post-implementation?
Method

Participants

The target population for this study was mental healthcare clinicians in training. Forty-five male and female clinicians participated in the study drawn from the doctoral psychology training program at a northwest university. This sample included supervisors, interns, and practicum students who were practicing at the northwest university psychology clinic. The age range was 23-50 years old with a mean age of 28.67, and reported years of computer use between 8-35 years. All other employees at the clinic were excluded (e.g., receptionist, office managers, etc.).

Measures

Variables examined within the study included technology acceptance, computer anxiety, computer self-efficacy, Perceived Ease of Use & Perceived Usefulness, and personality. A qualitative and quantitative self-report approach was chosen because of the lack of triangulated value between quantitatively validated technology theories and user satisfaction (Dadayan & Ferro, 2005) and also ease of administration in using a survey format.

Demographic Questionnaire (Appendix A). A brief questionnaire developed by the researchers was administered during the first data collection to assess characteristics such as participant name, email, age, sex, race, formal education completed, the nature of their undergraduate and (if applicable) postgraduate degree, years of computer use experience both professionally and personally, and opinions on electronic health records utilization and transition.
Computer Anxiety Rating Scale (Appendix B). Computer anxiety was measured pre- and post- EHR system implementation using the Computer Anxiety Rating Scale (CARS, Sam, Othman, & Nordin, 2005) a 19-item self-report measure, which assesses emotional anxiety related to computer use. For each question, respondents were asked to indicate their rating of agreement on a 5-point Likert-type scale with endpoints ranging from “strongly disagree” to “strongly agree.” Chronbach’s alpha value is 0.87 ($r = .70, p < .0001$).

Computer Self-Efficacy Measure (Appendix Ca and Cb). Self-efficacy of computer ability was measured pre- and post- EHR system implementation using the Computer Self-Efficacy Measure (Compeau & Higgins, 1995) a 10-item self-report measure used to identify a computer user’s beliefs about his or her ability to complete a task requiring the assistance of a computer software package. For each question, respondents were asked to indicate their confidence level using a software program with endpoints ranging from “not at all confident” to “totally confident.” Chronbach’s alpha value is 0.90 ($p < .05$).

Perceived Usefulness and Ease of Use (Appendix Da and Db). Electronic health record technology acceptance was measured pre- and post- EHR system implementation using the Perceived Usefulness (PU) and Ease of Use (EU) Measurement Scales (Davis, 1989); a 12-item self-report measure comprised of two subscales used in the assessment of technology acceptance and predictability of future use. Each subscale contains six items. For each question, respondents were asked to indicate how likely the usefulness of technology would be and how easy it would be for them to use it on a 5-
point Likert-type scale with endpoints ranging from “extremely likely” to “extremely unlikely.” Chronbach’s alpha value is 0.97/0.91 ($p < .001$).

**Five Factor Personality Test (Appendix E).** The Five Factor Personality Test assesses personality domain identification from the model proposed by Costa and McCrae (1992) and modified into an online friendly format by Buchanan, Johnson, and Goldberg (2005). It was administered online during the second phase of the study, and consists of a 41-item self-report measure used to identify the following personality traits: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. For each question, respondents were asked to indicate how accurate the statement was to them on a 5-point Likert-type scale with endpoints ranging from “very inaccurate” to “very accurate.”

**Procedures**

Sampling took place in two parts, and utilized a self-report survey method. Students were recruited via e-mail (Appendix Fa and Fb). Surveys were conducted through a secure internet-based survey program. Only the principal investigators had access to the study data. All data was collected, analyzed, and contained in a password-protected computer that was only accessible by the principal investigators.

Participants completed two study sessions. They were recruited from a northwest university school of professional psychology. Each group completed the below surveys, which were administered as appropriate over their semester timeline (session 1) and following EHR integration training and use (session 2).
Session 1. Study participants were recruited via intercampus e-mail. The recruitment message included a link that directed the individual to a SurveyMonkey study website that was owned and operated exclusively by the primary investigator. Upon entering the study site, the participant was presented with the informed consent document. Upon agreeing to participate, the participant was asked to complete a demographics questionnaire, the Computer Anxiety Rating Scale, the Computer Self-Efficacy Measure, and the Perceived Usefulness and Ease of Use measure. Once the participant had completed these measures, they were thanked for their time and participation. The participant was informed that they would be contacted via e-mail and invited to continue participation in Session 2 once the electronic health record system was in place and they had been adequately trained on its usage. It was estimated that the total time for participation for this first session was no longer than 15 minutes for each participant.

Session 2. Those individuals who completed participation in the first study session were contacted via e-mail for the opportunity to continue their participation in a second study session. This recruitment message included a link to a second secure study SurveyMonkey site. Upon entering the study site, the participant was presented with the same informed consent document they were provided in Session 1. Upon agreeing to continue their participation, they were presented with three of the measures utilized in Session 1 (the Computer Anxiety Scale, the Computer Self-Efficacy measure, and the Perceived Usefulness and Ease of Use measure). Participants in this second study session were also presented with and asked to complete the Five Factor Personality Test. Once
the participant completed all of these measures, they arrived at a screen that stated that their participation was now concluded and they were thanked for their time and continued participation. It was estimated that the total time for participation in this second study session was no longer than 20 minutes.

Participant identification was accessible through an already established email list at the university training clinic. The researcher sent the recruiting email to the clinic director who then forwarded the email to all clinicians. Care was taken in protecting the survey results of all participants. Due to the nature of the study, participant data was de-identified after the first study session, identifying information was replaced with a unique study ID number and a key was produced linking contact e-mail addresses with this participant ID number. Completed survey data were stored on the primary investigator’s computer located on campus. The key that linked contact e-mail address with study ID number was also kept by the principle investigator.
Results

There were more participants in session 1 \((n=45)\) than session 2 \((n=20)\) with 44% attrition from pre- to post-implementation. Although some attrition is expected, this large percentile is most likely due to a research pitch omission prior to session 2 where students were not reminded of the option to complete their participation at a staff meeting in the same way they were invited to in session 1. Only participants who completed both sessions were included in the following analyses. Since the sample size was so small and there was significant inconsistency in recruitment for pre- and post-implementation surveys, analysis of attrition factors between groups was not conducted. Out of the 40 clinicians invited to participate, 15 (33%) individuals responded for both sessions. The majority of respondents were female \((n=12)\). All respondents were student clinicians at the university clinic. The mean age was 28 years old \((SD=5.49)\).

No specific directional hypotheses were formulated due to the newness of this area of research. Significant findings will be reviewed below according to measures.

Computer Anxiety Rating Scale

EHR implementation resulted in an increase in computer anxiety from session 1 \((M=43.07, SD = 9.18)\) to session 2 \((M=45.00, SD = 8.44)\) \((t(15) = .65, p =.009, \text{two-tailed})\). Computer anxiety at post implementation was significantly negatively correlated with Perceived Usefulness \((r=-.619, p=.004)\) and Perceived Ease of Use \((r=-.693, p=.001)\) post-implementation of EHR.
Computer Self-Efficacy Measure

EHR implementation resulted in no significant difference in computer self-efficacy between sessions (t(15) = -0.223, p = 0.424, not significant). Computer self-efficacy was significantly negatively correlated with computer anxiety (r = -0.544, p = 0.013) post-EHR implementation. Computer self-efficacy was correlated with Perceived Ease of Use post-implementation (r = -0.602, p = 0.005). Experience with EHR was correlated with Perceived Usefulness (r = 0.30, p = 0.051).

Perceived Usefulness and Ease of Use

Perceived Usefulness and Ease of Use were significantly positively correlated (Pre-implementation r = 0.71, p = 0.000 and post-implementation r = 0.663, p = 0.001). However, there was no significant change between pre- and post- implementation for either (t(15) = 0.094, p = 0.926) and (t(15) = 1.169, p = 0.262). Predicted success of EHR Implementation was also correlated with Perceived Ease of Use (r = 0.30, p = 0.05).

Five Factor Personality Questionnaire

There were no significant correlations between the personality types and other study measures.
Discussion

There was not enough literature specific to EHRs and the population being studied to formulate useful hypotheses. Therefore, research questions, versus specific directional hypotheses, were used due to the newness of this area of research. These questions are discussed below with the significant findings in the following order: according to measures, between measures, limitations to the findings, and finally how the results provide suggestions for future research.

Within Measures

Computer Anxiety Rating Scale. This research questionnaire explored changes in the mental healthcare student clinicians’ computer anxiety based on implementation. EHR implementation resulted in an increase in computer anxiety. This conflicts with Venkatesh’s (2000, 2003) research showing that by exposing individuals to technology, their computer anxiety should decrease. Two possibilities might have caused this result. One, the sample is too small to truly match the larger studies Venkatesh conducted. Also, it is possible that a 3rd session further from the EHR implementation would have reflected the “return to the mean” phenomenon often found in research. In other words, session 2 might have measured a temporary emotional state in the clinicians which, with more time, would have diminished.

Consistent with Venkatesh’s findings, Computer Anxiety at post implementation was significantly negatively correlated with Perceived Usefulness and Perceived Ease of Use. This means that as computer anxiety increased, Perceived Ease of Use and Perceived Usefulness decreased.
**Computer Self-Efficacy Measure.** This measure examined if mental healthcare clinicians showed greater computer self-efficacy over time through significant increase on scores of Computer Self-Efficacy from pre-implementation to post-implementation. To review, self-efficacy is the internal state of believing that one is capable and competent to autonomously perform. If there had been a significant increase in self-efficacy, it could indicate that the less confident and more anxious clinicians would feel empowered by engaging in meaningful use of the software. EHR implementation resulted in no significant difference in computer self-efficacy. However, computer self-efficacy was significantly negatively correlated with computer anxiety post-EHR implementation. This result makes intuitive sense. As the perception of competence with technology diminished, the user’s anxiety increased.

It appears that learning and interacting with the EHR software lessened feelings of competence, Perceived Ease of Use, and Perceived Usefulness, and feelings of EHR anxiety increased. Again, it is possible that this trend might have diminished with a third measurement after more time had passed following EHR implementation. However, in the study reviewed previously of the nurses’ attitudes towards EHRs in a hospital changing from paper records to an EHR system (Laramee, Bosek, Shaner-McRae, & Powers-Phaneuf, 2012), the nurses’ attitudes towards EHRs became even more negative on the third measurement one year post-implementation.

**Perceived Usefulness and Ease of Use.** This measure examined how mental healthcare clinicians perceived the usefulness and ease of use of EHR technology and how this influences the anticipated successfulness of the EHR program. Consistent with
previous studies, Perceived Usefulness and Ease of Use were significantly positively correlated. This indicates that the TAM correlation shown in other populations holds true with student mental health clinicians. However, there was no significant change between pre and post implementation either between the domains or individually. This might be explained by the studies that found that Perceived Usefulness and Ease of Use are not as strongly correlated for individuals with a higher education (Davis, 1993; Shank et al., 2011). The barriers of complexity and cumbersomeness are not influenced by actual use. And, possibly because actual technology use was not voluntary, the clinicians did not have self-awareness of whether the technology felt any more or less useful, so they did not report it at session 2. Having a perception of usefulness was irrelevant to their interaction with the EHR system.

**Five Factor Personality Questionnaire.** There were no significant correlations between the personality factors within the measure and with other examined constructs. Most likely this is due to the small sample size. Other studies utilizing personality questionnaires had significantly larger samples (n>100) (Buchanan, 2001; Devaraj, Easley, & Crant, 2008a).

**Between Measures**

One of the original research questions asked: How do the student clinician’s ratings (positive or negative) towards EHRs overall change pre- and post-implementation? If computer anxiety increased, computer self-efficacy negatively correlated with computer anxiety, and there was no increase (or decrease) in Perceived Usefulness or ease of use with EHRs, it would appear that overall the student clinicians’
ratings were slightly more negative post-implementation. The demographics gave further explanation on who was most likely to rate EHR technology positively.

Being more experienced (with computers and EHR), having a positive outlook about the EHR implementation, and being older in age made student clinicians’ more positive towards EHRs. Predicted success of EHR Implementation was also correlated with Perceived Ease of Use. A positive outlook on EHR implementation correlated with clinicians rating higher levels of Perceived Ease of Use. In other words, believing that the EHR system implementation would go well was connected to finding the system easy to use.

Computer self-efficacy was correlated with Perceived Ease of Use post-implementation. A clinician feeling like he or she could competently use EHRs was connected to feeling like they are easy to use post-implementation. This makes sense that both would be positive only after students had gained experience with the system. Alternatively, the results could have been that the feelings of self-efficacy (“I’m good at using EHRs”) increased while Perceived Ease of Use remained low or decreased (“but EHR’s are hard to use”), which would have indicated that the student clinicians believed something was wrong with the EHR software. Instead, a confidence and familiarity, or ease of use, was gained after the student had experience with the system.

Although the qualitative comments did not reflect anything new or highlight any of the significant findings, the quantitative measures of population characteristics and experience encourages further research on how the mental healthcare population relates to EHR technology. If clinicians had previous experience with EHRs, they were more
likely to rate EHRs as useful pre-implementation. Experience with EHR was correlated to Perceived Usefulness. So, having longer exposure to the technology in some form showed that users believed pre-implementation that the technology would be useful. This correlation disappeared post-implementation, which might indicate that the users were disappointed or had an increase in negative attitudes towards the EHR system (either the implementation or the actual software).

Limitations

This study was non-experimental and therefore causality cannot be inferred. Comparison across groups (i.e., generalizability) is also limited because this was a very small convenience sample. The measures were compiled from various articles, and might not reflect a complete range of constructs necessary to accurately measure or draw any conclusions from the findings. Further, the low sample size increases the possibility of a type II error.

Diversity is a prominent issue. Most participants were white and American. Even though a variety of experience levels were measured in the clinicians (i.e., supervisors, interns, and 1st-year graduate students) to increase generalizability of results, the anticipated sample group characteristics of low EHR and work experience, low age level, and socioeconomic status make generalizability beyond mental health education training programs questionable. Furthermore, the TAM has not been found to have as powerful explanatory power in other cultures as in the United States (Bandyopadhyay &
Fraccastoro, 2007). Of course, applying the results to other industries should also be approached with caution.

Two drawbacks to most technology acceptance models are low explanatory power and varying factor influences (Sun & Zhang, 2006) A comparison to the TAM that could have been explored further is the Unified Theory of Acceptance and Use of Technology (UTAUT), which has more success for predictive power in estimating technology success (Dadayan & Ferro, 2005; Schaper & Pervan, 2007). The researcher ultimately decided against use of this model for the present study because of the sparse studies using it for research specific to healthcare. However, in some ways the model is more fitting to the complexity behind meaningful use of EHR technology (Zheng, Padman, Johnson, & Diamond, 2007) where multiple levels of a population are interacting with various needs with this technology. However, the validity of the model’s measures in relationship to healthcare has not been explored, and considering how sparse the research is in the area of mental healthcare EHR technology, its’ inclusion seemed premature.

Self-selection bias could exist from the responders being more interested or reactive to technology than those who did not respond. Non-response bias must also be considered. It might be easy to contact a sample of the non-responders and inquire for any patterns with those who did not complete one or both sessions of the surveys. This was not done, however, due to the limitations of time and planning on the research window. User experience is an anchor that influences all of the models and measures examined. Due to the small sample size and opportunistic, but narrow, window to capture student clinicians before and after implementation of EHR technology, the depth of
analysis that could have been obtained from measuring a longer experience with EHR systems (e.g., technology use maturing) was largely unexplored (Zheng et al., 2007). This also influenced the reliability of these reactions (e.g., in years to come these clinicians might feel less or more positively towards EHRs as their professional identity and comfort level grows). The EHR attitudes in nurses study (Laramee, Bosek, Shaner-McRae, & Powers-Phaneuf, 2012) indicates that potentially their perspectives on EHR might have grown even more negative over time.

Future Research

For future research it will be important to gather both quantitative and qualitative response from the technology programing and training end of EHR implementation as well as the clinician user (Dennis, Venkatesh, & Ramesh, 2003). While EHR systems in more general healthcare settings include routinely updated hardware (Ward et al., 2008), it might be useful to study the lack of uniform technology hardware in mental health as a barrier contributing to sluggish EHR implementation. It would also be useful to test the influence and predictive power of social and media influences on maintained EHR receptivity. For example, the global debate recently on “Obamacare” might have had an effect on how clinicians perceived and interacted with an EHR system. Finally, the field would benefit from teasing out the differences between how technology attitudes in personal use impact professional expectation and efficiency and how technology training mediates this relationship (Devkota, Lamia, Pommer, Smith, & Whitman, 2011). There is much left to be explored and the hope is that this study provides support for better utilization of healthcare technology within the mental health profession.
References


Costa, P. T., McCrae, R. R., & Psychological Assessment Resources, I. (1992). *Revised NEO Personality Inventory (NEO PI-R) and Neo Five-Factor Inventory (NEO-FFI)* Psychological Assessment Resources Odessa, FL.


Stein, K., & Milne, R. (1999). Mental health technology assessment: Practice based research to support evidence-based practice. *Evidence-Based Mental Health, 2*(2), 37. doi:10.1136/ebmh.2.2.37

Sun, H., & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies, 64*(2), 53-78.


Appendices

A: DEMOGRAPHICS AND QUALITATIVE INFORMATION QUESTIONNAIRE

Please fill in the following information:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email Address</th>
<th>Age</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Caucasian</td>
</tr>
</tbody>
</table>

Highest Level of Education
Completed (Circle one)

<table>
<thead>
<tr>
<th>1&lt;sup&gt;st&lt;/sup&gt; year</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; year</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; year</th>
<th>4&lt;sup&gt;th&lt;/sup&gt; year</th>
<th>Internship</th>
<th>Supervisor</th>
</tr>
</thead>
</table>

What was your undergraduate degree?

What was your postgraduate degree (if applicable)?

What degree are you presently working on?

Years of Personal Computer Use Experience

Years of Professional Computer Use Experience

How much experience have you had working with electronic health records systems?

<table>
<thead>
<tr>
<th>Used Never</th>
<th>Used Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Please describe your experience with electronic health record systems:

How well do you anticipate your clinic’s transition to Electronic Health Records System will go?

<table>
<thead>
<tr>
<th>Very Difficult</th>
<th>Will go smoothly</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1 This is requested so that you may be contacted for the second set of questions following the electronic health record system implementation at your clinic
Appendix

B: COMPUTER ANXIETY RATING SCALE

Likert Scale
Strongly Disagree 1
Disagree 2
Neither Agree or Disagree 3
Agree 4
Strongly Agree 5

1. I feel insecure about my ability to interpret a computer printout
2. I look forward to using a computer on my job
3. I do not think I would be able to learn a computer programming language
4. The challenge of learning about computers is exciting
5. I am confident that I can learn computer skills
6. Anyone can learn to use a computer if they are patient and motivated
7. Learning to operate computers is like learning any new skill, the more you practice, the better you become
8. I am afraid that if I begin to use computers more, I will become more dependent upon them and lose some of my reasoning skills
9. I am sure that with time and practice I will be as comfortable working with computers as I am in working by hand
10. I feel that I will be able to keep up with the advances happening in the computer field
11. I would dislike working with machines that are smarter than I am
12. I feel apprehensive about using computers
13. I have difficulty in understanding the technical aspects of computers
14. It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key
15. I hesitate to use a computer for fear of making mistakes that I cannot correct
16. You have to be a genius to understand all the special keys contained on most computer terminals
17. If given the opportunity, I would like to learn more about and use computers more
18. I have avoided computers because they are unfamiliar and somewhat intimidating to me
19. I feel computers are necessary tools in both educational and work settings
Appendix

Ca: MEASURE OF COMPUTER SELF-EFFICACY (PRE-IMPLEMENTATION)

Likert Scale
Not at all confident 1
2
3
4
Moderately Confident 5
6
7
8
9
Totally Confident 10

I COULD COMPLETE THE JOB USING THE ELECTRONIC HEALTH RECORDS SYSTEM SOFTWARE...
...if there was no one around to tell me what to do as I go.
...if I had never used electronic health records system software like it before.
... if I had only the software manuals for reference.
...if I had seen someone else using it before trying it myself
...if I could call someone for help if I got stuck.
...if someone else had helped me get started.
...if I had a lot of time to complete the job for which the software was provided.
...if I had just the built-in help facility for assistance.
...if someone showed me how to do it first.
...if I had used similar electronic health records system software before this one to do the same job.
Appendix

Cb: MEASURE OF COMPUTER SELF-EFFICACY (POST-IMPLEMENTATION)

<table>
<thead>
<tr>
<th>Likert Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident 1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>Moderately Confident 5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>Totally Confident 10</td>
</tr>
</tbody>
</table>

I COMPLETED THE JOB USING THE ELECTRONIC HEALTH RECORDS SYSTEM SOFTWARE...
...when there was no one around to tell me what to do as I go.
...even though I had never used electronic health records system software like it before.
...when I had only the software manuals for reference.
...when I saw someone else using it before trying it myself
... when I could call someone for help if I got stuck.
... when someone else had helped me get started.
... when I had a lot of time to complete the job for which the software was provided.
...when I had just the built-in help facility for assistance.
... when someone showed me how to do it first.
... when I had used similar electronic health records system software before this one to do the same job.
Appendix

Da: MEASURE OF TECHNOLOGY ACCEPTANCE (PRE-IMPLEMENTATION)

Likert Scale
Extremely Likely 1
Quite Likely 2
Slightly Likely 3
Neither Likely or Unlikely 4
Slightly Unlikely 5
Quite Unlikely 6
Extremely Unlikely 7

Perceived Usefulness
Using an electronic health records system in my job would enable me to accomplish tasks more quickly
Using an electronic health records system in my job would increase my productivity.
Using an electronic health records system in my job would increase my productivity.
Using an electronic health records system would enhance my effectiveness on the job.
Using an electronic health records system would make it easier to do my job.
I would find an electronic health records system useful in my job.

Perceived Ease of Use
Learning to operate electronic health records system would be easy for me.
I would find it easy to get the electronic health records system to do what I want it do.
My interaction with electronic health records system would be clear and understandable.
I would find electronic health records system to be flexible to interact with.
I would find it easy for me to become skillful at using an electronic health records system.
I would find an electronic health records system easy to use.
Appendix

Db: MEASURE OF TECHNOLOGY ACCEPTANCE (PRE-IMPLEMENTATION)

Likert Scale
- Extremely Likely 1
- Quite Likely 2
- Slightly Likely 3
- Neither Likely or Unlikely 4
- Slightly Unlikely 5
- Quite Unlikely 6
- Extremely Unlikely 7

Perceived Usefulness
Using an electronic health records system in my job has enabled me to accomplish tasks more quickly.
Using an electronic health records system in my job has increased my productivity.
Using an electronic health records system in my job has increased my productivity.
Using an electronic health records system has enhanced my effectiveness on the job.
Using an electronic health records system has made it easier to do my job.
I have found the electronic health records system useful in my job.

Perceived Ease of Use
Learning to operate electronic health records system has been easy for me.
I found it easy to get the electronic health records system to do what I want it do.
My interaction with electronic health records system has been clear and understandable.
I found the electronic health records system to be flexible to interact with.
I found it easy for me to become skillful at using an electronic health records system.
I found the electronic health records system easy to use.
Appendix

E: FIVE FACTOR PERSONALITY QUESTIONNAIRE

International Personality Item Pool

Broad Bandwith Inventory Measuring NEO-PI-R Domains

Please use the rating scale below to describe how accurately each statement describes you.

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then indicate the choice corresponds to the number on the following scale.

<table>
<thead>
<tr>
<th>Likert Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Inaccurate 1</td>
</tr>
<tr>
<td>Moderately Inaccurate 2</td>
</tr>
<tr>
<td>Neither Inaccurate or Accurate 3</td>
</tr>
<tr>
<td>Moderately Accurate 4</td>
</tr>
<tr>
<td>Very Accurate 5</td>
</tr>
</tbody>
</table>

1. Often feel blue.
2. Dislike myself.
3. Am often down in the dumps.
4. Have frequent mood swings.
5. Panic easily.
6. Rarely get irritated.
7. Seldom feel blue.
8. Feel comfortable with myself.
10. Am very pleased with myself.
11. Feel comfortable around people.
12. Make friends easily.
13. Am skilled in handling social situations.
15. Know how to captivate people.
16. Have little to say.
17. Keep in the background.
18. Would describe my experiences as somewhat dull.
19. Don't like to draw attention to myself.
20. Don't talk a lot.
21. Believe in the importance of art.
22. Have a vivid imagination.
23. Tend to vote for liberal political candidates.
24. Carry the conversation to a higher level.
25. Enjoy hearing new ideas.
26. Am not interested in abstract ideas.
27. Do not like art.
28. Avoid philosophical discussions.
29. Do not enjoy going to art museums.
30. Tend to vote for conservative political candidates.
31. Have a good word for everyone.
32. Believe that others have good intentions.
33. Respect others.
34. Accept people as they are.
35. Make people feel at ease.
36. Have a sharp tongue.
37. Cut others to pieces.
38. Suspect hidden motives in others.
39. Get back at others.
40. Insult people.
41. Am always prepared.
42. Pay attention to details.
43. Get chores done right away.
44. Carry out my plans.
45. Make plans and stick to them.
46. Waste my time.
47. Find it difficult to get down to work.
48. Do just enough work to get by.
49. Don't see things through.
50. Shirk my duties.
Appendix Aa

Fa: INFORMED CONSENT AND RECRUITING MESSAGE (PRE-IMPLEMENTATION)

**Proposed Recruiting Email Message**

Hello. My name is Ruth Diaz and I am a Doctoral student within the School of Professional psychology at A Northwest University. I am emailing you to invite you to participate in part one of a two-part research survey. This project is being conducted under the supervision of Lisa Christiansen, Psy.D., and Shawn Davis, Ph.D., Associate Professors within the School of Professional Psychology at A Northwest University.

This study is an examination of technology receptivity in mental healthcare clinicians pre- and post- Electronic Health Records implementation.

I know that your time is limited and valuable but your input is vital to this study. Your opinions will be useful in compiling data that will help researchers understand the process of technology integration for clinicians in mental healthcare settings.

If you would like a summary of the findings from this study, whether or not you choose to participate, please email me (ruth@pacificu.edu). I will send you the summary once the data has been received and analyzed.

If you would like to participate, please fill out the following surveys by clicking on the below link to begin. Your participation will likely require no more than 15 minutes today and 20 minutes in a few months, after you have learned the electronic health record system at your clinic.

(link looked like:) http://www.surveymonkey.com/diaz

Thank you very much for your time!
Hello. My name is Ruth Diaz and I am a Doctoral student within the School of Professional psychology at A Northwest University. I am emailing to invite you to participate in the second part of the research survey you began during the Fall of 2011. This project is being conducted under the supervision of Lisa Christiansen, Psy.D. and Shawn Davis, Ph.D., Associate Professors within the School of Professional Psychology at A Northwest University.

This study is an examination of technology receptivity in mental healthcare clinicians pre- and post- Electronic Health Records implementation.

I know that your time is limited and valuable but your input is vital to this study. Your opinions will be useful in compiling data that will help researchers understand the process of technology integration for clinicians in mental healthcare settings.

If you would like a summary of the findings from this study, whether or not you choose to participate, please email me (ruth@pacificu.edu). I will send you the summary once the data has been received and analyzed.

If you would like to continue to participate, please fill out the following surveys by clicking on the below link to begin. Your participation will likely require no more than 20 minutes of your time.

(Proposed link will look like:) http://www.surveymonkey.com/diaz

Thank you very much for your time!