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Electronic Medical Records (EMR): An Empirical Testing of Factors Contributing to Healthcare Professionals' Resistance to Use EMR Systems

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Electronic Medical Records (EMR): An Empirical Testing of Factors Contributing to Healthcare Professionals' Resistance to Use EMR Systems

by

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We hereby certify that this dissertation, submitted by Emmanuel Bazile, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

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An Abstract of a Dissertation Submitted to Nova Southeastern University
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ELECTRONIC MEDICAL RECORDS (EMR): AN EMPIRICAL TESTING OF FACTORS CONTRIBUTING TO HEALTHCARE PROFESSIONALS' RESISTANCE TO USE EMR SYSTEMS

by
Emmanuel Patrick Bazile
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The benefits of using electronic medical records (EMRs) have been well documented; however, despite numerous financial benefits and cost reductions being offered by the federal government, some healthcare professionals have been reluctant to implement EMR systems. In fact, prior research provides evidence of failed EMR implementations due to resistance on the part of physicians, nurses, and clinical administrators. In 2010, only 25% of office-based physicians have basic EMR systems and only 10% have fully functional systems. One of the hindrances believed to be responsible for the slow implementation rates of EMR systems is resistance from healthcare professionals not truly convinced that the system could be of substantive use to them.

This study used quantitative methods to measure the relationships between six constructs, namely computer self-efficacy (CSE), perceived complexity (PC), attitude toward EMR (ATE), peer pressure (PP), anxiety (AXY), and resistance to use of technology (RES), are predominantly found in the literature with mixed results. Moreover, they may play a significant role in exposing the source of resistance that exists amongst American healthcare professionals when using Electronic Medical Records (EMR) Systems. This study also measured four covariates: age, role in healthcare, years in healthcare, gender, and years of computer use. This study used Structural Equation Modeling (SEM) and an analysis of covariance (ANCOVA) to address the research hypotheses proposed. The survey instrument was based on existing construct measures that have been previously validated in literature, however, not in a single model. Thus, construct validity and reliability was done with the help of subject matter experts (SMEs) using the Delphi method. Moreover, a pilot study of 20 participants was conducted before the full data collection was done, where some minor adjustments to the instrument were made. The analysis consisted of SEM using the R software and programming language.

A Web-based survey instrument consisting of 45 items was used to assess the six constructs and demographics data. The data was collected from healthcare professionals across the United States. After data cleaning, 258 responses were found to be viable for further analysis. Resistance to EMR Systems amongst healthcare professionals was examined through the

utilization of a quantitative methodology and a cross-sectional research measuring the self-report survey responses of medical professionals. The analysis found that the overall R^2 after the SEM was performed, the model had an overall R^2 of 0.78, which indicated that 78% variability in RES could be accounted by CSE, PC, ATE, PP, and AXY. The SEM analysis of AXY and RES illustrated a path that was highly significant (β= 0.87, $p < .001$), while the other constructs impact on RES were not significant. No covariates, besides years of computer use, were found to show any significance differences.

This research study has numerous implications for practice and research. The identification of significant predictors of resistance can assist healthcare administrators and EMR system vendors to develop ways to improve the design of the system. This study results also help identify other aspects of EMR system implementation and use that will reduce resistance by healthcare professionals. From a research perspective, the identification of specific attitudinal, demographic, professional, or knowledge-related predictors of reference through the SEM and ANCOVA could provide future researchers with an indication of where to focus additional research attention in order to obtain more precise knowledge about the roots of physician resistance to using EMR systems.

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Chapter 1

Introduction

Background

In a world where the patient population is growing at an accelerating rate, the emerging use of technologically based medical record-keeping offers increasingly effective and efficient means of medical practice (Bleich & Slack, 2010). Electronic Medical Record (EMR) systems are revolutionizing the process by which physicians consult with, educate, and treat their patients (Ackerman, Filart, Burgess, Lee, & Poropatich, 2010). Cutting-edge medical equipment along with enhanced techniques have increased physicians' capacity to alleviate pain as well as providing cures for illnesses. Within the realm of medical record-keeping and storage, EMR systems use digital inputs to maintain patients' health records with germane medical history data in a centralized computer database, which permits easy access, editing, and updating without reliance on physical paper files (Li & West-Strum, 2010). This research focused on the factors influencing the resistance to using EMR systems among medical professionals, including physicians, nurses, medical technologists, as well as all other healthcare professionals who use an EMR system in their daily work. According to Hillestad et al. (2005), the use of EMR systems has the potential to save the United States over $81 billion annually; the question remains, why do healthcare professionals continue to resist the implementation of EMR systems?

Problem Statement and Research Goals

Problem Statement

The research problem that this study addressed is healthcare professionals' resistance to using Electronic Medical Record systems (EMR), which appears to hinder productivity in the healthcare industry (Cherry, Ford, & Peterson, 2011; Ferris, 2010). Healthcare professionals perceive that EMR systems are difficult to use; therefore, a preference still exists for paper charting patients' medical records (Price, 2010). According to Compeau and Higgins (1995), Computer Self-Efficacy (CSE) is "an individual's perception of his or her ability to use a computer in the accomplishment of a job task" (p. 193). The role played by healthcare professionals' CSE in mastering computer systems may be critical to using or resisting EMR systems (Ilie, Seha, & Sun, 2009). Physician adoption of EMR systems has long been studied by Information Systems (IS) studies; however, CSE and its part in the resistance to using EMR systems as documented in prior research to require further investigation (Morton, 2008; Nixon, 2009; Price, 2010). Healthcare professionals' resistance to using EMR systems is a significant problem because these systems have been shown to induce work efficiency, reduce costs, and provide accurate patient tracking capabilities (Block, 2008). Despite these benefits, one study found that about 52% of healthcare professionals still resist implementations of EMR systems (Nov & Schecter, 2012). Resistance to using EMR systems puts both hospitals and patients at greater risk of possible medical mishaps (Block, 2008; Ilie, Courtney, & Van Slyke, 2007).

According to Ilie, Courtney, and Van Slyke (2007), the problem may be linked to Perceived Complexity (PC), where healthcare professionals believe the systems are built with too many components, increasing the learning curve. Another factor, Attitude Toward EMR systems (ATE), may also contribute to the problem, wherein the systems are said to be too clunky and take too long to process information (Burt & Sisk, 2005). Angst and Agarwal (2009) indicated that the problem may be attributed to a third factor, anxiety, explaining that healthcare professionals may be anxious that their current workflow would not be effectively replicated by EMR systems; thus, their productivity would be slowed.

Without EMR systems, patients with complex medical problems are difficult to track, as they often visit a number of physicians with various specialties (Crane & Crane, 2008; Nixon, 2009). Studies have found that the inability to integrate these visits has caused as many as 20% of medical records to be missing the information necessary for effective patient care (Hersh, 1995; Ilie et al., 2007). Additionally, EMR systems provide many benefits, including the ability to expedite billing and reimbursement, optimize documentation, and enable communication between healthcare providers, all of which are vital to the overall healthcare process (Fisher, 2011). EMR systems also improve patient screening procedures relating to age-specific testing (Fisher, 2011). The resistance to using EMR systems is subverting healthcare regulation policies, lowering hospitals' efficiency, and raising their administrative costs (Block, 2008; Ma & Lui, 2007). EMR system usage has been shown to reduce clinical and billing errors that often cost healthcare facilities substantial amounts of money (Crane & Crane, 2008; Grevier, Barnsley, Glazier, Moineddin, & Harvey, 2011). However, it appears that many of the

EMR systems implemented are still faced with major resistance from healthcare professionals.

Dillon and Lending (2010) defined resistance as a natural behavior of human beings. They refer to resistance as a reaction to an emotional process. According to Spil, Shuring, and Katsma (2002), resistance from an Information Systems (IS) perspective is "the personal attitude of groups towards the introduction of an information system" (p. 1). Since most medical professionals believe that EMR systems are difficult to use, this perception may have substantially increased the resistance to EMR usage (Grevier et al., 2011).

The EMR system resistance problem has been quantified in two ways: non-usage of EMR and suboptimal usage of EMR (Brooks & Grotz, 2010). Some healthcare professionals use EMR systems infrequently or inexpertly (Dillon & Lending, 2010; Ma & Lui, 2007). Studies of physician resistance to innovative technology have found that only 30% to 35% of physician offices are using EMR systems, compared with the 85% to 90% who have embraced technology in other industries, such as retail, manufacturing, and finance (Crane & Crane, 2008; Dixon, 2007; Hillestad et al., 2005; Venkatraman et al., 2008).

It is true that there are different definitions of usage, with some definitions emphasizing the basic implementation of formal tools (Ilie et al., 2009) and others emphasizing a high level of formal engagement with those tools (Spil & Katsma, 2002). In this study, "usage" was defined as having implemented EMR systems for the daily care of patients, regardless of the level of expertise healthcare professionals in the system. This definition of usage will also not take into account whether or not medical professionals are utilizing the systems fully or partially.

The general consensus in the literature is that, as businesses grow, they must be amenable to implementing emerging technologies as part of the positive trend toward adapting to change (Brooks & Grotz, 2010; Hillestad et al., 2005). The health industry should be no different from other businesses (Brooks & Grotz, 2010; Hillestad et al., 2010). Yet there remains widespread resistance to using EMR systems in the medical community (Dillon & Lending, 2010; Ma & Lui, 2007).

Research to date on the implementation of EMRs by leading physicians or by standard medical practice has concentrated on adoption versus non-adoption (Angst & Agarwal, 2009; Brooks & Grotz, 2010; McCullough, 2007). However, such research has not fully investigated an important variable: the resistance to using EMR systems (Nov & Schecter, 2012). According to Bhattacherjee and Hikmet (2007), if resistance to using EMR systems decreases, utilization may follow; however, it appears that more research on the resistance to EMR systems is needed (Castillo, Martínez-García, & Pulido, 2010). Hence, the crucial variable is resistance (Berner, Detmer, & Simborg, 2005; Boostra & Broekhuis, 2010; Nov & Schecter, 2012; Rivard & Lapointe, 2012). Current studies dealing with resistance have focused primarily on resistance to change (Cherry, Ford, & Peterson, 2011; Ferris, 2010; Rivard & Lapointe, 2012). However, it is evident that more work is needed on the resistance to EMR systems (Castillo et al., 2010; Nov & Schecter, 2012).

What is not clear from the literature is precisely why healthcare professionals resist EMR systems, and what constructs may significantly impact their resistance.

References to CSE, PC, ATE, Peer Pressure (PP), and Anxiety have been found scattered in the literature (Boostra & Broekhuis, 2010; Eckhardt, Laumer & Weitzel, 2009; Oye, Iahad, & Rahim, 2012). However, they have not been employed in the same theoretical model. Therefore, it appears that an empirical investigation of the relative contribution of each variable to EMR resistance is needed (Cherry, Ford, & Peterson, 2011; Dixon, 2007).

One of the few studies that have been conducted on the topic of CSE as a predictor of resistance to EMRs was done by Morton and Wiedenbeck (2009), which measured self-efficacy (SE) of American physicians' ATE adoption. However, Morton and Wiedenbeck (2009) did not measure CSE as a predictor of all healthcare professionals' resistance to use EMR systems. Their study focused strictly on physicians only. Burt and Sisk (2005), Dansky, Gamm, Vasey, and Barsukiewicz (1999), as well as Ilie et al. (2007) each did a study measuring ATE and its influence on EMR system adoption. Anderson (2007), Boostra and Broekhuis (2010), as well as Grevier et al. (2011) also conducted studies that measured PC and its effects on EMR system adoption. Ludwick and Doucette (2009) as well as Venkatesh, Morris, Davis, and Davis (2003) conducted a study that measured PP and its influence on EMR system adoption. The cumulative problem of each of these studies is that ATE, PC and PP were not empirically tested in the same theoretical models. In addition, these studies focused on physicians' intention to adopt and use EMR systems rather than their reason for resisting the implementation and use of the systems.

Ma and Lui (2007), Dillon and Lending (2010), as well as Venkatesh et al. (2003) conducted empirical research studies measuring the contributions of CSE, PP and AXY respectively; however, each variable was measured in isolation from the others, basically not in the same model. Their study also did not empirically test five key demographic indicators: age, gender, precise healthcare role (e.g., medical specialty), years of healthcare experience, and years of computer use of the healthcare professionals who participated. Based on a review of the literature, it seems that previous research centered on EMR adoption but not on resistance to EMR systems (Bhattacherjee & Hikmet 2007; Nov & Schecter, 2012). More research is needed to test EMR resistance among healthcare professionals that (a) accounts for CSE, PC, ATE, PP, and Anxiety and (b) controls for key demographic indicators as part of the same theoretical model (Nov & Schecter, 2012).

Dissertation Goal

The main goal of this research study was to empirically assess the contributions of the independent variables of CSE, PC, ATE, PP, and Anxiety on the dependent variable of healthcare professionals' resistance to EMR systems, while controlling for the demographic indicators of physicians' age, gender, precise healthcare role and years in the profession. The need for this work is demonstrated by prior literature suggesting that healthcare professionals' resistance to EMR systems is not yet well understood (Ayatollahi, Bath, & Goodacre, 2009; Ilie, Van Slyke, Parikh, & Courtney, 2009). Previous research has suggested that a combination of the independent variables—CSE, PC, ATE, PP, and Anxiety—may better explain the reasons for healthcare professional resistance to EMR systems (Ayatollahi et al., 2012; Nov & Schecter, 2012). It appears that the lack of these variables in the same research study creates a gap in the literature that needs to be investigated further (Nov & Schecter, 2012).

This study was built on previous research by Morton and Wiedenbeck (2009) as well as Meinert and Peterson (2009). Morton and Wiedenbeck (2009) set out to predict the adoption of EMR systems based on ATE alone. Meinert and Peterson (2009) conducted an evaluation of the barriers impeding physicians from adopting EMR systems based on PP. The two studies used a single variable and focused on adoption, rather than resistance. Very few studies empirically investigated the impact of CSE, PC, ATE, PP and Anxiety on the resistance to EMR systems. This research also built on previous research by Boostra and Broekhuis (2010), who measured PC and CSE, but concluded that perhaps additional constructs would need to be studied to discover a more concrete predictor to resistance to EMR systems. This study proposed a theoretical model in which CSE, PC, ATE, PP, and Anxiety were all present as predictors of the dependent variable of EMR system resistance, extending the work done by Morton and Wiedenbeck (2009) by evaluating more than one variable, as well as by focusing on resistance, rather than on adoption. This study was also built on the work of Angst and Agarwal (2009), who focused only on physicians' reluctance to adopt EMR systems, but did not examine all healthcare professionals.

In their research, neither Morton and Wiedenbeck (2009) nor Boostra and Broekhuis (2010) accounted for the demographic indicators of healthcare professionals' age, gender, precise healthcare role, years of practice, and years of computer use. Controlling for these variables allowed for more precise insight into the relationship between the demographics data and specific manifestations of resistance to using EMR systems, as illustrated in Figure 1 (Price, 2010). The specific goals of this research study were (a) to empirically assess the contribution of the independent variables, CSE, PC, ATE, PP, and Anxiety on the dependent variable, resistance to EMR systems; (b) to empirically assess if the impact of the aforementioned independent variables (CSE, PC, ATE, PP, & Anxiety) on the dependent variable (resistance to EMR systems) is significantly different when controlled for age, gender, roles in healthcare, years in healthcare on each, and years of computer use; and (c) to empirically assess if there are any significant difference on the dependent variable (resistance to EMR systems) based on the effect of the control variables (age, gender, roles in healthcare, & years in healthcare) on each.

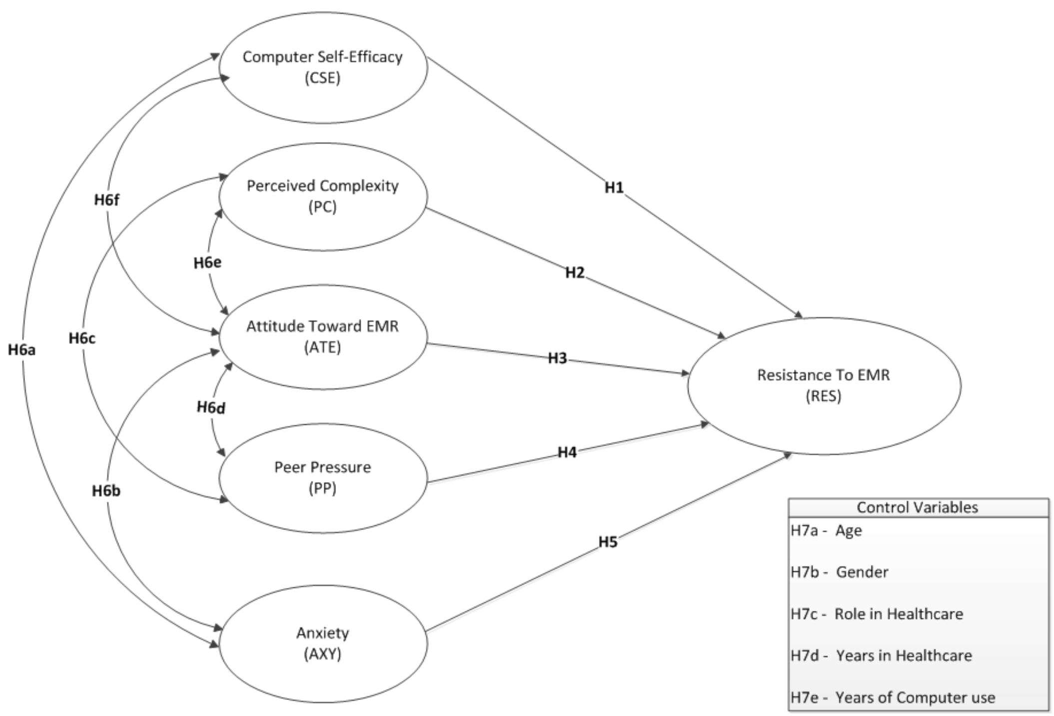

Figure 1. Resistance to using EMR systems concept diagram.

Hypotheses

$H_0$1: CSE will have no significant influence on medical professionals' resistance to using EMR systems as measured by the path coefficients and parameter estimates.

$H_0$2: PC will have no significant influence on medical professionals' resistance to using EMR systems as measured by the path coefficients and parameter estimates.

$H_0$3: ATE will have no significant influence on medical professionals' resistance to using EMR systems as measured by the path coefficients and parameter estimates.

$H_0$4: PP will have no significant influence on medical professionals' resistance to using EMR systems as measured by the path coefficients and parameter estimates.

$H_0$5: Anxiety will have no significant influence on medical professionals' resistance to using EMR systems as measured by the path coefficients and parameter estimates.

$H_0$6a: There is no-significant linear and non-linear correlation between CSE and Anxiety as measured by the correlation levels (high or low).

$H_0$6b: There is no-significant linear and non-linear correlation between Anxiety and ATE as measured by the correlation levels (high or low).

$H_0$6c: There is no-significant linear and non-linear correlation between PP and PC as measured by the correlation levels (high or low).

$H_0$6d: There is no-significant linear and non-linear correlation between PP and ATE as measured by the correlation levels (high or low).

$H_0$6e: There is no-significant linear and non-linear correlation between ATE and PC as measured by the correlation levels (high or low).

$H_0$7a: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their age.

$H_0$7b: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their gender.

$H_0$7c: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their role in healthcare.

$H_0$7d: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years in healthcare.

$H_0$7e: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years of computer use.

Relevance and Significance

The relevance of investigating the resistance to EMR systems is fully supported in the literature (Bleich & Slack, 2010; Boostra & Grotz, 2010; Castillo et al., 2010). As the development of EMR systems is regularly cited as a requirement for controlling healthcare costs, the recently passed Patient Protection and Affordable Healthcare Act (PPAHCA) requires healthcare practitioners to begin the transition to EMR systems. PPAHCA mandates that medical information systems be expanded through three primary strategies: grants, incentives to implement EMR systems, and proof of meaningful use. These strategies will involve the development of standardized processes for medical practices relating to EMR systems, as well as provisions for expanding the number of qualified medical information specialists and system developers (Majette, 2011). The resistance to EMR systems is such a problem that the PPAHCA had to be enacted to protect patients (Rivard & Lapointe, 2012). Research has shown that implementing EMR systems will improve healthcare efficiency and safety by enabling the management of chronic diseases (Eckhardt et al., 2009). According to Castro (2009), EMR systems contribute to a patient-centric healthcare system that allows patients to communicate more effectively with providers, and it also establishes a foundation for medical research.

While the benefits of implementing EMR systems are plentiful and could be transformative to a practice, healthcare professionals continue to resist widespread implementations (Dillon & Lending, 2010). As recently as 2007, Galt et al. (2007) found that 70% of healthcare providers had not implemented EMRs, 40% were reluctant to adopt, 20% were wholly opposed to the idea of adopting an EMR, and 10% were completely unknowledgeable about EMRs at all. The literature has also provided evidence of a number of failed EMR system implementations due to resistance on the part of physicians and nurses (Grevier et al., 2011).

This research is significant in that it looked in particular at resistance to EMR systems by all healthcare professionals, not only physicians. Most of the research in the literature examines the lack of EMR adoption among physicians, but not the reason for such resistance. While user resistance to information technology (IT) implementations have been studied considerably (Burt & Sisk, 2005; Ilie, 2009; Spil et al., 2002), the literature is scarce when it comes to studies involving all healthcare professionals other than physicians. According to Rivard and Lapointe (2012), it is not uncommon for EMR system implementations to come to a halt as a result of organization-wide resistance to the systems. One of the issues believed to be responsible for the resistance to EMR systems is that healthcare professionals may not be convinced the systems can be useful (Boostra & Broekhuis, 2010).

This research is relevant and significant in (a) expanding the literature by examining specific combined constructs that were empirically tested to determine the factors contributing to resistance to use EMR systems on the part of all healthcare professionals, not just physicians (Morton & Wiedenbeck, 2009); (b) adding new data to the existing literature that will enable technology vendors to develop new approaches to present EMR systems to healthcare professionals with more successful implementation outcomes; and (c) proposing a model consisting of constructs, namely CSE, PC, ATE, PP, and Anxiety with the control variables age, gender, role in healthcare, and years in healthcare, which, to date, do not appear to be present in the same study.

Barriers and Issues

The primary barriers to attaining the goal of this study included the successful development and delivery of a survey instrument for the population of healthcare professionals. Morton and Wiedenbeck (2009) likewise observed that physicians in general are a difficult group to survey because they are often wary of providing any type of information using surveys, and generally need to exercise significant control over the research in which they participate (McFarlane, Olmstead, Murphy, & Hill, 2007; VanGeest, Johnson & Welch, 2007). Physicians historically represent one of the least responsive populations for surveys, with a non-response rate that is reported between 10% and 20% (Olson, 2013). Responses are highest when physicians are being surveyed by other physicians, or when physicians are secure in the belief that their anonymity is guaranteed (Olson, 2013). The literature suggests that response rates amongst other healthcare professionals are much higher than those of physicians (Potts & Wyatt, 2002).

Hence, this research had a *'study physician champion'* who encouraged other physician colleagues to complete the survey instrument.

Another barrier to consider is the sample size needed to achieve statistical generalizability from the results. A sample size of at least 300 participants was required for sufficient statistical power, which means this research study needed to use a sampling procedure that can contact a large number of participants in a relatively short timeframe. This barrier could be overcome by undertaking data collection in a manner similar to the study by Morton and Wiedenbeck (2009), who drew their sample from a nationwide contact of physician offices by meeting physicians in their surrounding areas, and a nationwide conference where over 2,000 professionals from all 50 states were present. This study could possibly draw its sample from a similar setting, such as a major medical convention, by working with a sponsor company to sample on-site. Another alternative would be to sample by using telephone calls, e-mail, and online surveys. However, telephone calls were time-consuming and difficult to achieve success. Healthcare professionals are very busy and were not be able to make the time to complete the survey via telephone, especially a survey as detailed as the one being proposed in this study. The use of e-mail or online surveys could lead to a biased sample, as participants may have a higher degree of CSE and more positive attitudes toward technology than the healthcare population as a whole (Booth-Kewley, Edwards, & Rosenfeld, 1992). A means of overcoming this barrier would be to take out an advertisement in a major American medical publication to solicit participants. This method would involve self-selected participation, which would pose issues for the validity of this study; therefore, this would have to be addressed.

Another barrier to data collection involves the survey instrument itself. Participants may decide to skip survey questions or abandon the survey altogether if they are using a survey instrument that is overly long and complex. Determining the maximum survey length that could be used without losing participants' interest would be useful in overcoming this problem (Dane, 2010). Dane (2010) documented the phenomena of survey length and participant task engagement in various research contexts. He recommended that research investigators limit their surveys to a maximum of 40 to 50 questions to minimize the risks of survey abandonment, preserve participant interest, and reduce other threats to the validity of the data derived from the survey results. This study made use of Dane's (2010) recommendations regarding survey length with its data collection instrument.

Nearly every research project involving the use of a survey instrument must deal with the significant obstacle of non-responsiveness. Non-response rates can raise questions that challenge the validity of sample techniques and skew the validity of findings. A non-response error occurs when "the information obtained from a sample of survey respondents differs from the information that would be obtained from non-respondents" (Collier & Bienstock, 2007, p. 164). There is no way to know if non-response results are the result of the poor wording of questions, questionnaires routing to a spam filter section of a subject's electronic mailbox, or "if a respondent simply misplaced or forgot about the survey form received" (Rogelberg & Stanton, 2007, p. 199). What is known is that failure to respond to a survey creates statistical voids that can render findings questionable.

The rate for nonresponse among physicians varies according to the delivery method, but nonresponse remains high for all methods (Olson, 2013). Face-to-face interviews have the lowest non-response rate, but physicians are unlikely to agree to participate in a lengthy face-to-face interview without some form of significant remuneration, and even then they are likely to impose time limits on the interview (Nicholls, Chapman, Shaw, Perkins, Sullivan, Crutchfield, & Reed, 2011; Olson, 2013). Several studies have shown that e-mailed surveys remain the favored delivery method, despite a high non-response rate (Olson, 2013). Nicholls et al. (2011) found that physicians overwhelmingly prefer e-mailed surveys and are less likely to respond to surveys completed using postal mail service, fax, or online survey sites. Hence, this research used a combination of e-mailed surveys, and an online survey, as professionals other than physicians prefer a more hands-on approach (Nicholls et al., 2011).

Assumptions, Limitations, and Delimitations

According to Polit and Hungler (1997), research assumptions are elements of the research study that are accepted without proof and assumed to be true, which enabled the study to make useful conclusions. For this study, the following assumptions have been identified: (a) this research assumed that all respondents thoroughly read and understand each question in the questionnaire, taking adequate time to answer, without rushing through the survey; (b) it is also assumed that CSE, PC, ATE, PP, and Anxiety adequately represented the variables affecting the reasons for EMR system resistance; (c) Another assumption is that the research survey instrument adequately captured the data needed to categorize CSE, PC, ATE, PP, and Anxiety as well as describe the resistance to use EMR systems that is found amongst healthcare professionals.

An additional assumption for this study was that healthcare professionals' experiences of using EMR systems illustrated in the literature are applicable to all healthcare settings. It should be noted that different settings would require different tools to care for patients; therefore participant's experience is limited to usage of EMR systems only. Another assumption is that the findings of this study—identifying the constructs that may help healthcare professionals to overcome resistance to using EMR systems—may help other healthcare professionals who are still resisting. This research also assumed that the participants would be a representation of a normal population of EMR system users since there are a variety of ERM systems in the market, so as to make the results of this study generalizable. Lastly, it is assumed that references to EMR systems strictly apply to healthcare systems developed for the purposes of capturing, transmitting, storing and managing of patient healthcare information regardless of vendor. Hardware-based tools such Picture Archiving systems (PACS), Magnetic Resonance Imaging (MRI), X-Ray Crystallography, and Computer Tomography (CT) etc... do not apply in this context since they are able to exist independently of the EMR systems.

This study also had a few limitations and delimitations as well, and they were as follows: (a) the number of healthcare professionals (physicians, nurses, phlebotomists, medical technologists, & system analysts) may not be evenly distributed and may not represent the complete range of professionals; (b) another limitation is that the entire sample population of healthcare professionals cannot be surveyed in this research study. This means that results would not be generalized to all healthcare professionals; (c) careful application of context was necessary when drawing conclusions from the data collected; (d) lastly, only usage of EMR systems was considered. Although EMR systems are an important part of patient care, it is one amongst a number of tools used in the healthcare IT domain. Other components such as scanners, robotic lab systems, robotic pharmacy systems, and other mobile devices were not taken into consideration. Therefore, the results of this study provided information on resistance to other healthcare information system tools. The way response-set was handled is as follow: should response-set drop considerably below the anticipated number, the solution was to generalize the results to the respondent set only and not the entire population.

Definition of Terms

Electronic Medical Record (EMR systems) – An EMR system is a software program developed for the storage, processing, and data exchange of medical information by healthcare providers (Angst & Agarwal, 2009).

Computer Self-Efficacy (CSE) – A measure of an individual's judgment of his or her own abilities to use computers (Durndell, Haag, & Laithwaite, 2000).

Delphi Exercise – "A survey conducted in two or more rounds and provides the participants in the second round with the results of the first so that they can alter the original assessments if they want to or stick to their previous opinion. Delphi Exercise uses pen and paper" (Fleuren, Wiefferink, & Paulussen, 2004, p. 31).

Delphi Conference - "A survey conducted in two or more rounds and provides the participants in the second round with the results of the first so that they can alter the original assessments if they want to or stick to their previous opinion. Delphi Conference uses a computer program" (Fleuren et al., 2004, p. 31).

Perceived Complexity (PC) – "The degree to which an innovation is viewed as being difficult to use" (Ilie et al., 2007, p. 3).

Attitude toward EMR (ATE) – A user's emotional feeling toward using EMR systems, whether positive or negative (Grams, 2009).

Peer Pressure (PP) - Positive or negative; in either case, one agent chooses an amount of pressure to exert on another agent (Ilie et al., 2007).

Anxiety – "A physiological state that is portrayed by cognitive, somatic, emotional, and behavioral components that create feelings of nervousness, fear, worry, or apprehension" (Seligman, Walker, & Rosenhan, 2001, p. 23).

Resistance to EMR Systems – The premise for this study. Despite the benefits of EMR systems, physicians continue to resist the implementation of the system (Boostra & Broekhuis, 2010).

Software – A set of instructions that communicate with the computer hardware, telling it how to behave. These instructions are generally packaged into what is referred to as a software solution (Dupont, Koeninger, Guyer, & Tavers, 2009).

Hardware – Hardware is the physical components that make up a computer. Generally, this consists of hard drive, network card, motherboard, DVD drives and cabling for data transfer (Dupont et al., 2009).

Healthcare Professionals – The staff at a hospital or clinic. This generally consists of the physicians, nurses, physician assistants, phlebotomists, radiologists, surgical technologists, pharmacy technologist and all employees with patient care-related roles (Ayatollahi et al., 2009).

Health Information Systems (HIS) – A computer system that contains all patient registration information, and is responsible for distributing this information to all ancillary systems in the hospital. Generally, in hospitals, the HIS is considered the source of truth (Baron et al., 2012).

Information Systems (IS) – All the components that make up a technology infrastructure. That includes hardware, software, data center, analysts, and all those that make up the organization (Ackerman et al., 2010).

PPAHCA – The Patient Protection and Affordable Healthcare Act of 2010. PPACA, along with the Health Care Reform and Education Reconciliation Act of 2010, was intended to reform the health insurance industry and expand insurance coverage to more than 30 million Americans (Majette, 2011).

Electronic Connectivity – The ability and characteristic of access, exchange, and retrieval of the information around and within different organizations or geographical locations (Ackerman et al., 2010).

NAMCS – The National Ambulatory Medical Care Survey, the nation's foremost study of ambulatory care provided at physicians' offices since 1973. "It focuses on visits made to non-federally employed office-based physicians who are primarily engaged in direct patient care" (Burt & Hing, 2005, p. 15).

ARRA –The American Recovery and Reinvestment Act of 2009 which "includes $17.2 billion for financial incentives to physicians and hospitals through Medicare and

Medicaid to accelerate adoption of health information technology" (Steinbrook, 2009, p. 1059).

Computerized Physician Order Entry (CPOE) – A computerized system that allows physicians to order services such as biopsies, laboratory tests, medications, and other procedures electronically, instead of recording them on order sheets or prescription pads (Shah et al., 2006).

Primary care physician (PCP) – A generalist physician who provides continuous care to an undistinguishable group of patients (Ilie et al., 2009).

Technology – Consists of two components: hardware (the physical object), and software (a package's set of instructions) (Dupont et al., 2009).

Perceived Ease of Use – "The degree to which the prospective user expects the target system to be free from effort" (Davis, Bagozzi, & Warshaw, 1989, p. 985).

Health Care Provider – For the purpose of this study, the term is limited to a practicing physician, regardless of specialty (Ferris, 2010).

Summary

Historically, paper-based charts have been "the gold standard" for medical records. According to Grams (2009), healthcare professionals who resist using EMR systems feel that a good paper system can perform nearly as well as a good digital copy of the same system. Given the host of medical conditions as well as the vast amount of information associated patient education materials available from government agencies, pharmaceutical companies, professional associations, as well as other sources, identification, storage, retrieval have become cumbersome with a paper-based system (Li & West-Strum, 2010). EMR systems can link diagnostic codes to appropriate educational materials for efficient dissemination to the patient at the point of care, facilitating a discussion about such information between the physician and patient. Patient information can improve compliance with follow-up instructions and eliminate post-visit phone calls to the physicians (Cherry et al., 2011).

EMR systems allow healthcare professionals to provide detailed medical histories, including family medical history, allergies, medications, prior/existing conditions, and previous surgeries, among other information (Nixon, 2009). With a paper-based chart, patient history is often requested by the same provider during each clinical encounter or by different providers during each new encounter because such information may not be readily accessible or easily shared (Fisher, 2011). Moreover, depending on the patient’s situation, patient histories can be lengthy, time-consuming work. Although some redundancy is necessary for purposes of validation, unnecessarily repeated histories may contain inaccuracies over time because of problems with patient recall. In addition, the patient may not be able to repeat a history, for example, because of cognitive or other impairments. The EMR reduces the need to repeat history-taking, enables the provider to review updated information, and share with colleagues when appropriate (Fisher, 2011).

The United States is amidst a strong impetus for the implementation of EMR systems across the board. Despite this push, resistance among some healthcare professionals abounds (Castillo et al., 2010; Nov & Schecter, 2012). For this reason, this study tested and examined five constructs that may be contributing to this resistance. CSE, PC, ATE, PP, and Anxiety have been identified as constructs that may shed some light on the reasons for this resistance after reviewing the existing literature. These constructs, though discussed individually in the prior literature, have not been found in the same study (Morton & Wiedenbeck, 2009). Therefore, there is a need in the Information System (IS) research to further examine these constructs, but from a resistance perspective.

There are limitations to all self-report survey based research (Austin et al., 1998); as such, it's appropriate to note that while this study examined resistant to EMR systems among healthcare professionals; it offered no insight into differences across EMR systems that have been developed by a variety of vendors. It is also important to note that even though the graphical user interfaces are not identical across vendor products, the EMR systems are designed to perform similar tasks. The shared purpose of all the EMR systems is to capture, transmit, store, and manage patient healthcare data.

The barriers and issues that made this study worthwhile are (a) the limited literature on resistance to use EMR systems. The literature is plentiful on adoption of EMR systems; however, the resistance literature is scarce. Another issue is the dichotomy nature of the problem. It is a federal mandate the healthcare organizations implement EMR systems; yet, resistance amongst healthcare professionals persists. Ultimately, this study is hoping to shed some light to the source of this resistance.

Chapter 2

Literature Review

Electronic Medical Records

EMR have been on the scene for many years (Reid, 2010; Stead, 2009) with software solutions to store and retrieve patient records identified as early as 1958 (Grams, 2009; Stead, 2009). An EMR system is a software program developed for the storage, processing, and exchange of medical information by healthcare providers (Angst & Agarwal, 2009). The Institute of Medicine (IOM) recommended implementation of EMR as the foundation of the U.S. Department of Health and Human Services' strategy to increase the use of healthcare-specific IT (Layman, 2008; Simon et al., 2009). The IOM, a body comprising physicians and industry leaders, is a pivotal actor in assessing the best measures for advancing medical practice, while serving the patient community in the United States (Simon et al., 2009). The integration of more technologically advanced equipment enhances the capacity of healthcare institutions to serve their patient community, maximize efficiency, and offer cutting-edge treatment (Venkatraman et al., 2008).

An EMR system is composed of one or several computerized clinical information systems used during various stages of a patient's doctor/hospital visit. In the clinical setting, EMR systems offer many benefits, such as integrating lab analyzers and expediting patients' sample analyses so that the results can be discussed with the patient during the same consultation (Hsiao et al., 2009). Such capabilities for the integration of testing, analysis, and record storage eliminate unnecessary trips to the doctor’s office, helping to catch potential health problems sooner. This has been shown to be a great benefit in improving patient care (Anderson & Bowers, 2008). In 2003, the IOM identified important functions of these systems that can contribute to greater quality of care, safety and efficiency.

These functions include:

- Order entry/order management. Clinical tests, consults, and medication orders are managed electronically.
- Results management. Physicians can access all patient information based on care delivered in the hospital or health system.
- Electronic health information/data capture, which is a computerized repository that holds all patient health information data.
- Administrative processes, which include scheduling management for visits, procedures, and billing.
- Electronic connectivity, which is the electronic exchange of clinical data among providers.
- Clinical decision support, which is the use of computerized tools such as computer-assisted diagnosis and disease management and which has proven to contribute to improved clinical performance.
- Health outcomes reporting, where information for quality indicator reporting can be automatically extracted.
- Patient access, which is the ability to access patients’ records remotely for faster reviewing of test results, as well as consults with other physicians.

The United States Healthcare System

The U.S. healthcare system is currently facing a variety of challenges, including the need to deliver high-quality patient care while minimizing costs. Due to reductions in patient medical errors, EMR systems have been associated with improved care and reduced costs, ensuring that healthcare staff have access to a standardized set of information and increased efficiency with regard to staff workload tasks (Lau et al., 2012).

The systems came to the forefront in 2004 with then-President George Bush's strategic plan to increase drastically the adoption of EMR systems in the U.S. by 2014 (Dixon, 2007). On April 27, 2014, he signed an executive order to form the Office of the National Coordinator for Health Information Technology, whose charge was to incorporate EMR systems into clinical practice (DHHS, 2008; Dixon, 2007; Moreno, 2005). To accomplish this, the following strategies were proposed: (a) establish incentives to drive EMR adoption, reducing the financial risk of EMR investment; (b) target EMR diffusion to rural and underserved areas by identifying state laws and business policies on privacy and security that may impede health information sharing; and (c) develop a method to coordinate software applications and develop industry-wide standards by structuring a prototype for a national health information network (Dixon, 2007; Moreno, 2005).

Despite these efforts, the U.S. has lagged seriously behind other countries in adopting health IT and EMRs (Ayatollahi et al., 2009). To assess the baseline level of health IT implementation, Poon et al. (2006) studied its use among eight stakeholder groups in two markets: Boston, Massachusetts and Denver, Colorado. The eight groups included integrated delivery markets, community stand-alone hospitals, skilled nursing facilities/rehabilitation hospitals, physician practices, home health agencies, pharmacies, reference laboratories, and third-party payers. Their study targeted the five IT applications (including the EMR) most likely to impact patient safety, healthcare quality, and organizational efficiency. Based on in-depth interviews with stakeholders (n = 52) and a panel of experts (n = 12), Poon et al. (2006) found that the adoption of EMRs was limited in both inpatient and ambulatory settings. They concluded that, despite the emergent interest in the role of health information systems (HIS) in improving safety and quality, adoption in these areas was especially slow due to concerns regarding cost and productivity.

Based on a review of surveys on EMR implementation through 2005, Jha et al. (2009) found that only about one fourth of physician practices were using EMR systems in ambulatory settings. In addition, Hillestad et al. (2005) reported that only about 47% of providers in the United States, including physicians and non-physicians, had implemented some form of HIS, considerably less than in other countries. Data from the National Ambulatory Medical Care Survey (NAMCS) showed that physicians have increasingly implemented all or some EMR and EHR system functions from 2007 to 2008, with increases of 25.2% and 43.9% respectively; however, there has been no significant change since then (Hing & Burt, 2009; Hing & Hsiao, 2010).

Schoen et al. (2009) conducted an extensive survey of more than 10,000 primary care physicians in the United States and 10 other countries, including Australia, Canada, France, Germany, Italy, the Netherlands, New Zealand, Norway, Sweden, and the United

Kingdom, representing a mix of healthcare systems. The findings showed the United States lagging substantially behind other countries in terms of HIS usage. Schoen et al. (2009) found that only 46% of U.S. physicians used basic EMR functions, compared with nearly universal use (more than 90%) in Australia, Italy, the Netherlands, New Zealand, Norway, Sweden, and the United Kingdom. At least half of practices in these countries reported using full EMR functions.

As a solution to America’s lag in implementing EMR systems, the American Recovery and Reinvestment Act of 2009 (ARRA) included $19 billion in stimulus grants to support the development of HIS. The requirements of the PPAHCA and the stimulus grants offered in ARRA created a source of funding to subsidize the implementation of the EMR systems through 2014.

Despite this encouragement, Angst and Agarwal (2009) conducted a study of physicians and hospital administrators that found that financial incentives alone were not going to be sufficient to encourage the implementation of EMR systems, or to decrease the resistance that is pervading the industry. Therefore, it has become necessary to test empirically other factors that may be contributing to this resistance of EMR systems among healthcare professionals.

Theoretical Foundation for Resistance to Use Technology

One of the main theories in the literature that deals indirectly with resistance to using information systems is Rogers’s (1995) Diffusion of Innovation (DOI), first introduced in 1983. Used predominantly as part of theoretical frameworks for analyzing individual-level acceptance and resistance to information systems within social structures

(Angst & Agarwal, 2009; Rogers, 1995), it can be conceptualized as the use of an idea, practice, or object by adopting groups or individuals. As Rogers (1995) stated,

> It matters little, as far as human behavior is concerned, whether or not an idea is objectively new as measured by the lapse of time since its first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new and different to the individual, it is an innovation. (p. 11)

The DOI theory can be decomposed into five constructs: relative advantage, compatibility, complexity, trialability, and observability, which are all determinants of adoption behavior.

The DOI theory presents *innovation* as any form of technology or process that represents a new way of completing or accomplishing a task or process (Greenhalgh et al., 2008; Rogers, 1995). Implementation of a technology rests upon key user perceptions of the new technology that the innovation represents an improvement that is beneficial to users in multiple ways (Greenhalgh et al., 2008; Landaeta, Mun, Rabadi, & Levin, 2008).

Resistance to innovation in the DOI model begins with variables such as relative advantage, compatibility, complexity, trialability, and observability, but is not limited to them. Attributes of the DOI model that enhance and foster the implementation and acquisition of EMR systems may include perceptions of relative advantage (it is a better way of doing the task), simplicity, compatibility with existing ways of conducting activities, trialability, observability, and a potential for reinvention (Greenhalgh et al., 2008). Trialability allows the innovation to be tried on a limited basis with no obligation for permanent use (Rogers, 2010). Observability allows the benefits of the innovation to be observed during the trialability phase and the potential for reinvention allows users to adapt innovations to meet their particular needs (Greenhalgh et al., 2008; Rogers, 2010). Rogers's (1995) model for IS diffusion is presented in Figure 2.

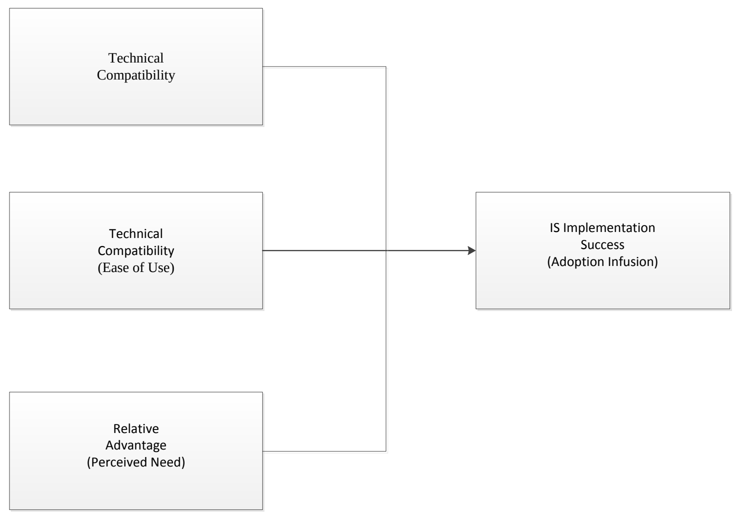

Figure 2. Rogers' (2003) model for IS diffusion

Rogers (1995) stated that acceptance of an innovation is often a scattered process and it does not always occur in a linear fashion. Self-efficacy is also a diffuse presence throughout the acquisition and implementation of the innovation. Self-efficacy, which can be enhanced or reduced by a variety of factors, including accessible knowledge regarding the benefits of the innovation and how to work or use the innovation, is crucial to the acquisition and implementation of technology because of the role it plays in motivating individuals to implement the innovations.

Resistance may result from the users' determination that the benefits of the innovation are either inappropriate to their circumstances or would not be realized at all for a variety of reasons (Olson, O'Brien, Rogers, & Charness, 2011). Studies in the past four years have suggested that the primary reasons for resistance are the perception that the innovation was unable to overcome inherent organizational and individual deficiencies present in the environment where the innovation is to be introduced. Resistance is the expression of doubt that the innovation was able to deliver benefits to users due to the failure of leadership to introduce and sustain novel technologies within the organization (Dalkir, 2011; Rogers, 2010).

Rogers (2010) argued that social networks affect diffusion rates more than the actual technology or innovation, citing studies in the early 1980s that focused on the installation of water and crop technologies in small villages in India and Asia. He argued that the type of social interaction between social members is a key indicator of how rapidly a technology diffuses within a group. Rogers's model as applied to a social network is presented in Figure 3.

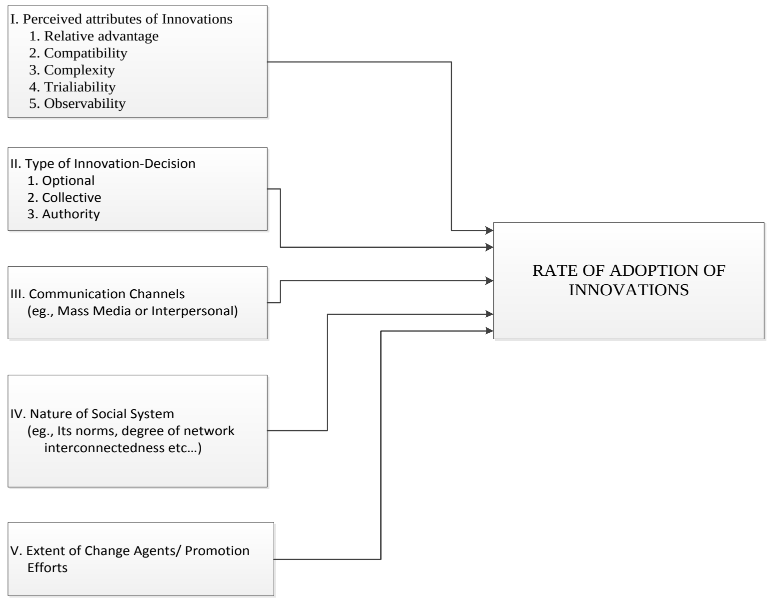

Figure 3. Rogers' (2003) model for determining the rate of Adoption in Innovations

Resistance Theories

IS research has provided rich insights into why technologies are needed and the reason people use them, but has not given enough attention to the question why -IT workers resist technologies, and what factors are impacting implementation/usage of systems (Cenfetelli 2004; Lapointe & Rivard 2005; Kim & Kankanhalli 2009). Laumer and Eckhardt (2012) noted that user resistance to technology has been growing, in particular when implementation projects are initiated by the IT department rather than business operations. End-users often become resentful for having to cope with yet another system. They become disruptive to the implementation process (Cenfetelli, 2004).

After a review of nine resistance theories and models, Laumer and Eckhardt (2012) have concluded that the IS research still lacks a solid and unified theory on user resistance. Using a modified version of the Compliance Resistance Workaround Model introduced by Ferneley and Sobrepererez (2006), Laumer and Eckhardt (2012) have expanded the three construct model to six items (Figure 5).

Ferneley and Sobrepererez (2006) initially proposed a classification of three resistance behaviors, namely compliance, resistance, and workaround. They argued that these three resistance behaviors were categorized as being negative in that there is an underlying rationale to oppose or deceive. Negative resistance exits when end-users become non-compliant, resistant to the implementation and find workarounds to using the system if the implementation is successful. This is contrary to positive resistance, where there is an underlying rational to support and improve. The problem with positive resistance is little or no system usage (Kim & Kankanhalli, 2009). Positive resistance exists when end-users do not negatively reject the system, but find other workarounds instead of using the system that has been implemented. In the case of positive resistance, the end-users are compliant and not resistant during the implementation, but after the implementation, system usage may be very low due to the discovery of workarounds (Ferneley & Sobrepererez, 2006; Kim & Kankanhalli, 2009).

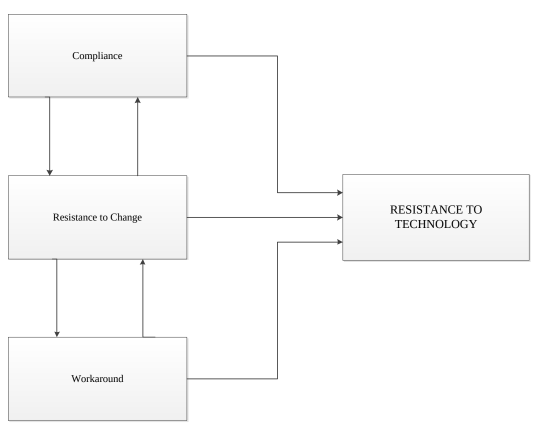

Figure 4. Concept underlying resistance theories.

Laumer and Eckhardt (2012) expanded on Ferneley and Sobreperez (2006). The Resistance theory as formulated Laumer and Eckhardt posited that there were six distinct influences on user resistance to IS. They are as follow: Individual Differences, Context, Social Influences, Beliefs and Attitudes, Resistance to Change, and Equity-implementation Model. Ferneley and Sobreperez (2006) three constructs are embedded within the six items proposed by Laumer and Eckhardt (2012), particularly in the Equity-implementation model.

These constructs that make up Laumer and Eckhardt's model are directly related to this study's constructs and model. Social Influences in the context presented by Laumer and Eckardt (2012) has a broader definition as it extends to workplace and co-worker influences. However, the concept underpinning this construct is Peer Pressure (PP). Similarly, Individual Differences is broadly defined in the model, thus, it incorporates cognitive and behavioral dimensions. However, Computer Self-Efficacy is also supported as Individual Differences include one's belief in his ability use information systems. Context as defined by Laumer and Eckardt (2012) extends to managerial psychology. However, Perceived Complexity (PC) is exactly the reason managerial psychology is introduced to the concept. Fear of job loss due to the complexity of the system causes managerial psychology to play a part in the definition of this construct. Beliefs and Attitudes as presented by Laumer and Eckardt (2012) is directly related to Attitude Toward EMR (ATE) the main difference is that the authors distinguished between change recipients and change agents, thus creating a recipient-agent relationship. The underpinning concept behind Beliefs and Attitudes is the end-users' attitude toward the system or change.

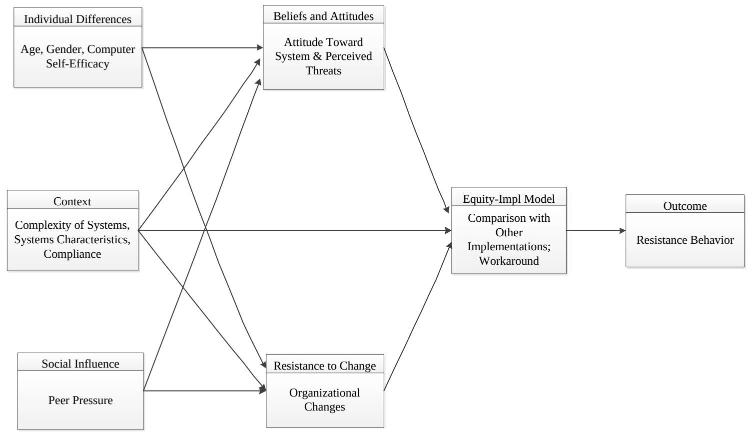

Figure 5. Concept underlying resistance theories

Sources of Resistance

Resistance Due to the Financial Costs of EMR Systems

The affordability of EMR systems in terms of start-up and ongoing maintenance costs may be one of the reasons for resistance across practice settings (Bates, 2005; Gans, Kralewski, Hammons & Dowd, 2005; Jha et al., 2009). A recent literature review on the resistance of EMR systems, comprising 22 studies from 1998 to 2009, found that financial resistance was the single most frequently reported constraint (Boonstra & Broekhuis, 2010). Four sub-categories of cost-related issues were identified: high start-up costs, high ongoing costs, uncertainty over return on investment (ROI), and lack of financial resources to cover these costs. More specifically, EMR systems require an investment in servers, networks, software, security, and continuous IT support (Ludwick & Doucette, 2009).

Cost is of particular concern, especially for small practices that have difficulty justifying the outlay and for older physicians (55+ years) who may not be able to reap the long-term ROI (Kumar & Aldrich, 2010). Menachemi, Hikmet, Stutzman, and Brooks

(2006) found that the level of intent to implement EMR systems mediated the extent to which cost was a factor. However, a large-scale study of primary care physicians and clinical specialists conducted by Jha, Ashish, DesRoches, Kralovec, and Joshi (2010) (*n* = 4,203), comparing “imminent adopters” of EMR systems (physicians who planned to implement a system within one year), “interested adopters” (physicians who planned to implement a system at a later date), and those not considering adoption at all, found that imminent adopters were less likely to consider the upfront costs for hardware and software, ongoing maintenance, or the inadequate ROI as reasons to resist the implementation. Similarly, Brailer (2010) surveyed Massachusetts-based practices (*n* = 1,345) and found that imminent adopters were less likely than others to cite cost as a reason not to implement the systems, though they did report start-up and ongoing costs as hindrances.

The North Shore Hospital System in New York took an important step to accelerate the use of EMR systems in physician practices in its network by offering incentives up to $40,000 for EMR implementation and use, including 50% of the cost if a function to integrate with other hospitals was included and 85% if sharing of de-identified data on the quality of care was also included. Such payments would be above the $44,000 incentive promised by ARRA authorizing Medicare to pay each eligible provider who uses certified EMR systems in a meaningful way. Shea and Hripcsak (2010) noted that, in addition to such financial incentives, four factors would contribute to greater EMR system implementation: (a) decreased cost of EMR systems given the volume of software licenses; (b) the investment in time for implementation; (c) system functions beyond documentation are now available, such as automated coding, billing, referral, patient letters, prescribing, task tracking; and (d) payment for quality of care which is contingent on such documentation. Based on the findings of EMR system implementation in hospitals across the country, Jha et al. (2009) proposed that hospitals should be financially rewarded for using EMR systems, mainly those most financially at-risk. Yet a study of physicians and administrators by the Robert Wood Johnson Foundation (2009) found that financial incentives would not be enough to increase EMR system implementation, suggesting that more constructs should be examined.

Despite initial concerns about the cost of EMR implementation, MGMA (2010) found that medical practices with EMR systems, including independent physician practices and hospital/delivery-system practices, showed better financial performance than those not using the systems. Schoen et al. (2009) also showed that cost factors have been negated by incentives.

Resistance to EMR Systems Due to Privacy Concerns

Medical practices are increasingly being expected to implement EMR systems that can be linked to, or integrated with, systems at other physicians' clinics, hospitals, pharmacies, and clinical laboratories, posing challenges to privacy and security with the possible disclosure of confidential patient information (Black & Anderson, 2007; Kralewski, Dowd, Zink, & Gans, 2010). According to the *Code of Medical Ethics of the American Medical Association*, physicians are authorized to share patient information by consent of the patient or by legal intervention. According to the AMA's ethical force program (Black & Anderson, 2007) even the release of legally authorized information may possibly jeopardize the physician-patient relationship, the trust of the public in physicians, and the healthcare system itself. Damschroder, Pritts, Neblo, Kalarickal, Creswell, and Hayward (2007) explained that in the absence of any comprehensive standard addressing privacy issues related to EMR systems, the *Code of Medical Ethics* provides some guidance for the profession. According to Angst and Agarwal (2009), actions must be taken to ensure patient confidentiality of computerized records, as with all other records — specifically, the release of data must be for a specific reason and prescribed time frame. Dillon and Lending (2010) argued that among the risks posed by electronic records, in comparison with traditional paper records, is that electronic records, to a greater extent, include comprehensive and even outdated patient information in a single place, facilitating access to a larger amount of data, which can be damaging if it falls into the wrong hands. Gaylin et al. (2011) added that contributing to the risk is also that patients, even if counseled by physicians, may not fully understand that they have given permission for the release of all information, even when some of that information is not pertinent to patient care. Information such as insurance, employer, and other demographic data collected during registration may be stolen and used inappropriately by individuals (Black & Anderson, 2007).

Ultimately, although incorporating EMR systems into the healthcare system is important, lack of privacy protection serves as an obstacle to some degree, which in turn is increasing resistance (Simon et al., 2007). Within the framework of interoperability, data exchange occurs over both the Internet and network communications, which are often unsecured (Cherry et al., 2011). For this reason, Boonstra and Broekhuis (2010) found that the issue of EMR system data exchange may have a negative effect on patient privacy, with physicians being skeptical about the ability of an EMR system to store patient data securely and not to risk making it available to unauthorized users. Moreover, although there is progress in addressing patient concerns about privacy, physicians who use EMR systems seem more concerned than patients, who are not very familiar with the systems and how they work (Simon et al., 2007). In a study of ambulatory care network and information leaders, Yoon-Flannery et al. (2009) found that patient privacy was high among their concerns when it came to EMR system use in academic ambulatory care settings.

According to Gaylin et al. (2011), the extent to which EMR system data are stored in interoperable systems is relatively low. However, Awa, Nwuche, and Aseigbu (2011) argued that the diffusion of EMR systems would continue to grow; therefore, information security and privacy in the integration area cannot be ignored as the digitization of patient data are widespread. Privacy and security measures must be implemented to ensure that patient data do not fall into the wrong hands (Nicholls et al., 2011). Although the U.S. has stringent laws and regulations to protect patient privacy, including the Health Insurance Portability and Accountability Act (HIPPA), such laws do not specifically address the issue of data ownership. For example, under HIPPA, physicians have the right to share data with insurance companies and other physicians (Hoffman, 2009).

A study of IT practitioners conducted by Kralewski et al. (2010) (n = 542) in healthcare organizations reveals some disconcerting findings related to patient privacy. Fully three-fifths (61%) of respondents surveyed reported that their organizations do not have sufficient resources to protect sensitive or confidential patient information and a staggering 70% reported that senior management in their institutions did not view patient privacy and security as a high priority. It is not surprising, therefore, that more than half

(53%) said their organizations do not take necessary measures to protect their patients privacy rights, although 54% respondents believe that such policies and procedures are available. Regarding measures already in place, only 43% said they were effective or very effective. According to Dillon and Lending (2010), the most significant threats to securing electronic health information concern virus or malware infections, loss of patient data (breaches), and malevolent employee attacks. Ponemon (2009) noted that 48% of healthcare facilities admitted to having had at least one incident of lost or stolen electronic health information.

In particular, the complexity of the healthcare system contributes to privacy concerns in that it becomes difficult to determine or monitor which healthcare professionals have access to electronic patient data (Angst & Agarwal, 2009). An emergency department is a case in point, where many providers, including physicians and ancillary staff, may examine a single patient in a brief period of time, exposing the patient's data to many eyes, thus increasing chances for breach (Bleich & Slack, 2010). Ideally, however, only providers with a direct medical need for information should have access to that patient's record (Ponemon, 2009). At Partners HealthCare hospital network, for instance, physicians can access records of patients who have visited that hospital only and can view, but not amend the data (Hoffman, 2009).

Physicians who were not likely to use EMR systems in the near future were found by Menachemi et al. (2006) to be more concerned than imminent adopters about issues of patient privacy and confidentiality; they illustrated stronger resistance to the use of EMR systems. Yoffee (2009) conducted a statewide study of Massachusetts-based physicians (*n* = 150), which showed that those who care for Black and Hispanic patients were less concerned than healthcare professionals caring for other ethnic groups about privacy, though their reported resistance levels to using EMR systems were similar. Dunlop (2007) showed that privacy concerns still exist amongst minority patients; however, the level is slightly below individuals of other ethnicities. Hoffman (2009) noted that resistance is strong enough to impact the implementation and use of EMR systems.

Angst and Agarwal (2009) argued that patient concerns about privacy may interfere with the national goal of EMR systems for all patients. By allowing or not allowing the digitization of their records, patients can influence the extent to which EMR systems are diffused. Since privacy concerns are still cited as a reason for resistance to the implementation and use of EMR systems, Wright et al. (2010) studied consumer attitudes and beliefs toward the systems, rather than their actual behaviors. Using an experimental design study, subjects (n = 366) were randomly assigned to two groups and each was presented a differing argument framed around privacy and the use of EMR systems, one positive and the other negative. The findings showed that attitudes toward the use of EMR systems and concern for information privacy in particular may continue to impact resistance to using EMR systems. The limitation of the study done by Wright et al. (2010) is that attitude toward EMR systems was examined with just one other construct, namely privacy concerns. More constructs were needed in the model for a more accurate picture of resistance.

Resistance Due to Workflow Concerns: Time and Productivity

According to Hoffman (2009), the intent is for EMR systems to mesh smoothly into a clinician's existing workflow. As such, clinical workflow must be considered in order to integrate the systems effectively into routine clinical practices (Castillo et al., 2010). The reality is that implementation of EMR systems is disruptive to the workflow, even at the very outset, in terms of the obligatory time to select, procure, and implement the system, though studies have shown that some physicians often choose not to become involved in these activities (Boonstra & Broekhuis, 2010; Jha et al., 2009).

EMR implementation can result in a protracted learning curve together with a decline in productivity for physicians (El-Kareh et al., 2009). According to Brooks and Grotz (2010), it can take up to a year after implementation to return to full productivity. This is especially problematic for small, primary care practices that are burdened by high patient volumes (Castillo et al., 2010). According to Nixon (2009), physicians often find it easier and faster to write a prescription on paper than log into the EMR system and type in the information. Wagner et al. (2008) noted that because physicians are paid per procedure, they may have little incentive to improve workflow efficiency. Consequently, it has been suggested that EMR systems may never completely replace paper, nor should they (Hoffman, 2009).

Boonstra and Broekhuis (2010) stated that data entry has been identified as a concern among physicians, which may be attributed to complaints of system complexity. By law, patient records must be transitioned from paper to electronic records, a time-consuming process (Nixon, 2009). More specifically, using EMRs has been associated with the need for increased time during the clinical encounter, for example, additional time is needed to enter patient data or prescribe a medication, thereby disrupting the workflow (Boonstra & Broekhuis, 2010). To facilitate data entry in the face of this demand, some physicians have resorted to simple solutions such as the use of Post-Its or index cards. In fact, Saleem et al. (2009) found that physicians and other providers in a

Veterans Affairs Medical Center continued to use paper even when a Web-based EMR had been in place for some time. Miller and Tucker (2009) surveyed key informants (n = 20) and identified the following reasons for paper workarounds: providers perceived paper use to enhance efficiency; providers lacked knowledge or skills or found the system difficult to use; paper served as a cognitive memory aid; and paper provided sensory input or motor activity, that is, something tangible. Saleem et al. (2009) noted that some frequently reported benefits of paper by providers included increased awareness of new information; need to customize data for a particular patient, provider, or department; system functionality did not support necessary tasks; display of electronic data was not adequately organized; and tracking data over time was difficult to accomplish.

Baron, Fabens, Schiffman, and Wolf (2005) conducted a case study of the end-user experience from an EMR system implementation in one internal medicine practice. They underscored the pervasive impact on workflow (Baron, Fabens, Schiffman, & Wolf, 2005, p. 224):

> Going live rendered everyone in the office incompetent to do their core jobs. The front desk had to use new on-screen forms to record telephone messages; pairing electronic messages with paper charts required the file clerks to follow a new workflow; physicians had to find telephone messages on their computer desktop rather than neatly piled in a physical telephone message bin. The medical assistants had to record vital signs and chief symptoms in the computer and had to learn how to record the results of a tuberculosis skin test, visual acuity test, or urinalysis. Everyone in the office simultaneously experiences pervasive anxiety

> and unhappiness. Waiting time for patients dramatically increased. In short, people were miserable at work.

Another issue disruptive to the workflow noted by Cheriff, Akshay, Qiu, and Cole (2010), is that depending on the EMR system selected by the healthcare facility, data from the old paper-based charts could not be migrated into the digital system. Egleson, Kang, Collymore, Esmond, and Gonzalez (2010) argued that migration issues create additional problems that foster resistance to the implementation and use of EMR systems. According to Cheriff et al. (2010), whether a facility selects a system with the capability of migrating the old paper-based charts depends on its budget. In the long run, productivity, communication, information-sharing, and access to current health information were reported as benefits to EMR system implementation and use (Wright et al., 2010).

Miller and Sim (2004) conducted interviews (n = 90) with EMR managers and physician champions in 30 physician organizations, ranging in size from solo/small groups to large multi-specialty groups, to examine workflow issues and their impact on resistance to EMR system use. Representatives from EMR vendors were also interviewed. Respondents reported that initial physician and other healthcare professionals' workloads were high due to workflow changes. More specifically, most physicians using EMR systems spent more time per patient after EMR implementation over a period of months or even years, contributing to longer workdays or fewer patients seen. Callan and Deshazo (2007) identified three underlying workflow issues, the first being difficulty following the automated workflow, the second lack of integration with ancillary systems, and third slow transition from one screen to the next. According to a study by Brooks and Grotz (2010), even EMR systems that were highly regarded as leading products in the industry were challenging to use due to multiple screens, lack of functions, and non-intuitive navigational tools. Block (2008) noted that physicians had problems documenting progress notes and were forced to spend additional work time learning how to use the EMR systems most effectively. Crosson, Ohman-Strickland, Cohen, Clark, and Crabtree (2012) noted that system vendor initial responses to the complaints were not encouraging; however, in the last couple of years, vendors have introduced module-specific applications via mobile devices that deal with specific areas of patient care. Fisher (2011) added that the eventual simplification of EMR solutions through devices such as voice recognition and mobile computing would eventually alleviate the workflow complaints.

Ayatollahi et al. (2012) found that another workflow-related concern was inadequate system support, including installation and training, which is costly and time-consuming. Barbeite and Weiss (2004) cited hurried training that did not allow end-users to grasp the concepts for the new system as a problem. Castillo, Martínez-García, and Pulido (2010) argued that vendors should spend more time at the client sites showing how the new workflow compares to the old. Dey, Sinha and Thirumalai (2013) noted the need for vendors to spend time with providers, customizing their own visit-specific or disease-specific electronic forms and short-cuts to documentation and redesigning their examination room to accommodate the new workflow. Finally, Crosson et al. (2012) noted that inadequate electronic exchange data between EMR systems and other clinical data systems (e.g., laboratory, radiology, and referral systems) was identified as an issue, particularly for solo and small group practices. According to Crosson et al. (2012), the end-users have to use both the new EMR system and the old paper-based charts when the newly implemented ERM system is not fully integrated.

Iglehart (2013) also found that time constraints due to workflow issues interfered with the use of EMR systems, including the fear of falling behind schedule (52%). The findings suggest computer-related problems may contribute to scheduling concerns. For example, respondents reported slow computers (49%), computers “timing out” (19%), lack of fast or available printers (12%), and an inability to type fast enough (32%). Interestingly, although time was a concern, 28% of respondents indicated a preference for writing long prose notes.

Resistance Due to Physician-Patient Relationship

Physician-patient communication can impact such patient outcomes as satisfaction, compliance, pain management, and physiological measures such as blood pressure and blood sugar (Rouf, Whiffle, Lu, & Schwartz, 2007). So, while EMR systems in the clinical setting are expected to contribute to good patient care, physicians may still resist them due to concerns about their adverse impact on the physician-patient encounter (Boonstra & Broekhuis, 2010). For example, the use of EMRs requires a computer in the examination room, which can change the dynamics of the clinical encounter, because the time physicians spend on the computer may take away from the time spent with patients (Rouf et al., 2007).

Ferris (2010), Rouf et al. (2007), as well as Shachak, Hadas-Dayagi, Ziv, and Reis (2009) have noted gaps in the literature in the area of physician-patient interaction during routine doctor visits. To address the need for this information, Shachak et al. (2009) conducted a literature review on the effect of the EMR systems on patient-doctor communication. An analysis of recurring themes in the literature suggests that EMR system use can have both a positive and negative influence on the clinical encounter. Ferris (2010) noted that some patients complained that the use laptops or other mobile devices had depersonalized their encounter with the physician.

Rouf et al. (2007) found that EMR system use has improved the exchange of medical information because the system allows physicians and other healthcare providers to acquire and verify patient information, in addition to encouraging patients to ask more questions than when paper records were used. Wu et al. (2010) noted that EMR systems use also contributed to improved accuracy in prescribing medications and medication-related counseling of patients, because patients often referred to general descriptions rather than generic or brand names when requesting certain medications. In contrast, Adler-Milstein et al. (2013) revealed that patient-centeredness was adversely affected because physicians and other healthcare providers tended to walk straight to the computer and spend considerable time viewing and recording information. This same issue was found in studies of Israeli physicians (Hadas-Dayagi, Ziv, & Reis, 2008; Shachak et al., 2009). Hadas-Dayagi et al. (2008) concluded that with the EMR systems, physicians tend to organize the clinical encounter around the data-gathering, rather than around patient narratives when, instead, they should be starting with their patients' concerns and making eye contact with them at the outset. Ajami and Bagheri-Tadi (2013) argued that rapport with the patient might also be improved if physicians and other care professionals learned to use the computer more effectively, for example, by mastering their typing skills and the ability to navigate the screen and the Internet.

On a broader level, Shachak et al. (2009) emphasized the need for basic and continued training, not only for the technical use of the EMR systems, but also to improve the ability to integrate seamlessly with other facilities, thus enhancing the doctor-patient experience. Ackerman, Filart, Burgess, Lee, and Poropatich (2010) conducted a study of 215 primary care physicians practicing in the country's largest health maintenance organization, where more than nine out of 10 respondents said that the use of EMR systems disrupted communication with their patients.

According to El-Kareh et al. (2009), physicians participated in a cross-sectional, electronic survey of primary care physicians (n = 255) at Partners in HealthCare. Results revealed that the use of EMR systems during an ambulatory patient visit can interfere with doctor-patient communication. Another study by Johnson, Bakken, and Dine (2008) at a regional, integrated health delivery system with 21 primary care clinics affiliated with Massachusetts General Hospital found that physicians and other care professionals were unsatisfied with their level of interaction with the patients. The respondents cited documentation time as a factor taking time away from interaction with their patients. Another study by Ommen et al. (2008), where the facility used the longitudinal medical record (LMR) as the official ambulatory health record system, found the system was used during every patient visit to review patient information, document findings of the history and physical exam, access reference information, and prescribe medications. However, the inability to maintain eye contact with the patient was the most often reported problem (62%). Respondents (31%) also felt that using a computer in front of patients was rude.

McGrath, Arar, and Pugh (2007) also examined the influence of EMR on non-verbal communication, an important consideration because it is associated with such outcome variables as patient satisfaction, recall, and compliance. Observations of non-verbal communication were based on video-taped clinical encounters (n = 50) of staff physicians (n = 6) in a Veterans Administration Hospital. Four dimensions were studied:

(1) Time using the EMR system. Most physicians used the system at length, treating it as a central part of the consultation, although the majority of these same physicians also showed low system use at times. McGrath et al. (2007) suggested that time using EMR systems may not, in fact, be physician-dependent.

(2) Physical orientation. Non-verbal communication related to system use was a function of the physician's body orientation in relation to the computer. Detmer (2009) noted that to access the system, physicians were forced to orient themselves toward the computer and away from the patient, contributing to less eye contact, fewer gestures, and an increase in the number and length of pauses during interaction. McGrath et al. (2007) suggested that spatial arrangement of the room influenced interaction with the patient. Among high EMR system users, physicians typically sat so that the patient was in their field of vision while still able to access the computer visually (Ommen et al., 2008)

(3) Breakpoints. To orient themselves toward the computer, physicians had to break eye contact with patients, thereby interrupting the normal flow of communication. To minimize the effect, some physicians obtained the information from the computer, stopped, and turned toward the patient to resume eye contact and verbal communication before returning attention to the computer. These pauses, or breakpoints, facilitated the communication process (McGrath et al., 2007).

(4) Pausing: Patients did not seem uncomfortable during pauses in communication, evidenced by the absence of fidgeting, sighing, or looking around the

room but, instead, used this time to ask questions or make comments (McGrath et al., 2007; Piette et al., 2005) However, McGrath et al. (2007) noted that EMR system use did slow down the interview process, which may have been beneficial in that it allowed more time to discuss the patients' problems. O'Malley et al. (2010) noted that despite these various approaches to curb the problem, physicians and other care professional continued to claim that computers are disruptive to the consultation process, thus, resisting their use in this manner.

Other Factors Impacting Resistance to Using EMR Systems

Bhattacherjee and Hikmet (2007) observed significant resistance during the EMR system implementation process. They inferred that this resistance was caused by the complexity of the implementation and perceived threats toward healthcare professionals, such as loss of control over the environment. An EMR system is a multifaceted, electronic patient record-keeping system that is often implemented in a model of hierarchical and increasingly complex stages (Smith et al., 2013). Lapointe and Rivard (2005) noted that implementation of EMR systems is seldom performed in a single phase. Although there is no universal stage installation framework, it is not unusual to begin installation and operation with primary care operations, followed by ancillary operations such as pharmacies, laboratories, and radiology. Smith et al. (2013) discovered that this pattern has been followed in several thousand clinics and hospitals studied and it may cause the implementation to take longer, thus, frustrating the staff and causing resistance.

The implementation of EMR systems almost always takes place in stages that can last as long as three to four years (Ilie, Van Slyke, Parikh, & Courtney, 2009). The time required can often allow resisters time to build negative momentum while frustrating supporters impatiently await full implementation (Ilie, Van Slyke et al., 2009; A. L. Smith et al., 2013). A prolonged implementation can sometimes end in failure, as can a rushed implementation. The most well-known case of a failure to implement an EMR system successfully was in 2002 at Cedars-Sinai Hospital (CSH) in California. CSH spent approximately $34 million to fund a complete, one-stage implementation of an EMR system (Kumar & Aldrich, 2010; Rutten, Kremers, Rutten, & Harting, 2009). The failure of the CSH implementation program was blamed on a lengthy, all-inclusive implementation of the EMR system (Kumar & Aldrich, 2010; A. L. Smith et al., 2013). The all-at-once strategy used by CSH was foiled by human resistance to change and opposition by physicians, nurses, and other employees to new technologies, as well as suspicions of how poorly implemented technologies can affect their performance, exposing them to legal liabilities (Bekkering, Van Tulder, & Hendriks, 2005; Kumar & Aldrich, 2010). The CSH effort rushed its strategies for training and building confidence concerning the system's stability and reliability, thus triggering resistance amongst staff, which in turn led to failure (Kumar & Aldrich, 2010).

Retrospective studies of failed implementation efforts at CSH and other organizations suggest that there are eight main categories of resistance to EMR system implementation: financial, technical, time, psychological, social, legal, organizational, and change process (Boonstra & Broekhuis, 2010; Kumar & Aldrich, 2010; Rutten et al., 2009; A. L. Smith et al., 2013).

Other factors affecting resistance to EMR systems include planning and execution. Zheng, Fear, Chaffee, and Zimmerman (2011) noted that managing EMR system projects can be extremely complex and that poor planning and lack of scope often caused the project to derail, resulting in resistance among the staff. Ford, Menachemi, and Peterson (2010) observed that system builds can become chaotic when nurses are not fully engaged in the process. They noted that some facilities allowed analysts with little knowledge of clinical workflow to perform the build; this decision backfired during testing, causing resistance when the system build had to be redone.

Trivedi et al. (2009) observed that some EMR systems were so complex that an implementation plan by an organization’s IT department without significant involvement from the clinical staff produced very different results in the clinical workflow, which caused the implementation to linger. Callen, Braithwaite, and Westbrook (2008), as well as A. L. Smith et al. (2013), noted that the pace of the implementation affected resistance to using systems, since many physicians, nurses, and other healthcare employees who resisted the change continued using paper-based charts as the transition was progressing. The literature related to resistance to EMR systems is summarized in Table 1.

Table 1.

Summary of resistance-related literature

Study Conducted by	**Methodology Employed**	**Sample**	**Instrument/Construct**	**Major findings and contributions**
Bhattacherjee & Hikmet, 2007	Empirical Study	n = 131	Quantitative survey based on constructs: perceived threat, resistance to change, behavioral intention, perceived usefulness	Resistance precedes IT usage: it is unclear whether this association is direct or mediated by other constructs
Takian et al., 2012	Re-analysis of the literature	23 papers	Constructs taken into consideration in journal analysis: performance expectancy, effort expectancy, social influence, facilitation conditions	Resistance by end-users can still cause an EMR system implementation to fail

Berner et al., 2005	Historical analysis	Papers from the 1960s to the present (2005)	Constructs taken into consideration in journal analysis: EMR underperformance, change to practice, EMR interoperability	Reduction in medical errors and reduced healthcare costs were still not sufficient motivation to overcome resistance to EMR
Jayasuriya, 1998	Empirical Study	n = 75	Investigator-created quantitative survey	Lack of a formal training program has been implicated as a reason for resistance to the use of computer systems in the work environment
Morton & Weidenbeck, 2009	Empirical Study	n = 239	Quantitative survey based on constructs: perceived ease of use, perceived usefulness, attitude toward EMR, adequate training	Hasty deployment of health IT may result in resistance and implementation failure
Castillo et al., 2010	Systematic review of the literature	Records from eight databases covering EMR adoption studies	Constructs taken into consideration in systematic review: attitude toward information systems, perceived characteristics of DOI, norms of social systems	Resistance will lessen if physicians understand the EMR systems will benefit patients
Angst & Agarwal, 2009	Empirical Study	n = 67	Quantitative survey based on constructs: privacy, ability, attitude, likelihood of adoption, peer pressure	Increased issue involvement increases "latitude of rejection," i.e., increases resistance to persuasion

Physicians as a Unique Group of EMR System Users

According to Zheng et al. (2011), physicians are not always the main stakeholders at the hospitals or clinics that are implementing EMR systems. Many physicians, however, have privileges due to their ability to bring significant amounts of revenue for their facilities (Hauser & Johnston, 2008). But physicians with privileges are generally not employees of the hospital or clinic (Aldosari, 2003; Cabana, Rand, & Powe, 1999). Other healthcare employees, such as nurses, medical technologists, and clinical analysts, are employees of the hospitals and clinics where they work and as such, they are subject to the decisions of administrators in ways that are significantly different from the physicians (Alkhateeb, Khanfar, & Clauson, 2009; DesRoches et al., 2008). Therefore, any physician effort to resist the selection of a given EMR system is addressed with the utmost care, knowing that this resistance may lead to the failure of the implementation (Castillo et al., 2010; DesRoches et al., 2008).

Overcoming physician resistance to the implementation of EMR systems can often require diplomacy and persuasion, rather than mandates and requirements (Castillo et al., 2010; A. L. Smith et al., 2013). One reason hospitals now use a gradually phased implementation of EMR systems is to take the opportunity during each phase to illustrate to the physicians that the EMR systems are worthwhile, despite the issues (Dey, Sinha, & Thirumalai, 2013). Physicians are granted certain financial benefits and professional prestige based on their visiting privileges (Gaster et al., 2003). Physicians, however, frequently have clauses in their contracts that prevent them from leaving a hospital or facility just because they disagree with the EMR system being implemented (Dey et al., 2013).

Other employees may be required to adapt to new systems implemented by hospitals and healthcare facilities; however, research shows that when innovation and IS upgrades are accompanied by a partnership approach, the implementation is much more likely to succeed (Furukawa, Raghu, & Shao, 2010). Physicians are often opposed to innovation and believe that they are not subject to administrative mandates, especially when such mandates interfere with established routines and may represent new exposure to litigation for malpractice (Gaster et al., 2003; Ilie et al., 2009).

Nurses as a Unique Group of EMR System Users

Key concerns for non-surgical nurses are the hours required to care for patients, complete recordkeeping, and avoid overtime work (Furukawa et al., 2010). Although nurses practice a high degree of homophily and a significant degree of heterophily regarding technological innovations, their belief that EMR systems can reduce overtime and allow nurses to engage in direct patient care rather than bureaucratic record maintenance appears to be the key to securing their support for EMR system implementation (Furukawa et al., 2010; Wang, Walther, Pingree, & Hawkins, 2008). According to K. Smith, Krugman, and Oman (2005), this support level still requires significant effort to demonstrate the effectiveness of the system being used. For this reason, nurses are generally key team members during site visits, vendor demonstrations, and system builds (Sassen, 2009; K. Smith, Krugman, & Oman, 2005). Because nurses have intimate knowledge of the workflow at the facility, they can sometimes influence the decision of which vendor gets awarded a request for proposal (RFP) (Poissant, Pereira, Tamblyn, & Kawasumi, 2005).

The workflow is basically nurses' daily routine and it is automated during EMR system-implementations (Kossman & Scheidenhelm, 2005). Nurses tend to be very vocal during the implementation process, expressing opinions on how the automation of the workflow should be done (Staggers, Kobus, & Brown, 2007). Once the nurses are on board with the implementation of an EMR system, they serve as "super-users." Basically, a super-user either attends formal training at the vendor's location or works directly with the vendor's experts to gain knowledge of the system. In turn, that super-user returns to his or her facility and trains the other users of the system (Carayon, Smith, Schoofs Hundt, Kuruchittham, & Li, 2009). Nurses may also serve as trainers. This training differs from that given by the super-users. Nurses who opt to become trainers do not see patients. They normally transition from the clinical area at the hospital to the IT department (Kossman & Scheidenhelm, 2005; Sassen, 2009).

Nurses share some concerns with physicians regarding group efficacy, in that if nurses believe in their ability to manage and operate an IT innovation, they bond and create a consensus in support of the implementation (Darr, Harrison, Shakked, & Shalom, 2003; Wang & Lin, 2007). This consensus is contingent on the belief that their peers and others in similar job categories have the requisite knowledge and skill sets to maintain and operate the EMR system. However, their concern regarding overtime and time away from patients is the largest force for drawing nurses toward the support for new systems (Darr et al., 2003; Furukawa et al., 2010). From the perspective of resistance, nurses can be similar to physicians in that they will band together in opposition to a system selection or implementation of an EMR system if the clinical workflow is significantly disrupted (Ahn et al., 2006; Alquraini, Alhashem, Shah, & Chowdhyry, 2007; Furukawa et al., 2010; Wang & Lin, 2007).

Building the Conceptual Design for this Study

Each construct proposed in this study has been strategically selected based on its use in prior research in the literature (see Figure 1 on p. 9). According to Castillo et al. (2010) and Zandieh et al. (2008), the transition from paper to electronic records by healthcare professionals must be considered in terms of technology-related knowledge, attitudes, and skills, along with behaviors relating to healthcare systems; the following constructs have been selected for this study:

Construct 1. Computer Self-Efficacy (CSE)

CSE is considered one of the most important constructs in social cognitive theory in that it provides direct insight into human intentions and behavior (Torkzadeh, Pflughoeft, & Hall, 1999). CSE, in the context of EMR, refers to a healthcare professional's abilities to perform patient care tasks when he or she uses computers (Compeau et al., 1999). It is defined as a judgment of one's capability to apply computer knowledge to a specific task (Stephens & Shotick, 2002). It can represent an individual assessment of self-skill sets necessary to use technology effectively for performing tasks related to patient care. EMR systems not only include complex hardware and software, but also require healthcare professionals to have a certain level of computer skills; therefore, CSE was selected as one of the constructs for this study as it pertains to one's comfort level when using EMR systems. Boonstra and Broekhuis (2010) as well as Wallace (1999) have identified and investigated three main components that influence the development of self-efficacy: computer confidence, computer liking, and computer literacy. Computer confidence is a self-judgment on an individual's ability to use a computer (Compeau & Higgins, 1995). Computer liking is the enjoyment that an individual experiences from using a computer (Compeau et al., 1999). Computer literacy is the knowledge and ability to use computers effectively (Brinkerhoff & Koroghlanian, 2005).

Dillon et al. (2003) found that CSE significantly influenced EMR system usage by nurses. According to Boonstra and Broekhuis (2010), resistance may stem from (a) a lack of computer and typing skills or the desire necessary to deal with EMR systems and/or (b) a lack of technical knowledge by healthcare professionals to support the systems after implementation. Sam et al. (2005) surveyed healthcare professionals' computer skills and found that vendors have underestimated the actual skill level required to operate their systems effectively. According to Boonstra and Broekhuis (2010), without adequate typing skills, EMR systems actually introduce a new type of medical documentation error, the typographical error ("typo"), as professionals have to enter patient medical information, notes, and prescriptions. Oye, Iahad, and Rahim (2012) noted that a concern often expressed by nurses with poor typing skills in particular is that the implementation of EMR systems may put their careers in jeopardy. This stems from the pressures of learning the new systems, accompanied by a fear of failing to perform the required job functions in a timely manner (Furukawa et al., 2010). CSE was selected as one of the constructs for this study because EMR systems are legal, digital records that require sufficient computer skills for proper operation and the literature has indicated that healthcare professionals' computer skills may not be up to par (Baron et al., 2005).

Factors Impacting CSE

Adler-Milstein et al. (2013) as well as Littlejohn and Foss (2009) found that training may have an impact on CSE level. A correlation has been established between computer literacy and CSE levels, whereby individuals who have had training in various software applications were found to have increased levels of computer literacy as well as higher CSE (Hasan, 2003; Kagima & Hausafus, 2000; Simon et al., 2009). This is also supported in the literature based on work by Kher et al. (2013), J. Smith (1994), as well as Torkzadeh and Koufteros (1994). As a result, organizations that anticipated saving greater amounts of money were found, in one survey, to invest larger amounts of time and resources into employee EMR system training during the implementation (Adler-Milstein, 2013b; Madhavan & Phillips, 2010). Employees at these organizations usually expressed higher CSE than individuals who had not had EMR system training (Adler-Milstein, 2013b). Results from another study by Takian, Sheikh, and Barber (2012) suggested that training effects might even be able to overcome initially low levels of computer literacy among staff members at an organization. Takian et al. (2012) interviewed some 26 stakeholders at a clinic that had implemented an EMR system. They found that, initially, employees at the clinic tended to report low levels of computer literacy and, correspondingly, they also expressed low CSE.

Although computer liking was not directly addressed in semi-structured interviews conducted by Wrench and Punyanunt-Carter (2007), comments made by the staff would seem to indicate that they did not particularly like the idea of a new EMR system, even though training was provided during the implementation phase; the end-users found it to be overly complicated and challenging (Wrench & Punyanunt-Carter. 2007). Hasan (2006a) surveyed an organization that had implemented a training program for its employees prior to full implementation. Following the training program and actual implementation of the EMR system, employees expressed higher levels of CSE. Hasan (2006b) noted that although the employees acknowledged that learning the system had been difficult, they generally felt that they had become more literate in healthcare IS systems and felt more confident about their ability to use the EMR system. Of course, the effects were just the opposite when cases involving a lack of training and computer skills were observed in studies by Takian et al. (2012) as well as by Thatcher, Zimmer, Gundlach, and McKnight (2008). A summary of the literature concerning CSE is provided in Table 2.

Table 2.

Summary of CSE-related literature

Study Conducted by	Methodology Employed	Sample	Instrument/Construct	Major findings and contributions
Dillon et al., 2003	Empirical Study	Sample of 50 nurses	Survey instrument with questions on use frequency and CSE	A lack of CSE reduces EMR system usage in nurses
Adler-Milstein et al., 2013	Theoretical study	Nationwide clinics	Quantitative cost and employee factor survey	Anticipated savings predicted employee training levels and more training equaled greater CSE among staff
Takian, Sheikh, & Barber, 2012	Empirical Study	26 stakeholders at single clinic	Qualitative interview analysis	Training investments could overcome initially low computer literacy and raise CSE
Gillard, Howcraft, Mitev, & Richardson, 2010	Historical study	Sample of articles on gender and IT	Quantitative trend analysis related to gender differences in IT training and use	Reduced CSE in women may be related to anxiety
Jordi, Eva, MaRosa, Teresa, & Nuria, 2011	Empirical Study	113 nurses from single clinic	Regression analysis to account for variance in acceptance of EMR	Training drove greater CSE in women

Construct 2. Perceived Complexity (PC)

PC refers to the degree to which information systems are viewed as being difficult to use (Tornatzky & Klein, 1982). PC has been found to be closely related to perceived ease of use in the literature (Moore & Benbasat, 1991; Thong, 1999; Van Slyke, Belanger, & Comulane, 2004). In fact, many scholars view PC as being the conceptual opposite of perceived ease of use, which explains the degree to which a prospective user would expect EMR systems to be free of effort (Davis et al., 1989). On that basis, perceived ease of use was omitted and PC adopted for this study. The work behind the selection of PC as a construct is that of McDonnell, Werner, and Wendel (2010), which found that professionals were concerned by the complexity of the systems, including multiple screens, functions, and navigational tools, thus hindering the effective use of the implemented workflow. These issues were also noted by Harting, Rutten, Rutten, and Kremers (2009) as well as Thatcher et al. (2008) as causes for resistance.

Legris, Ingham, and Collerette (2002) also found that the complexity of an innovation, in this case an EMR system, may be related to resistance encountered during the implementation of that innovation. Physicians, nurses, and medical technologists complain that the multitasking features of systems are difficult to comprehend. Price (2010) and McDonnell et al. (2010) noted that the more complex a system is, the greater the chance there is for professionals to make data-entry errors or accidently disclose confidential medical information.

Levels of PC vary between professionals who are willing to use EMR systems and those who are not willing to use or learn EMR systems. According to Bleich and Slack (2010), only those who were not willing to learn or use EMR systems cited complex navigation as a factor for resistance. Those who were least resistant to EMR systems cited a large number of required fields and systems not developed to match existing workflow as factors contributing to their resistance (Bleich & Slack 2010;

Kumar & Aldrich, 2010). Post-implementation studies have found that healthcare professionals cited higher levels of PC when they did not receive at least two to four weeks of training prior to live usage (Callan & DeShazo, 2007; McDonnell, Werner, & Wendel, 2010).

Factors Impacting PC

Ajami and Bagheri-Tadi (2013), using a meta-analysis of available articles on EMR usage, found that several other factors could influence PC. Physicians who required new EMR systems to be interoperable with older systems for ease of use tended to express the belief that the systems were more complex than those who did not require this type of compatibility (Ajami & Bagheri-Tadi, 2013; Huang & Shih, 2011). A lack of general knowledge about information systems, combined with concerns over the security and privacy of patient and financial data, was usually associated with physicians and healthcare professionals asserting a higher level of PC (Ajami & Bagheri-Tadi, 2013; Price, 2010). As with the respondents in McDonnell et al. (2010), physicians who believed that their workflow would be disrupted or would require significant changes were also more likely to state that EMR systems were high in complexity (Ajami & Bagheri-Tadi, 2013; Gardner & Amoroso, 2004). The results from Takian et al. (2012) suggested that PC might be more resilient to change compared with other constructs; even after training, clinic employees in that study still believed that the EMR systems were as complex as before. However, the gain in CSE they experienced seemed to offset the negative effects of PC, implying that even fairly high levels of complexity in an EMR system do not necessarily have to serve as a deterrent against that system's implementation and use (Harting, Rutten, Rutten, & Kremers, 2009; Thatcher, Zimmer, Gundlach, & McKnight, 2008).

Similarly, respondents in the articles reviewed by Jordan et al. (2013) tended to express higher PC levels when they had not had a period of familiarization and training with a given EMR system. Due to the many domains that PC seems to intersect as well as the frequency with which it appears as a construct in EMR studies, it could be an important determinant of EMR-related attitudes and actions (Merali, 2006). Contrary to this belief, Jordan et al. (2012) argued that PC has not been comprehensively studied as a central focus in many studies, which is why this construct is included in this research study. A summary of the PC-related literature can be found in Table 3.

Table 3.

Summary of PC-related literature

Study Conducted by	Methodology Employed	Sample	Instrument/Construct	Major findings and contributions
Ajami & Bagheri-Tadi, 2013	Extensive review of the literature	100 articles	Quantitative trend analysis on physician attitudes	Training, interoperability, and security concerns could all impact PC
Callan & DeShazo, 2007	Empirical Study	*n* = 150	Quantitative survey based on constructs: Predisposition to use, and perceived ease of use	Higher levels of PC when people lacked at least 2-4 weeks of training before EMR implementation
Kumar & Aldrich, 2010	Empirical Study	*n* = 180	Quantitative survey based on constructs: perceived usefulness, perceived ease of use, attitude toward technology	Large number of required fields and poor workflow integration leads to PC
Bleich & Slack, 2010	Empirical Study	*n* = 130	Investigator-created quantitative survey	Resistance based on PC only occurs in people not willing to learn/use EMR
McDonnell, Werner, & Wendel, 2010	Empirical Study	*n* = 115	Investigator-created quantitative survey	Providers concerned by highly complex systems that would hinder workflow and lead to errors/breaches

Construct 3. Attitude toward EMR Systems (ATE)

ATE is defined as a disposition to respond either favorably or unfavorably to a technology, institution, or event (Whitten, Buis, & Mackert, 2007; Zheng, Padman, Johnson, & Diamond, 2005). ATE was found to be strongly affected by previous personal experiences with computer systems in either professional or personal settings (Boonstra & Broekhuis, 2010; Schoen et al., 2009). EMR implementation has been studied as an individual decision made by physicians based on their attitudes toward technology, standards of care, and administration (Zandieh et al., 2008). However, resistance as it relates to ATE is scarce in the literature. This seems to warrant further investigation, leading to the selection of ATE as a construct in this study. There is a tendency to extend previous computer system experience to the learning curve of EMR systems usage (van der Meijden, Tange, Boiten, Troost, & Hasman, 2000). The danger is that previous experiences do not dictate how easy or difficult a given EMR system is to learn (Holmes, Brown, St. Hilaire, & Wright, 2012; Schoen et al., 2009). This influence often comes from using simplified systems such as e-mail and word processing applications (Holmes et al., 2012). Negative attitudes seem to impact the motivation either to learn a new system or to develop interest in learning about a new system (McLearney et al., 2012). Healthcare professionals who were involved in the analysis and design process, providing their input on interface design, features, and workflow implementation, depicted a more positive attitude toward EMR systems (Lau et al., 2012).

Factors Impacting Attitude toward EMR Systems

Zarcadoolas, Vaughon, Czaja, and Rockoff (2013) have considered which factors could influence the attitudes that care providers express regarding EMR use and implementation. They found that healthcare professionals cited issues such as complex language, complex visual layouts, and poor usability features as reasons for negative attitudes toward ERM system, also leading to resistance. Similarly, Ajami and Bagheri-Tadi (2013) reviewed 100 articles from journals, books, the Internet, and other sources that concerned healthcare professionals' ATE. The analysis of these articles revealed that physicians and other healthcare providers seemed to exhibit multiple factors that could influence their ATE. Physicians who believed that the use of EMR systems would require significant amounts of time using peripheral devices felt that these systems would prevent them from having sufficient time to spend with their patients; consequently, these physicians expressed more negative ATE. In a study conducted by Goel et al. (2011), respondents expressed concerns about the physical space that EMR systems would require; the belief among some care professionals is that they would benefit little from using EMR systems and especially that any potential benefits would be outweighed by the high cost of the systems. Yamin et al. (2011) reported that the mandate to implement the system within a specific time frame was also associated with fairly negative ATE. On the contrary, Takian et al. (2012) found that negative aspects creating resistance to EMR systems, such as complexity and screen navigation, were counterbalanced with training. However, Lyles et al. (2011) noted that ATE may be a psychological issue; as such, training would do very little to minimize its affect.

Just as expectations related to a lack of benefits or incentives were mentioned in Ajami and Bagheri-Tadi (2013) as being a reason for negative ATE, there are also incentive-related issues that can positively influence the ATE levels expressed by staff members. In a study by Ting, Kwok, Tsang, Lee, and Yee (2011), eight doctors were interviewed regarding their experiences and perceptions of EMR systems that had recently been implemented in their multidisciplinary clinic. The physicians had reported initial expectations involving several specific incentives they believed would be realized with the use of EMR. These incentives were related to some of the evidence-based benefits that have been associated with general EMR use in the literature; they include preventing medical errors or mistakes due to poor or illegible handwriting, avoiding the loss or misplacement of physical copies of paper-based charts, encountering inconsistent terminology from one staff member to another as the terms were standardized, and patients being administered the wrong medications (Ting, Kwok, Tsang, Lee, & Yee, 2011).

Fairley et al. (2013) argued that individuals who had personally encountered negative issues such as medical errors due to illegible handwriting, misplaced paper-based charts, or wrong medication being administered at some point in their career, were more than likely to have their overall ATE linked to the belief that the EMR system would address these problems. While these results show that there are possibilities for positive influences on ATE, the small sample size of Ting et al.'s (2011) study makes their findings difficult to generalize to larger populations, including healthcare staff populations that do not include non-physicians. The discovery of both positive and negative influences on ATE has been fairly well documented in the literature, but studies have not yet determined the relative strength of these influences or how they interact. The importance of the ATE construct and the number of aspects of it that remain to be discovered, provide a rationale for including ATE in the present study. Table 4 outlines the relevant literature on ATE.

Table 4.

Summary of ATE-related literature

Study Conducted by	**Methodology Employed**	**Sample**	**Instrument/Construct**	**Major findings and contributions**
Poon et al., 2006	Empirical Study	52 healthcare stakeholders, 12 experts	Focus group interviews/semi-structured interviews involving five IT dimensions	Cost and productivity are major concerns causing negative attitude toward the systems

Jha et al., 2006	Literature review and meta-analysis	Surveys of EMR implementations through 2005	Surveys of facilities who have implemented EMR system through 2005	Negative attitude toward EMR limits adoption in private physician clinics
Schoen et al., 2009	Empirical Study	10,000 private care physicians in 11 nations	Investigator-created quantitative survey	More negative views on EMR in the United States than in other nations
Fairley et al., 2013	Literature review	50 staff and 9,725 EMR documents	Efficacy analysis and attitude survey	Females emphasized less patient contact as a driver of low ATE, while males had higher ATE due to greater system efficiency
Ajami & Bagheri-Tadi, 2013	Literature review	100 articles	Trend analysis on physician attitudes	Belief that EMR would reduce time spent with patients leads to reduced ATE

Construct 4: Peer Pressure (PP)

Homophily is a social process where opinions are generated by social leaders who are similar in various ways to people choosing whether to resist a particular situation or innovation (McPherson et al., 2001). Actually, Tarde (1903) first presented this idea of homophily, describing a social practice that he deemed critical to the adoption of technology; however, his theory did not extend to the resistance of technology. Rogers (2010) transferred the class nature of homophily to the employment status of individuals in the 21st century, noting that most diffusion networks in business are more interpersonal in nature, “occurring between persons with similar jobs and education levels” (p. 287). This trend was further studied by Kearns (1992) who identified sociocognitive links between IT specialists in 127 municipalities in Pennsylvania.

According to Glaser (2009), the diffusion of computer applications and computer hardware was shown to depend more on interpersonal professional and casual communications within groups of professionals who shared similar education, work experience, and personal backgrounds than on individual evaluations of the software and hardware. This seems to be the case as it relates to resistance of EMR systems (Schoen et al., 2009). Healthcare professionals who share similar backgrounds, education, and work experience tend to band together either to accept or to resist a given EMR system (Zhend et al., 2011).

Zhu, Kraemer, and Xu (2006) noted that homophily can also result in the blocking or slow the diffusion of technology, as seems to be the case with EMR systems. This is because communication between very like-minded groups often creates a resistance to changing the status quo (Kearns, 1992; Rogers, 2010). More extreme or radical innovations are often diffused through heterophilious communication (Rogers, 2010). Homophilious populations communicate only with one another, so "weak tie," one of the more valuable diffusion processes, has no opportunity to function in homophilious settings (Rogers, 2010; Zhu et al., 2006). Innovation often requires some degree of heterophilious communication and interaction for diffusion within a general population of mixed groups (Rogers, 2010). In the context of EMR system implementation and use, this heterophilious communication has been demonstrated during various interactions where through this type of communication, physicians or nurses establish a "strong tie" leading to resistance, thus, causing the implementation to fail (Reardon & Davidson, 2007; Wright et al., 2010).

The primary driver of diffusion, whether the process is homophilious or heterophilious, is a small population of leaders labeled by Rogers (2010) as opinion makers. Opinion makers in a workplace setting are respected leaders perceived as being "more technically competent" by the majority of persons within a group (p. 289). These leaders may be formal "leaders" or executives or they may be employees who are acknowledged as competent and trustworthy by other employees. They have the ability to bring EMR implementations to a halt using resistance.

Factors Impacting Peer Pressure

Healthcare professionals tend to follow the lead of respected peers and, when they have a close network, they are strongly influenced by peer attitudes regarding the value of EMR systems (Sykes, Venkatesh, & Rai, 2011). However, the same reliance on peer networks may result in these professionals being less concerned with instruction and guidance on the proper use of EMR systems, simply because they do not want to change their routine and would prefer the systems to adapt to their environment and workflow (Burt, Meltzer, Khalili, & Marlow, 2010; Sykes et al., 2011). A study by Doolan et al. (2003) involving one particular EMR system being used at 10 hospitals found that physicians and other healthcare professionals do talk to one another and with management about EMR systems, their functions, and their perceived effectiveness. The literature suggests positive peer pressure is an important factor that influences resistance (Rogers, 2010). Positive peer pressure serves as a driving force for technology usage, thus keeping companies and individuals competitive in a market (Gatignon & Robertson, 1989). Analyses by both Thong (1999) and Zhu et al. (2006) have served as theoretical foundations of PP as it relates to IS adoption. However, resistance to use as it pertains to PP is scarce in the literature.

It is known that healthcare professionals talk amongst themselves about the EMR systems and their views on implementing the systems (Glaser, 2009). The literature is not clear on the nature of peer pressure and its role in the resistance to EMR systems. The only fact that is clear is that healthcare professionals tend to follow the leader of their respected peers. For this reason PP was added to this study to test the relationship between PP and resistance to EMR systems amongst healthcare professionals. Table 5 gives a summary of the PP-related literature.

Table 5.

Summary of PP-related literature

Study Conducted by	Methodology Employed	Sample	Instrument	Major findings and contributions
Glaser, 2009	Empirical Study	Care providers at 10 hospitals	Structured interview on EMR, attitudes, and communication	Care providers talk to one another frequently, allowing for rapid transmission of information related to EMR
Schoen et al., 2009	Empirical Study	10,000 private care physicians in 11 nations	Investigator-created quantitative survey	Less peer pressure in favor of use in the United States than in other nations

Zhu et al., 2006	Empirical Study	415 businesses	Quantitative survey based on constructs: relative advantage, compatibility costs	Competitive pressure or peer pressure will positively influence businesses to use technology.
Doolan et al., 2003	DOI Empirical Study	Sample *n* = 215	Investigator-created quantitative survey	Those who fall in the late majority are typically skeptical and implement only as the result of increasing peer pressure.
Burt et al., 2010	Re-analysis of the literature	75 articles	Trend analysis on peer pressure	Found that peer-pressure had the weakest effect on physicians' behavior change and instead noted it was more likely that it was their personal predisposition toward implementation.

Construct 5: Anxiety

Anxiety in the context of EMR systems use is defined as a fear of electronic health records when using them or fearing the possibility of having to use a computer (Chua, Chen, & Wong, 1999; Cork et al., 1999; Embi, 2007). Anxiety is considered an emotional fear of a potential negative outcome, such as rendering a system inoperable or appearing computer-illiterate in the eyes of others (Brosnan & Lee, 1998; Kaushal et al., 2009). From an information-processing perspective, the negative frame of mind associated with high anxiety diminishes cognitive resources for task performance (Brown & Coney, 1994; Dixon & Stewart, 2000). According to Embi (2007), the performance of computer users with anxiety might be less adequate than those with little or no anxiety. The literature seems to indicate that a high level of anxiety may be negatively related to learning new software and resistance to using new applications (Beiter et al., 2008; Coffin & Mackintyre, 2000).

In relation to resistance to EMR systems use, anxiety seems to increase due to a perceived lack of support once the systems are implemented (Kumar & Aldrich, 2010). It reflects self-doubts, concerns for changes in one's routine and common practice, and beliefs in technical competence (Devine et al., 2008). According to Dansky et al. (1999), some healthcare professionals feel anxious that implementing EMR systems was equivalent to handing their jobs over to machines or that using them would create an over-reliance on technology that would make them increasingly unable to function without IT systems. Anxiety was selected as a construct for this study because it is considered one of the most reliable predictors of computer usage in personal and professional settings (Chua et al., 1999; Crosson, Isaacson & Lancaster, 2008).

Factors Impacting Anxiety

According to Kumar and Aldrich (2010), one factor that may potentially be impacting anxiety is perceived financial loss. The current regulation requires that healthcare facilities implement EMR systems by a certain deadline and show meaningful use of those systems. Devine et al. (2008) explained that if the systems are not implemented and meaningful use achieved, the facilities risk financial loss in terms of fines and loss of incentives promised to those who have successfully implemented EMR systems. In a large-scale assessment of overall EMR implementations in the United States between 2008 and 2012, DesRoches et al. (2013) found that for hospitals that had implemented these systems, executives generally favored financial reasons for doing so, including more efficient care delivery with fewer errors and the ability to reduce administrative tasks and staff.

In another survey, Adler-Milstein, Green, and Bates (2013a) noted that many clinics and healthcare providers did not share this enthusiasm for cost savings. Instead, private-practice physicians were concerned that EMR systems could be too expensive to purchase, implement, and maintain, while those working in larger organizations feared that EMR system implementations might result in staff downsizing (Adler-Milstein, Green, & Bates, 2013a; Kumar & Aldrich, 2010; Sam et al., 2005). These concerns would seem sufficient to cause providers to have anxiety that would lead to resistance against implementing and using EMR systems (Adler-Milstein et al., 2013a; Wrench & Punyanunt-Carter, 2007). Interestingly, the financial analysis in Angst and Agarwal (2009) also validated anxiety expressed by private practice physicians, as they predicted financial losses for the majority of practices implementing these systems. Kaushal et al. (2009) feared that implementation of the systems simply to meet the mandate would cause difficulty in achieving meaningful use. The anxiety-related literature is presented in Table 6.

Table 6.

Summary of anxiety-related literature

Study Conducted by	Methodology Employed	Sample	Instrument/Construct	Major findings and contributions
Schectman, Schorling, Nadkarni, & Voss, 2005	Quasi-experimental study design and administered survey	*n* = 117	Investigator-created quantitative survey	Found that prior computer experience did not affect actual use, although it diminished anxiety
Barbeite & Weiss, 2004	Empirical Study	*n* = 612	Quantitative survey based on constructs: anxiety and self-efficacy	Anxiety about computer use was a significant predictor of self-efficacy
Wrench & Punyanunt-Carter, 2007	Empirical Study	*n* = 145	Quantitative survey based on constructs: anxiety, computer-self-efficacy, presence	Anxiety causes a person to focus internally on his or her anxiety, prohibiting him or her from attending to external stimuli
Embi, 2007	Empirical Study	*n* = 262	Quantitative survey based on constructs: anxiety, computer anxiety, self-efficacy, computer self-efficacy	The best predictor of level of computer anxiety is level of computer self-efficacy
Sam et al., 2005	Empirical Study	*n* = 148	Quantitative survey based on constructs: computer self-efficacy, computer anxiety, and attitudes toward the Internet	Differences in computer anxiety, attitudes toward the Internet, and computer self-efficacy based on gender

Gender Differences in CSE, PC, ATE, PP, and Anxiety

Few studies have dealt directly with gender differences as they relate to the resistance to EMR systems, and more widely, HIS in general (Gillard et al., 2008). However, gender differences and their influence on resistance to EMR systems are important because of the larger societal issues that influence male and female IT ability and attitudes (Audet et al., 2004). In one of the few studies focusing on gender, IT training programs, attitudes toward IT, and the acquisition of systems, Burt, Hing, and Woodwell (2005) found that the United States, like other nations, suffered a gender gap with regard to IT usage. They argued that schools, workplaces, mass media, and other social institutions often reinforce the notion that IT is a male domain, which may discourage women from entering into IT as a profession, hobby, or recreational pursuit.

This social pressure can translate into PP in the workplace that discourages female employees from readily accepting technology or demonstrating a high skill level in IT usage (Gillard et al., 2008). MacGregor, Hyland, Harvie, and Lee (2007) found that some women tended to report higher anxiety in relation to using IT compared to males and that this higher anxiety level, combined with PP to excel in the workplace by demonstrating strong IT skills, was a major driver of lower CSE in women. Despite the findings by MacGregor et al. (2007), McGowan, Passiment, and Hoffman (2007) found that women were more open to the idea of implementing and using EMR systems than some of their male counterparts. These findings have obvious implications for how readily EMR systems are accepted by female healthcare providers, particularly if they are working in environments that are highly conscious of traditional gender roles.

While it appears that no study to date has focused solely on gender differences underlying EMR system resistance specifically, some gender differences do emerge in the research on EMR adoption. Fairley et al. (2013) described EMR implementation at an urban sexual health center by means of staff surveys. Their study found that there were gender differences expressed in overall ATE, with males tending to express higher ATE and female staff expressing lower ATE, particularly in the clinical area (Fairley et al., 2013). Differing reasons were cited by staff for their opinions, with males prioritizing greater efficiency and cost control, while female staff expressed concerns over having fewer opportunities for personal interaction with patients (Fairley et al., 2013). While these results would seem to support some of the claims made by Gillard, Howcroft, Mitev, and Richardson (2008), Fairley et al. (2013) did not use survey assessments with constructs CSE, PP, or anxiety, so in relation to this research study, this evidence can only be said to be partial at best.

Other research has found somewhat different outcomes, as well; Jordi, Eva, MaRosa, Teresa, and Nuria (2011) surveyed primary healthcare nurses and found that the gender differences present in their results were due to women having more positive ATE than the male nurses in their study. Of the sample, 87.5% of the nurses were female and 80% were trained on the EMR system prior to implementation; the gender ratio may have altered PP dynamics found by MacGregor et al. (2007) from what might be expected in Western society and the training may have raised participants' CSE to counteract any potential anxiety (Jordi et al., 2011). The main determinant of a positive ATE, however, seemed to be time spent using the EMR system (Jordi et al., 2011). More research was required to discern whether gender differences exist with regard to the factor of PC and if so, what these effects are.

What is Known and Unknown Regarding CSE, PC, ATE, PP, and Anxiety

A great deal of data have been collected over the last few years regarding an increase in EMR system usage that helps explain what is known and what is unknown in the literature as it relates to the constructs of CSE, PC, ATE, PP, and anxiety. Recent research has presented CSE in a useful way, showing in several studies how it seems to affect the likelihood of organizations implementing and/or using EMR systems (Ma &

Lui, 2007; Morton, 2008; Nixon, 2009; Price, 2010). What remains unknown is the impact that CSE has on resistance to using EMR systems, especially for all healthcare personal not just physicians.

Some of the features of PC have also been demonstrated in the literature and the available research seems to indicate that a combination of personal factors, such as beliefs and expectations, and technological factors, such as structure and function of EMR systems and HIS systems themselves, can impact this construct (Oye et al., 2012). PC has mostly been researched from the purview of adoption (Berner et al., 2005; Boonstra & Broekhuis, 2010; Morton & Wiedenbeck, 2009); hence, the literature is scarce when it comes to testing the impact of PC and resistance to EMR systems. Therefore, the exact impact of this construct to resistance to using EMR systems is not clearly documented in the research literature.

A wide range of positive and negative influences on ATE has been defined in the literature as well and the extant research indicates that this construct may be the most important one in determining whether organizations as well as their staff will ultimately implement and use EMR systems in a meaningful way (Ayatollahi et al., 2012; Brosnan & Lee, 1998; Gaylin et al., 2011; Ilie et al., 2007). The problem is that the construct of attitude towards technology, in general, is predominantly found in the adoption literature (Burt & Sisk, 2005; Dansky, Gamm, Vasey, & Barsukiewicz, 1999; Morton, 2008). As this research study focused on resistance to EMR systems, the literature provides little information on the impact of ATE on resistance to using EMR systems.

The phenomenon of PP has also been established in the research as occurring in organizations that are planning to, or already have, implemented EMR systems (Ludwick

& Doucette, 2009; Venkatesh et al., 2003). However, there are limited resources in the literature on exactly how PP impacts resistance to using EMR systems in particular. Similarly, anxiety has been fairly well described at the individual care provider level, along with the relationship it seems to share with several other constructs, such as perceived ease of use, perceived usefulness, and intention to use the technology (Brown & Coney, 1994; Chua et al., 1999; Sam et al., 2005). The results of these studies show the state of the current knowledge on EMR system implementation and use; however, from the perspective of resistance to use, there seems to be a lack of collected data to show what exactly is known.

While the findings that have been compiled regarding EMR adoption and the constructs that can influence acquisition among care providers are certainly useful, there are still many areas of resistance to EMR systems that have not been fully described in the literature, including the area of *resistance*. The literature is primarily focused on adoption and what it would take to convince health professionals to start using EMR systems. However, questions such as why healthcare professionals resist the implementation of EMR systems appear to be addressed very rarely. While CSE has been thoroughly studied, some findings seem to conflict on its significance, relative to other constructs considered in this study, and in particular, whether it can influence ATE through PC or whether it influences overall ATE independently of changes to the PC construct. Similarly, PC as an overall determinant of procurement of EMR systems has generated some inconsistent results, with some surveys suggesting that staff PC is critically high prior to EMR system implementation, while other studies imply that training can encourage implementation of EMR systems without impacting PC (Bleich &

Slack, 2010; Takain et al., 2012). The relative weights of the influences on ATE may also not have been determined in the literature, particularly in terms of which positive factors may be sufficient to overcome negative influences.

Further studies must also be conducted to define PP’s relationship to the other constructs more precisely, as well as how gender may impact the other constructs. As one of the major components impacting EMR system use, anxiety is one of the least-studied in EMR research, given that other research has focused on anxiety from patients’ perspectives (Ash, Berg, & Coiera, 2004; Hunt, Haynes, Hanna, & Smith, 1998; Stewart, Kroth, Schuyler, & Bailey, 2010). Patients are particularly concerned that the use of EMR systems by physicians and other healthcare professionals may impact their face time with their caregiver, thus, lowering the satisfaction level of their visit (Gillard et al., 2008). An in-depth review of the literature has not revealed the types of anxiety that would influence healthcare providers’ resistance to using EMR systems (Brown & Coney, 1994; Oye et al., 2012). Gender differences in healthcare technology have also presented a gap in the literature, because there appear to be few studies directly addressing gender as a variable that may impact resistance to EMR systems, even though the IS literature consists of several studies that address ATE and its impact on how men and women respond to technology (Ahuja & Thatcher, 2005; Gefen & Straub, 1997; Ong & Lai, 2006).

Summary

The theoretical frameworks built upon Tarde’s work over the past century have established that resistance to technology and innovation is a human social process. The studies of physician and nurse resistance to EMR systems directly or indirectly rest on the findings of Tarde (1903), Ryan and Gross (1943), Rogers (1995), Davis (1989), among others who have examined the human emotions as well as fears related to change and innovation. The literature consists of many studies that focus on one or more aspects of the human social process of adoption or resistance to technology.

The most effective studies use the theoretical frameworks of human response to innovation to identify specific factors that may be more common or more powerful in supporting resistance to using EMR system implementations (Ayatollahi et al., 2012; Bhattacherjee & Hikmet, 2007; Brooks & Grotz, 2010). Physician concerns with litigation are a common theme and this can be tied to self-efficacy, group efficacy, and even concerns about the physical environment in which the systems operate. Nurses generally focus on the effects a system will have on patient care and whether such a system will allow them to spend more time with patients (Furukawa et al., 2010).

EMRs are being implemented by an increasing number of healthcare providers, on the grounds that EMRs have the potential to confer a variety of benefits to multiple healthcare stakeholders, from improving productivity and enabling improved workflow to increasing patient safety. At the same time, however, the implementation of EMRs among American healthcare providers has not been universal and the implementation of these systems has proceeded at a rate that is much slower than other developed nations. Several constructs have been identified in the literature as having a potential impact on the likelihood of individual care providers to accept readily or to resist EMR implementation and usage. CSE has been established as a factor that involves computer literacy and computer liking; some studies have suggested that both prior and current experience can influence how an individual perceives his or her own level of efficacy with IT (Baron et al., 2005; Wallace, 1999). Higher levels of complexity have been seen to relate to computer experience, singular literacy, and training, but even fairly high PC does not always serve as a necessary reason for resistance to using EMR systems. On the other hand, negative ATE can be a potent resistance mechanism to EMR system implementation and there are a multitude of factors related to ATE. PP can promote resistance to EMR systems, although this construct could potentially work to facilitate implementation of the systems under certain circumstances (Crane & Crane, 2008). Anxiety could also pose a threat to implementation and the factors that promote or reduce it are not always clear (Brown & Coney, 1994). These constructs have been defined in the literature and some of their effects on EMR system implementation have been demonstrated in a robust, valid manner. At the same time, numerous studies remain to be undertaken on these constructs to understand their relative importance in determining resistance to use of EMR systems. This study addressed some of the gaps that currently exist in the literature while striving to build upon the knowledge of previous studies involving EMR system implementation and perception.

Chapter 3

Methodology

Despite the federal mandates to implement EMR systems, the literature shows strong resistance among healthcare professionals to use the systems (Cherry, Ford, & Peterson, 2011; Ferris, 2010). Therefore, using the proposed model (See Figure 1), which is based on the constructs of CSE, PC, ATE, PP, and Anxiety with the use of a Web-based survey instrument, this study sought to find the source of this resistance. Data was collected and analyzed from 300 healthcare professionals drawn from a sample population of 1576. This research evaluated healthcare professionals' resistance to using EMR systems using a quantitative approach. The quantitative analyses using SPSS and the R programming language allowed for the exploration of relationships between the constructs. CSE, PC, ATE, PP, and Anxiety were chosen based theoretical foundations established in previous research on technology usage. According to Creswell (2009), any research involving the measurement of the effect of variation of one or more independent variables on the variation of one or more dependent variables is quantitative in nature.

The quantitative approach allowed this study to minimize bias in the analysis by using statistical tests to examine the veracity of the proposed hypotheses (Plonsky & Gass, 2011). This study used Partial Least Square Regression in R (PLS), a Structural Equation Modeling (SEM) approach using SPSS, and R software for data analysis, hypotheses testing, to determine path significance estimates (Byrne, 2001; Chin, 1998). In order to implement EMR systems successfully, the reason for resistance must be well understood (Burt et al., 2010). PLS Regression in R is considered an effective approach to examine causal relationships between independent and dependent variables (Chin, 1998; DesRoches et al., 2008). SEM is a broader version of the general linear model (GLM), thus, making it a second-generation data analysis technique. First generation techniques such as linear regression and logistic regression are only able to test the relationship between the independent variables (IVs) and dependent variable (DV) without inter-IVs relationships. However, SEM is capable of examining all the relationships including the inter-IVs relationships in one procedure (Arbuckle, 2010). Moreover, Analysis of Covariance (ANCOVA) via SPSS was used to measure indirect effects of the IVs through control variables; in the case of this study, these control variables consist of: age, gender, role in healthcare, years in healthcare, and years of computer use.

The quantitative methodologies using SEM along with the proposed hypotheses guided the research design as well as the statistical analyses that this research study employed. The hypotheses are based on the proposed model consisting of constructs from prior literature (Barbeite & Weiss, 2004; Brown & Coney, 1994; Cork & Detmer, 1999; Laumer & Eckhardt, 2012; Rogers, 2003; Rogers, 2010). Research hypotheses were explored in two ways, namely (a) the use of SEM to discover specific path dependencies and inter-variable relationships within each hypothesis; and (b) the use of null hypotheses of the covariates using the ANCOVA approach (Creswell, 2009).

Both ANCOVA and ANOVA measure effect through an F value; the significance of F value is measured through p statistics (Rutherford, 2012). The use of F values, thus, allows the calculation of how much explanatory power is added to ANCOVA analysis by the addition of a covariate (Rutherford, 2012). For example, if the F value of an independent variable is both > 0 and has $p < .05$, but the F value of a covariate is not significant, then it can be concluded that the addition of the covariate did not add explanatory power to the relationship (Rutherford, 2012). On the other hand, if the covariate's F value is significant and positive, then it can be concluded that the ANCOVA model has more explanatory power because of the addition of the covariate (Rutherford, 2012). The SEM approach was used to test the proposed predictive model (Chin, 1998) (See Figure 6).

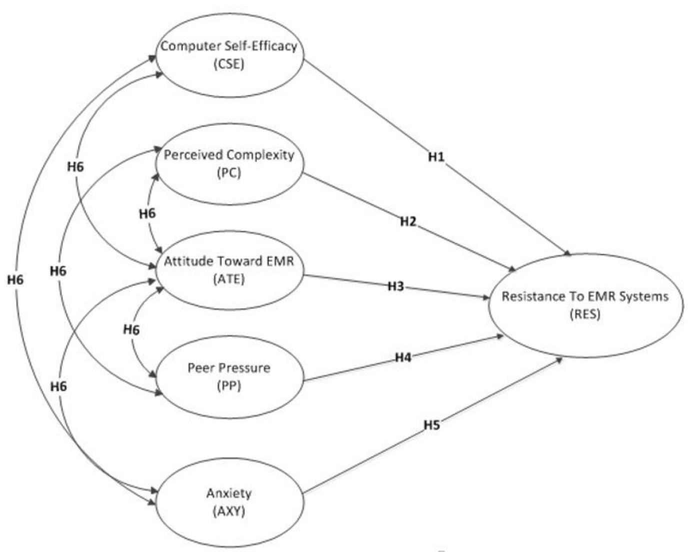

Figure 6. SEM schematic with five IVs and one DV.

Survey Instrument

Table 7.

Survey instrument format

Variable Type	Specific Variable	Scale
Independent	PC	Likert scale, 1-7 (1: Strongly disagree, 7: Strongly agree)
Independent	Anxiety	Likert scale, 1-7 (1: Strongly disagree, 7: Strongly agree)
Independent	ATE	Likert scale, 1-7 (1: Strongly disagree, 7: Strongly agree)
Independent	PP	Likert scale, 1-7 (1: Strongly disagree, 7: Strongly agree)
Independent	CSE	Likert scale, 1-7 (1: Strongly disagree, 7: Strongly agree)
Covariate	Age Gender Years in healthcare Healthcare role Years of Computer Use	
Dependent	EMR resistance	Likert scale 1-7 (1: Completely unenthusiastic, 7 = Completely enthusiastic)

This study used a combination of emailed surveys, and an online survey instrument to collect quantitative data to evaluate empirically the impact of CSE, PC, ATE, PP, and Anxiety on resistance to EMR systems. The survey instrument followed the format indicated in Table 8. The instrument was based on surveys by Aldosary (2003), Barbeite and Weiss (2004), Cork et al. (1998), as well as Laumer and Eckhardt (2012) in their research on technology resistance and usage. All three surveys have been tested and validated in prior studies. The survey instrument for this study consisted of 45 items as suggested by Dane (2010). The 45 items was divided into six categories: CSE (eight items), PC (eight items), ATE (eight items), PP (eight items), Anxiety (seven items), and a demographic information category consisting of six items. All the items in this study were modified from questions taken from Aldosary (2003), Cork et al. (1998), along with Laumer and Eckhardt (2012) to retain validity by maintaining the standard format for measuring the items. Chi-square testing was used to measure the internal reliability of the survey, with 0.8 representing the cutoff for acceptable internal reliability, based on Creswell's (2009) recommendations. The survey instrument for this study went through the following process:

1) Construct validity and reliability (Six subject matter experts)
2) Content and face validity (Delphi exercise)
3) Pilot study (20 participants complete the questionnaire & Cronbach reliability measured using SPSS)
4) A survey of 300 participants after the three items above from a sample of 1576.

Validity and Reliability

Construct validity was done to ensure a level of confidence with regard to the instrument used in a given study (Macnee, 2008). To achieve construct validity in this study, confirmatory factor analysis (CFA) of the items was performed along with Comparative Fit Index (CFI) using R programming. CFA was selected because it is the most widely used to test the validity of hypothesized models (Leedy & Ormrod, 2005). The constructs were evaluated for reliability, convergent validity, and discriminant validity (Straub, 1989). Before a data collection method can be done, validity and reliability of the data collection instrument must be established (Kimberlin & Winterstein, 2008). *Validity* is the extent to which the observation measures what it is supposed to measure. It ensures that a construct and model describes reality (Delgado-Rico, Carretero-Dios, & Ruch, 2012).

According to Vogt, King, and King (2004), internal validity shows that the data justify the results and it is the degree to which the details reflect reality at the moment of observation. To accomplish this type of validity in this study, six subject matter experts -- consisting of one physician, two nurses, one clinical technician, one medical technologist, and one clinical analyst -- were asked to review the initial draft of the instrument. The reliability was calculated in SPSS using Cronbach's Alpha measure (Delgado-Rico et al., 2012). According to Mertler and Vannatta (2001), measures using Cronbach's Alpha that demonstrate reliability score over 0.70 should be considered reliable. The subject matter experts were asked to review the survey instrument based on a 1-10 scale from the perspective of cause-and-effect relationship. From '1' being that the construct had no significant effect on the dependent variable to '10' being that the construct had a significant effect on the dependent variable. In addition to rating the constructs, the participant also provided feedback on the items aimed at testing them. In considering external validity, participant representation is of utmost importance (Campbell & Stanley, 1996). The participants for this study obtained through voluntary participation, as they are healthcare employees from the physician study champion's clinic. This constitutes a non-random convenience sampling of the participants.

Content and Face Validity

Content and face validity was determined using the four phases of the 'Delphi Exercise' Method (Okoli & Pawlowski, 2004). The Delphi is particularly appropriate when decision-making is required in decisions that affect strong factions with opposing preferences, such as implementing or not implementing EMR systems (Gill, Leslie, Grech, & Latour, 2013; Taylor & Meinhardt, 1985). The Delphi Exercise was chosen over the ‘Delphi Conference’ because this research study did not have the software resources required to implement the faster and more modern ‘Delphi Conference.’ The main difference between the two methods is that Delphi Exercise uses pen-and-paper and the Delphi Conference is a software program. This research study utilized a panel of experts in the area of EMR implementation to build consensus on healthcare professionals’ resistance to EMR systems, basically applying the Delphi Exercise technique to revise the questionnaire. A group of professionals different from those involved in Phase One were asked to participate in a Delphi Exercise process. These professionals consisted of one physician, two nurses, one clinical technician, one medical technologist, and one clinical analyst. In Round One (R1), the participants reviewed the questions on the questionnaire and provided feedback. The feedback was reviewed and the questions were modified accordingly. In Round Two (R2), the participants reviewed the modified questions and provided feedback once again. The feedback given was reviewed and the questions modified. In Round Three (R3), participants reviewed the modified questions and provided feedback once again. The feedback given was reviewed and the questions modified. In Round Four (R4), the participants for the last time reviewed and provided feedback on the modified questions from round three and provided final feedback. This study reviewed the feedback from the final round and determined the final 45 items that was used on the official survey instrument. Feedback obtained during each phase was used to encourage the selected Delphi participants to reassess their initial judgments on the area of healthcare professionals’ resistance to using

EMR systems until a consensus is met (Okoli & Pawlowski, 2004; Ramim & Lichvar, 2014).

Pilot Study

Prior to conducting the main study, a pilot study was conducted to examine the usability of the final survey instrument. Along with content and face validity, the pilot study helped to identify unclear and confusing survey items (Lewis-Beck & Liao, 2014). This helped to correct errors and rephrase questions for greater clarity. A variety of participants (e.g., physicians, clinical technicians, nurses, & medical technologists) and settings (clinics & hospitals) contributed to this process. The participants provided feedback on the design, content, and length of the questionnaire. The survey instrument was administered to a focus group of 20 healthcare professionals on two separate occasions, as suggested by Kimberlin and Winterstein (2008). Completing the survey was physicians (n=2), clinical technicians (n=2), nurses (n=2), medical technologists (n=2), clinical analysts (n=2), system analysts (n=2), phlebotomists (n=2), radiologists (n=2), surgical technologists (n=2), and case managers (n=2). Cronbach reliability was calculated using SPSS after the pilot study, and ultimately the pilot study helped to determine the estimated time to complete the survey, as well as identify ambiguities in the survey items.

Although, this research used modified items based on earlier studies that have been assessed for validity and reliability, as mentioned in the previous section, this does not guarantee reliability and validity for this study. Therefore, reliability and validity testing was conducted using a smaller sample in order to assure the main study would yield reliable results. As such, this study obtained a Cronbach’s Alpha score from the pilot study and that of the final study sample to ensure that the test demonstrates internal consistency (Leedy & Ormrod, 2005). With the help of the physician study champion, this study had 20 healthcare professionals ready and willing to participate in the validation of the survey instrument.

Population and Sample

This study required a sample of 300 participants from a population of 1,576. From the required 300 participants, 50 healthcare professionals have been secured with the help of the study champion. These 50 participants have agreed to complete the final version survey instrument after the approval of the dissertation proposal, Institutional Review Board (IRB), construct validity and reliability, content and face validity and the pilot study are completed. This study used a quantitative self-reporting exploratory survey to collect data for analysis (See Appendix A). This sample consists of a small number of physicians, nurses, medical technologists, healthcare IT professionals, and clinical technicians. This study drew the additional 250 participants from a nationwide population of healthcare professionals of all types, including physicians, nurses, technicians, and individuals performing administrative work. This study used PLS-SEM. This is an advanced form of regression analysis/principal component analysis that examines the relationship between a dependent variable matrix (A) and a matrix of independent variables (B) (Hair et al., 2014). Chin, 2011 noted that it is best to use the R software and perform variance-based SEM. Chin, 2011 also noted that the selection of the sample size should take into consideration the desired power levels; as such, this study followed Dattalo (2008) recommendation and used G*Power to computer sample size with settings (alpha= 0.05 & beta=0.80).

This study attempted to recruit participants who would allow the sample to match the healthcare professional population in terms of gender and age distribution, along with varying roles and years in the field. This research study collected more than 350 surveys from participants nationwide, despite needing only 300 surveys. This would help secure a total of 400 surveys (350 nationwide & 50 participants secured through this study's physician champion). Collecting more surveys than needed helped meet the criteria for statistical generalizability (Meinert & Peterson, 2009; Plonsky & Gass, 2011).

Pre-analysis Data Cleaning

Pre-analysis data screening was a critical step in the present study. After collecting and coding the data from survey participants, this research study reviewed each survey to ensure that all questions have been answered in a manner consistent with the coding. This helped to identify anomalies in the data collected, which was crucial for validating the conclusions of this study (Levy, 2006). If any participants abandon the survey or fail to answer multiple questions, their surveys were excluded from the analysis to avoid introducing biased responses. According to Levy (2006), this issue can be addressed with a Web-based survey developed to make sure all fields are completed before the form can be submitted. Pre-analysis data cleaning also involved addressing response-set and outliers. Response-set happens when participants provide the same response for all the items in the questionnaire. According to Myers and Mullet (2003), response-set may disclose true differences in attitudes, or just the fact that some participants have the predisposition to use only part of the rating scale. Therefore, response-set weakens that validity and reliability of the questionnaire. According to Levy (2006), this can be handled through a response-set test. For this study, collected data was evaluated using a response-set test. The data was exported into Microsoft Excel for analysis. Survey responses that were found to qualify as response-sets were discarded from the data set.

During this phase of this study, outliers were addressed. According to Levy (2006), outliers represent the effect of extreme cases or atypical data values. A review of the data was performed to isolate extreme cases that would skew the data set, and an analysis conducted to determine whether the discovered data should remain or removed. Multivariate outliers were also assessed for by examining Mahalanobis Distances. The multivariate outlier cases that fall within the 90th percentile were identified and considered for removal.

Analyses Proposed

Preliminary Cronbach's Alpha reliability and confirmatory factor analyses (CFAs) was conducted on the independent variables. In order to present acceptable reliability, Cronbach's Alpha reliability measure, their scores should be above .70 (Delgado-Rico et al., 2012; George & Mallery, 2010). This study used a PLS techniques in R to test the model. This method was selected for the fact that it is a statistical technique used extensively in causal relationship research (Byrne, 2001). Another reason is that measurement and CFA models can be used to eliminate errors, making estimated relationships among independent variables (CSE, PC, ATE, PP, & Anxiety) less sensitive to linearity, normality, and homoscedasticity assumptions (Arbuckle, 2006b). Participants were asked to evaluate each item based on a Likert-type scale, which range from (1) Strongly Disagree to (7) Strongly Agree. PLS path analysis in R was used to determine the strength of the structural paths (Chin, 1998). The use of PLS-SEM in R helped to examine a causal model for resistance to using EMR systems and empirically test the relationships between CSE, PC, ATE, PP, and Anxiety (Arbuckle, 2006b; Chin, 1998).

Based on this study's model (Figure 1), the PLS-SEM approach in the R software is adequate since it is used for causal modeling for the purposes of prediction and theory testing (Stevens, 2009). PLS path modeling was used for theory confirmation, and it assumed that all measured variance would be useful for explaining the hypotheses, and would indicate causal relationship with significant effect.

SEM has become common within a variety of domains, particularly management research, for analyzing the cause-and-effect relations between latent constructs (Kline, 2011). SEM was used to analyze the predicted paths between the variables since it is the preferred method for examining interactions between multiple independent variables (Matteson et al., 2011). SEM refers to one of a variety of covariance-based statistical methods. It is also referred to as "covariance structure analysis," "modeling," or the self-descriptive term "causal modeling." PLS is an advanced form of regression and principal component analysis combined that explores the relationship between latent variables. SEM is considered a second-generation technique and PLS-SEM is primarily used to develop theories in exploratory research (Tabachnick & Fidell, 2012). It is also considered an effective approach to examine relationships between independent and dependent variables. It is a comprehensive analysis method encompassing a number of statistical techniques such as correlations between independent variables, confirmatory factor analysis, path analysis, measurement errors and their correlations, causal modeling with variables, multiple latent independent and dependent variables as well as analysis of variance and multiple regression (Garson, 2008; Hair et al., 1998).

For this study, PLS-SEM was also used to test the hypotheses. Since PLS does not provide model fit indices, it tests the full mode of forecast level by the coefficient of determination. Using R, Maximum Likelihood Estimation (MLE) was used to estimate path coefficients and fit data to the model, along with the R^2 on the dependent variable (Kupek, 2005, 2006). Model fitting involved testing the predictive power of the variables while using the sample covariance matrix in R (Gerstoft, Menon, Hodgkiss, & Mecklenbräuker, 2012).

Since PLS does not provide overall measures of measurement model fit, the results of the PLS model were supplemented using a traditional covariate-based Confirmatory Factor Analysis (CFA). The lavaan package from the R programming language was used to calculate the estimates and model fit statistics. Construct validity was tested by examining the results of two model fit indices, the CFI and TLI using R. In order to determine whether or not the model fit the data in an acceptable manner, RMSEA was calculated for the CFA results. RMSEA measures the discrepancy per degree of freedom, in other words, it measures the average amount of misfit in the model with <0.05 being considered a close fit and <0.08 a reasonable fit (Kline, 2005). However, Hu and Bentler (1999) recommended statistical scores of .06 or lower. This study also performed the chi-square test, which is an absolute test of model fit (Kline, 2005). Browne and Cudeck (1993) recommended a probability value (p) above .05. Model fit was evaluated with a range from 0 to 1, with 1 suggesting a perfect fit. CFI and TLI values > .90 suggest of a good fit (Kline, 2004).

Table 8.

Proposed Statistical Analysis

Proposed Analysis	**Statistical Software**
Content & Face validity	SPSS
Pilot Study	SPSS
ANCOVA Analysis	SPSS
Descriptive Statistics and Reliability Measures	SPSS
Confirmatory Factor Analysis (CFA)	R
Root Mean Square Error	R
Chi-square Results and Goodness to Fit Indices	R
Maximum Likelihood Estimates for Hypothesized Paths	R

Hypotheses Testing

$H_0$1: CSE will have no significant influence on medical professionals' resistance to using EMR systems.

$H_0$2: PC will have no significant influence on medical professionals' resistance to using EMR systems.

$H_0$3: ATE will have no significant influence on medical professionals' resistance to using EMR systems.

$H_0$4: PP will have no significant influence on medical professionals' resistance to using EMR systems.

$H_0$5: Anxiety will have no significant influence on medical professionals' resistance to using EMR systems.

To examine hypotheses 1 through 5, the paths from CSE, PC, ATE, PP, and Anxiety to medical professionals' resistance to using EMR systems was examined. Each of the variables are latent variables within the model. The standardized regression weights were interpreted to examine the strength of the relationship between CSE, PC, ATE, PP, and Anxiety to medical professionals' resistance to using EMR systems.

$H_0$6 Null Hypotheses

$H_0$6a: There is no-significant linear and non-linear correlation between CSE and Anxiety.

$H_0$6b: There is no-significant linear and non-linear correlation between Anxiety and ATE.

$H_0$6c: There is no-significant linear and non-linear correlation between PP and PC

$H_0$6d: There is no-significant linear and non-linear correlation between PP and ATE

$H_0$6e: There is no-significant linear and non-linear correlation between ATE and PC

To examine H6 null hypotheses, the correlation between each of the independent variables was examined. CSE, anxiety, ATE, PP, and PC are latent variables in the model. The correlation coefficient was examined between these latent variables. Significance of the paths was identified using a SEM approach to the data.

$H_0$7 Null Hypotheses

$H_0$7a: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their age.

$H_0$7b: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their gender.

$H_0$7c: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their role in healthcare.

$H_0$7d: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years in healthcare.

$H_0$7e: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years of computer use.

To examine hypothesis 7, five ANCOVAs were conducted. The ANCOVA examined for statistical differences in resistance to use EMR systems by age, gender, role in healthcare, years in healthcare, and years of computer use after controlling for the covariates. One ANCOVA was conducted for each independent variable.

Formats for Presenting Results

Results was presented in a combination of narrative, summary (descriptive statistics), and inferential statistics. As indicated in Table 8 a combination of SPSS and The R software package was used for statistical analysis. Frequent use was made of charts, tables, and other graphics to represent findings. All SEM results was illustrated by SEM schemas generated in Visio version 12.0. Likewise, all summary statistics, inferential statistics, data tables, and other readouts was generated in SPSS but, where applicable, placed into APA-compliant tables and graphics. Results were presented in three general sections: (a) an overview of descriptive statistics, (b) hypothesis testing and PLS-SEM results, and (c) a narrative discussion of both descriptive and inferential results, with reference to the relationship between the results and results observed in the literature.

The results section of this study included a narrative of the process undertaken to complete validity and reliability of the survey instrument that was done via a focus group of 20 healthcare professionals on two separate occasions as suggested by Kimberlin and Winterstein (2008). Reliability was calculated using Cronbach's Alpha measure (Delgado-Rico et al., 2012). Only measures that demonstrate a reliability score over 0.70 using Cronbach's Alpha was considered reliable. The result of the between-test Pearson product-moment and Beta correlation was presented in table format along with the Cronbach's Alpha score from the focus group tests. The result CFA of the construct validity was also presented in a table format. Modifications made to the survey instrument during content and face validity was presented in the results section. Content and face validity were done using the Delphi Exercise consisting of four rounds. The results of each round were presented in the results section along with feedback from the members of the subject matter expert panel.

Resources Used

The resource requirements for this study were minimal. This research study made use of a laptop equipped with a licensed version of SPSS ™, R Software Package, Microsoft Visio, Word, and Excel, the four main programs that were utilized in writing this study. This study, likewise, made use of Survey Monkey, an online survey tool developed specifically for the purpose of collecting data from study participants. Data collected from the Survey Monkey website was extracted for statistical analysis. This study also had access to the academic databases that was used to obtain electronic versions of the scholarly works to be utilized in the literature review. These academic databases include ACM, Novacat, IEEE, Alt HealthWatch, ASTM Science and

Engineering Digital Library. There were some expenses involved in obtaining an e-mail list for participant recruitment purposes; there was also a significant time and effort involved in identifying and recruiting a physician to champion this study.

Summary

The purpose of this quantitative study is to examine the relationships between five independent variables (PC, Anxiety, ATE, PP, & CSE), four covariates (age, gender, role in healthcare, & years in healthcare), and one dependent variable (resistance to using EMR). The relationships between these variables were explored through the use of statistical analyses such as PLS-SEM in R, ANOVA, ANCOVA, and Covariate-based SEM. Data for this study was collected from a population of 1576 healthcare professionals, and the data collection instrument was based on previous explorations of technology adoption by Aldosary (2003), Cork et al. (1998), as well as Laumer and Eckhardt (2012).

Chapter 4

Results

Overview

The goal of this study was to determine if CSE, PC, ATE, and PP have significant effect on RES. A PLS-SEM path model and covariate-based SEM technique using R software were chosen as the analysis methods most suited to investigating the hypotheses (Muthen & Muthen, 2007). A PLS-SEM model consists of two components, a measurement model and a structural model. Before the structural model was assessed, the measurement model was tested using a confirmatory factor analysis (CFA). Since multivariate normality was violated for the data, the model was compared to the final PLS model in which factor projections were calculated using R's PLS algorithm, and significance was determined using bootstrap simulation with 10,000 samples. The proposed model is depicted below in Figure 7. The individual constructs have been collapsed to reduce the number of items in the figure. Details of the items in each construct are depicted in Appendix C.

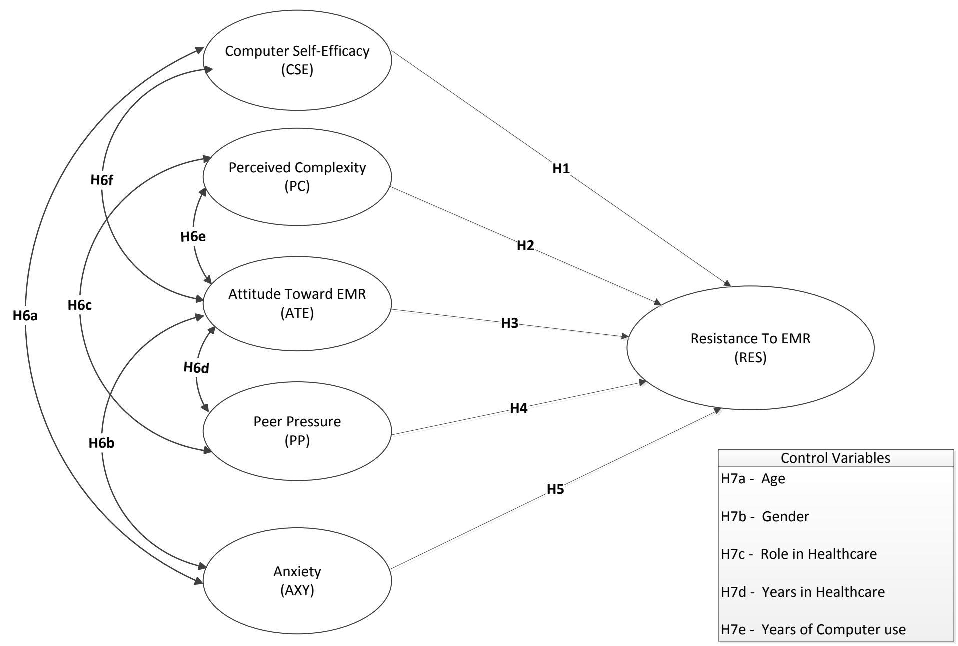

Figure 7. Proposed Model Structure

Data Screening

Prior to conducting the analyses, the data were screened for quality, including omitted content, non-normality, and outliers. A total of 310 responses were originally received. Any response containing missing data due to unclicked radio buttons or unchecked checkboxes were first reviewed, and, if justified, were omitted from analysis. For surveys with missing data, a total of 18 responses were removed. In order to address any issues with response-set, the data was downloaded into Microsoft Access and queries ran to identify responses that contained the same values for each question. A total of 16 responses were found to be qualified for removal. Another 18 were identified as outliers and removed leaving a total of 258 responses for the study analysis.

Normality and Outliers

A major assumption of factor analysis states that the data follow a multivariate normal distribution. In order to assess multivariate outliers, the Mahalanobis distances were calculated and plotted against their corresponding Chi-Square distribution percentiles (Schmidt & Hunter, 2003). The resulting scatterplot is similar to a univariate normal *Q*-*Q* plot, where deviations from a straight line show evidence of non-normality. The data showed indications of moderate deviations from multivariate normality, as indicated by the concavity of the data points. There were no additional multivariate outliers or missing values in the data after the removal of 52 responses. Traditional linear models assume that the error variances are drawn from a multivariate normal distribution. Estimates calculated from non-normal data have an increased chance to produce unreliable results under traditional linear models. However, PLS models do not make the assumption of multivariate normality, linearity, or homoscedasticity. They also perform well when there is multicollinearity present in the manifest variables. Since PLS models perform well despite violations of these assumptions, they do not need to be tested. The Chi-Square *Q*-*Q* scatterplot of the squared Mahalanobis distances is shown in Figure 8.

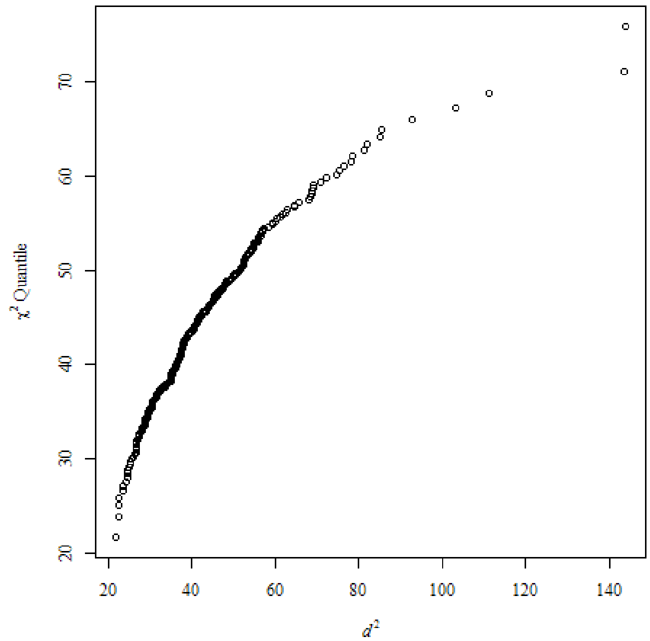

Figure 8. Chi-Square Q-Q Scatterplot of Squared Mahalanobis Distances

Descriptive Statistics

The sample data consist of 258 observations measured on 80 items, which were loaded over five constructs without the demographics information. Prior to the analyses, descriptive statistics were conducted on the overall sample. Frequencies and percentages were conducted for the demographics indicators, while means and standard deviations were calculated for the continuous indicators. For gender, there were 151 females (59%) and 107 males (41%) in the sample. For ethnicity, most participants were Caucasian (119, 46%), followed by African American (56, 22%). The two most populous education levels were Bachelor's (90, 35%) and Master's (62, 22%). The biggest proportion of the sample by age group was the 35-44 age group (101, 39%) followed by the 45-54 age group (59, 23%). Frequencies and percentages for all demographic indicators are outlined in Table 9.

Table 9

Frequencies and Percentages for Demographic Indicators

Variable	***n***	***%***
Gender		
Female	151	59
Male	107	41
Age		
18-24	43	17
25-34	47	18
35-44	101	39
45-54	59	23
55+	8	3
Education		
Associates	44	17
Vocational	4	2
Professional	9	3
Bachelor’s	90	35
Master’s	62	24
MD	18	7
DDS	2	1
DD	2	1
PhD	27	10
Ethnicity		
Caucasian	119	46
African American	56	22
Hispanic	27	10
Asian	21	8
Pacific Islander	1	0
Other	34	13

Note. *Percentages may not sum to 1 due to rounding.*

Confirmatory Factor Analysis and Composite Reliability

A CFA was conducted along with a reliability analysis to assess construct validity. Examination of modification indices and factor loadings indicated that CSE1, CSE5, CSE7, PC5, ATE1, ATE6, ATE8, PP5, and PP6 were all causing significant problems with the model parameters. These items were removed one at a time to determine the effect on the model. A total of nine iterations were conducted, removing problematic items each time until acceptable factor loadings were achieved. The results of the last iteration of the CFA performed in R showed significantly improved fit, although still poor overall ($\chi 2(545) = 2125.61$, $p < .001$, CFI = 0.82, TLI = 0.81, RMSEA = 0.11). The high degrees of freedom indicate that a very large number of parameters are being estimated in this model. Very frequently, covariance based models such as CFA and EFA have difficulty matching the covariance structure of the observed data to the model-implied covariance structure. Fortunately, PLS models do not use covariance based methods to estimate model fit. Instead, items are projected onto factors using a method similar to principal component analyses, which simply calculates linear combinations of the manifest variables that maximize relationships between each manifest variable and the linear combination.

Composite Reliability

Composite reliability was assessed to determine how well each indicator loaded onto their respective constructs. This is done by taking a ratio of square of summed loadings and the total variance. The formula is given by Equation 2 (Raykov, 1997).

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum Var(\varepsilon_i)}$$

For the full model, each construct had excellent reliability. The ATE latent construct had a composite reliability value of 0.89. The ORC construct had a composite reliability value of 0.94. The CSE latent construct had a composite reliability value of 0.85 and PC had a composite reliability value of 0.95. For PP and RES, the composite reliability scores were 0.80 and 0.96 respectively. These values indicate that the loadings for each construct were all directionally similar, and that the items in each construct show a high degree of consistency.

Cronbach's Alpha

As an additional measure of internal consistency, Cronbach's alpha values were calculated for the items in each construct. The coefficients were evaluated using the guidelines suggested by George and Mallery (2010), where values greater than 0.9 indicate excellent reliability, values greater than 0.8 indicate good reliability, values greater than 0.7 indicate acceptable reliability, values greater than 0.6 indicate questionable reliability, values greater than 0.5 indicate poor reliability, and values less than 0.5 indicate unacceptable reliability. A value of 0.7 was selected as the criterion for acceptable inter-rater reliability. The alphas for PC (α = 0.90), AXY (α = 0.94), and RES (α = 0.94) indicated excellent reliability. The alphas for CSE (α = 0.80), ATE (α = 0.88), and PP (α = 0.83) all showed good reliability. These values confirm the results of the composite reliability tests, and reiterate the high degree of reliability within each latent construct. Table 10 lists the AVE, CR, and Cronbach's Alpha values for each of the constructs. The results of this analysis were used to answer $H_0 6$.

Table 10.

Reliability Measures for Each Construct

Latent Variable	*AVE*	*CR*	*Cronbach's α*	*No. of Items*
ATE	0.53	0.89	0.88	8
AXY	0.69	0.94	0.92	8
CSE	0.44	0.85	0.80	8
PC	0.72	0.95	0.94	8
PP	0.35	0.80	0.83	7

CSE	0.81	0.96	0.94	5

Partial Least Squares – Structural Equation Modeling

A partial least squares- structural equation modeling (PLS-SEM) was conducted to determine how well the data fit the proposed model, and discern whether significant relationships existed between the independent and dependent constructs. Calculations were conducted using R software and programming language. Significance was tested using the bootstrap algorithm, which places $\frac{1}{n}$ probability on each observation and generates a new dataset on which to conduct analyses and calculate results. The results are then averaged over many samples to determine the sampling distribution of the estimated parameter, from which significance can be determined. A total of 10,000 bootstrap samples were used for this study, ensuring a reasonably large number of samples to determine significance.

Factor Loadings

To test the measurement model, the factor weights were estimated for each manifest variable. The results indicated significant loadings for all indicators except PP3, PP5, and PP6, indicating good model specification.

Average Variance Extracted

To assess convergent validity, the average variance extracted (*AVE*) values were calculated for the constructs of each model. The *AVE* value indicates the amount of variance in the indicator variables that is explained by the linear combination of each latent construct. The *AVE* values for each construct were calculated using Equation 1, where λ_i represents the standardized loadings for each latent construct (Fornell & Larcker, 1981).

$$AVE = \frac{\sum \lambda_i^2}{n}$$

The full model showed *AVE* values of 0.53 for ATE, 0.69 for AXY, 0.44 for CSE, .72 for PC, .35 for PP, and 0.81 for RES. The high values for AXY, PC, and RES indicate that the amount of variance accounted for in the manifest variables is sufficiently high. The values for ATE, CSE, and PP indicate that some of the variance in the manifest variables is left unexplained.

Structural Model

Once the measurement model had been tested for model specification, the structural model was tested to determine if ATE, AXY, CSE, PC, and PP had a significant effect on RES. A path weighted model was calculated using 10,000 bootstrap samples in R. The results showed a pseudo R-squared value of 0.78. This indicates that approximately 78% of the variance in RES is explainable by the collective effects of CSE, PC, ATE, PP, and AXY. Further examination of the effects indicated that AXY had a highly significant effect on RES ($B = 0.87$, $p < .001$). This indicates that a standard deviation increase in AXY increases the expected value of RES by 0.87 standard deviations. CSE did not have a significant effect on RES ($B = 0.02$, $p = .423$). Additionally, CSE ($B = 0.02$, $p = .423$), PC ($B = 0.05$, $p = .334$), ATE ($B = 0.00$, $p = .983$), and PP ($B = 0.03$, $p = .407$) did not have significant effects on RES. Table 11 outlines the results of the path estimates. The results of this analysis addressed $H_0$1-5.

Table 11.

Path Estimates for the Partial Least Squares - Structural Equation Model

Path	B	SE	t	p
CSE -> RES	0.02	0.03	0.80	.423
PC -> RES	0.05	0.05	0.97	.334
ATE -> RES	0.00	0.05	0.02	.983
PP -> RES	0.03	0.04	0.83	.407
AXY -> RES	0.87	0.02	48.85	< .001***

Note. Model $R^2 = 0.78$, $p < .001$***

Ancillary Analyses

In order to examine the relationships between each individual construct, the composite scores were calculated by taking the sum of the items within each construct. Both Pearson and Spearman correlations were calculated for each of these composite scores. Spearman correlations use the ranks of the data rather than the actual values. Therefore, linearity is not required, only a monotonic relationship between the variables. The correlation analyses were followed by a series of analyses of covariance (ANCOVAs) to determine the effects of the control variables, Age, Gender, Education, Specialty, YearsComputers, HoursEMR, and YearsEMR.

Correlation Analyses

Both Pearson and Spearman correlations were calculated on the composite scores. The results of the Pearson correlations indicated that CSE was significantly correlated AXY ($r = 0.22$, $p < .001$) and RES ($r = 0.21$, $p < .001$). The results also indicated that PC was significantly correlated with ATE ($r = -0.79$, $p < .001$), AXY ($r = 0.18$, $p < .001$), and RES ($r = 0.20$, $p < .001$). ATE was significantly correlated with AXY ($r = -0.19$, $p <$

.001) and RES (*r* = -0.19, *p* < .001). AXY was significantly correlated with RES (*r* = 0.85, *p* < .001). Pearson correlations are outlined in Table 12 below.

Table 12.

Pearson Correlation Coefficients for Each Composite Score

	CSE	**PC**	**ATE**	**PP**	**AXY**	**RES**
CSE	1					
PC	0.01	1				
ATE	-0.07	-0.79***	1			
PP	-0.12	-0.03	0.07	1		
AXY	0.22***	0.18**	-0.19**	-0.08	1	
RES	0.21**	0.20**	-0.19**	-0.04	0.86***	1

Note. **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

The Spearman correlations indicated significance between CSE and AXY (*r* = 0.21, *p* < .001) and RES (*r* = 0.15, *p* = .010). The results also indicated significant correlations between PC and ATE (*r* = -0.59, *p* < .001), ATE and AXY (*r* = -0.17, *p* = .010), and AXY and RES (*r* = 0.71, *p* < .001). Results of the Spearman correlations are outlined in Table 13. The results of this analysis were also used to answer $H_0 6$.

Table 13.

Spearman Correlation Coefficients for Each Composite Score

	CSE	**PC**	**ATE**	**PP**	**AXY**	**RES**
CSE	1					
PC	0.00	1				
ATE	-0.05	-0.59***	1			
PP	-0.16	-0.15	0.11	1		
AXY	0.21**	0.11	-0.17**	-0.06	1	
RES	0.16*	0.10	-0.10	-0.03	0.71***	1

Note. **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

ANCOVA Analyses

An analysis of covariance (ANCOVA) was conducted to determine if a significant relationship existed between the AXY, PP, CSE, PC, ATE scores and RES controlling for Gender, Age, Ethnicity, Education, and Specialty. The overall model was found to be significant ($F(63,194) = 53.39$, $p < .001$), with an R^2 value of .95, indicating that 95% of the variance in RES was explained by the collective effect of the independent variables and covariates. Since the overall model was found to be significant, the model's covariates were assessed. The AXY ($F(10,194) = 262.20$, $p < .001$), ATE ($F(7,194) = 2.20$, $p = .036$), Years computers ($F(1,194) = 5.71$, $p = .018$), and PC ($F(12,194) = 2.00$, $p = .026$) scores were found to be significant, indicating that a significant amount of variance in RES is explained by AXY, ATE, and PC, see Table 14.

Table 14.

Tests of Between-Subjects Effects - Dependent Variable: RES

Source	**Type III Sum of Squares**	***df***	**Mean Square**	***F***	**Sig.**
Corrected Model	8144.155	63	129.272	53.39	< .001***
Intercept	228.983	1	228.983	94.572	< .001***
Gender	0.116	1	0.116	0.048	.827
Age	0.014	1	0.014	0.006	.939
Ethnicity	2.56	1	2.56	1.057	.305
Education	2.398	1	2.398	0.99	.321
Specialty	1.874	1	1.874	0.774	.380
CSE	47.394	13	3.646	1.506	.118
PC	57.997	12	4.833	1.996	.026*
ATE	37.341	7	5.334	2.203	.036*
PP	20.463	11	1.86	0.768	.671
AXY	6348.629	10	634.863	262.203	.001***
Years EMR	1.97	1	1.97	0.814	.368
Years Computers	13.831	1	13.831	5.712	.018*
Hours EMR	0.006	1	0.006	0.003	.959

Error	469.725	194	2.421
Total	39459	258	
Corrected Total	8613.88	257	

Note. R^2= .945 (Adjusted R Squared = .928) Sig. *p < .05, **p < .01, ***p < .001

Hypotheses Testing Results

To test Hypotheses 1-5, the regression paths of the structural model were examined. Significance was determined using an alpha level of .05. The model had an overall R2 value of 0.78. This indicates that approximately 78% of the variability in RES can be accounted for by CSE, PC, ATE, PP, and AXY. Since the overall model was significant, the individual coefficients can be interpreted. A path diagram depicting the results of the structural model is shown in Figure 9.

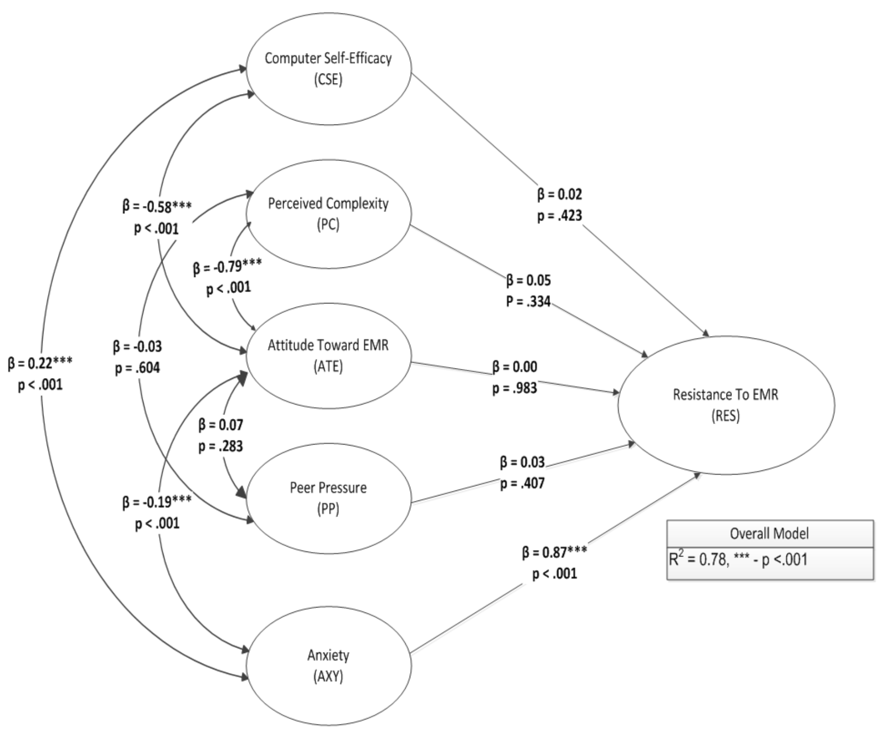

Figure 9. Partial Least Squares – Structural Equation Modeling Results

$H_0$1: CSE will have no significant influence on medical professionals' resistance to using EMR systems.

In order to address hypothesis 1, the standardized regression path for CSE was examined. The path for CSE predicting RES was 0.02, $p = .423$. This means that the study failed to reject the null hypothesis and indicates that there is no significant relationship between CSE and RES.

$H_0$2: PC will have no significant influence on medical professionals' resistance to using EMR systems.

To address hypothesis 2, the standardized regression bath between PC and RES was examined. The path between PC and RES was 0.05, $p = .334$. This means that the study failed to reject the null hypothesis and indicates that PC is not a significant predictor of RES.

$H_0$3: ATE will have no significant influence on medical professionals' resistance to using EMR systems.

To address hypothesis 3, the standardized regression path between ATE and RES was examined. The path for ATE predicting RES was less than 0.01 ($B = 0.00$, $p = .983$). This means that the study failed to reject the null hypothesis and indicates that ATE is not a significant predictor of RES.

$H_0$4: PP will have no significant influence on medical professionals' resistance to using EMR systems.

To address hypothesis 4, the standardized regression path between PP and RES was examined. The path between PP and RES was 0.03, $p = .407$, indicating that the study failed to reject the null hypothesis and means that PP was not a significant predictor of RES.

$H_0 5$: Anxiety will have no significant influence on medical professionals' resistance to using EMR systems.

To examine hypothesis 5, the standardized regression path between AXY and RES was examined. The path was very highly significant ($B = 0.87$, $p < .001$), which means the null hypothesis was rejected. Since both latent variables and observed variables were standardized in the model, a path of 0.87 for AXY indicating that a one standard deviation increase in AXY will change the expected value of RES by 0.87 standard deviations as depicted in Figure 10.

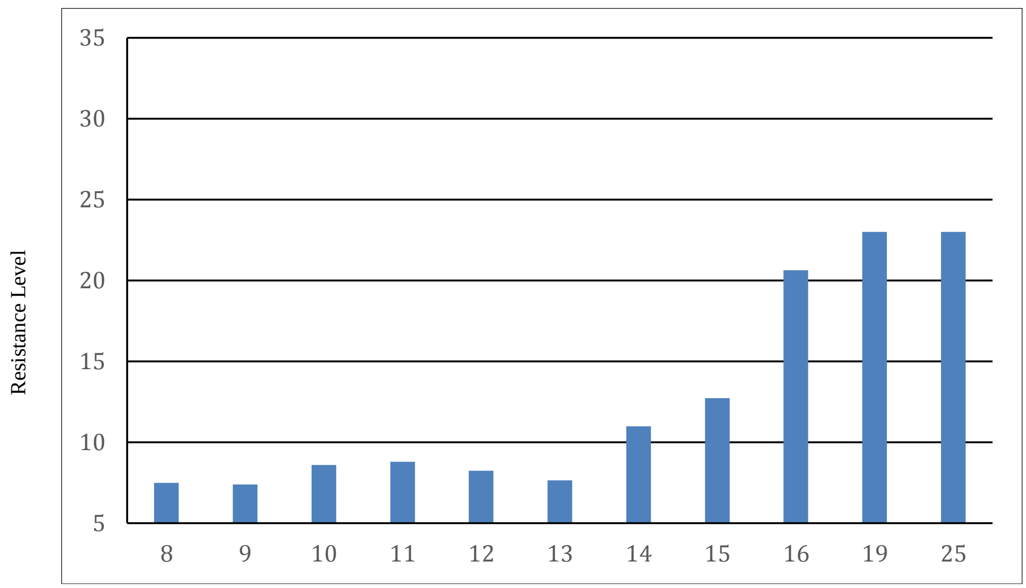

Figure 10. Resistance by Anxiety

$H_0 6$ Null Hypotheses

To assess hypothesis 6, composite scores were calculated for each latent construct in the final PLS model by summing each of the items. This method is supported by the Cronbach alpha values, which were all sufficiently high, indicating a high degree of reliability within each construct. Pearson product-moment correlations were calculated to determine if there was a significant association between the constructs. Spearman correlation coefficients were also calculated, and compared to the Pearson correlations to account for any non-linearity in the data.

$H_0$6a: There is no-significant linear and non-linear correlation between CSE and Anxiety.

To examine hypothesis 6a, the Pearson and Spearman correlation coefficients were examined between CSE and AXY. The Pearson correlation coefficient between CSE and AXY was 0.22, $p < .001$. This indicates that the null hypothesis was rejected and that there is a significant positive association between CSE and AXY. The Spearman correlation coefficient was 0.21, $p < .001$, again meaning that the null hypothesis was rejected and confirming the results of the Pearson correlation.

$H_0$6b: There is no-significant linear and non-linear correlation between Anxiety and ATE.

To examine hypothesis 6b, the Pearson and Spearman correlation coefficients were examined between AXY and ATE. The Pearson correlation coefficient between AXY and ATE was -0.19, $p < .001$. This indicates that the null hypothesis was rejected and that there is a significant negative association between AXY and ATE. The Spearman correlation coefficient was -0.17, $p < .001$, again meaning that the null hypothesis was rejected and confirming the results of the Pearson correlation.

$H_0$6c: There is no-significant linear and non-linear correlation between PP and PC

To examine hypothesis 6c, the Pearson and Spearman correlation coefficients were examined between PP and PC. The Pearson correlation coefficient between PP and PC was -0.03, $p = .604$, indicating that this study failed to reject the null hypothesis and there was no significant correlation. However, the Spearman correlation coefficient was -0.14, $p = .018$, which suggests a significant negative association between PC and PP. This indicates that the null hypothesis was partially rejected and that there is a significant non-linear relationship between PP and PC, but not a significant linear relationship.

$H_0$6d: There is no-significant linear and non-linear correlation between PP and ATE

To examine hypothesis 6d, the Pearson and Spearman correlation coefficients were examined between PP and ATE. The Pearson correlation coefficient between PP and ATE was 0.07, $p = .283$ and the Spearman correlation coefficient was 0.11, $p = .065$. This indicates that the study failed to reject the null hypothesis and there is no significant association between PP and ATE.

$H_0$6e: There is no-significant linear and non-linear correlation between ATE and PC

To examine hypothesis 6e, the Pearson and Spearman correlation coefficients were examined. The Pearson correlation coefficient between ATE and PC was -0.79, $p < .001$. This indicates the null hypothesis was rejected and that there is a highly significant negative relationship between ATE and PC. The Spearman correlation coefficient was -0.58, $p < .001$, again meaning the null hypothesis was rejected and confirming the results of the Pearson correlation.

$H_0$7 Null Hypotheses

$H_0$7a: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their age.

To address hypothesis 7a, an ANCOVA was conducted to determine if significant differences in the mean of RES by ATE, AXY, PP, CSE, PC controlling for Age. The overall model was found to be significant ($F(63,194) = 53.39$, $p < .001$), which means the null hypothesis was rejected. With an R^2 value of .95, indicating that 95% of the variance in RES was explained by the collective effect of the independent variables and covariates. The test statistic for Age was above .05 ($F(1,194) = 0.01$, $p = .939$), indicating that the researcher failed to reject the null hypothesis and that the proportion of variability in RES accounted for by Age was not significant as depicted in Figure 11.

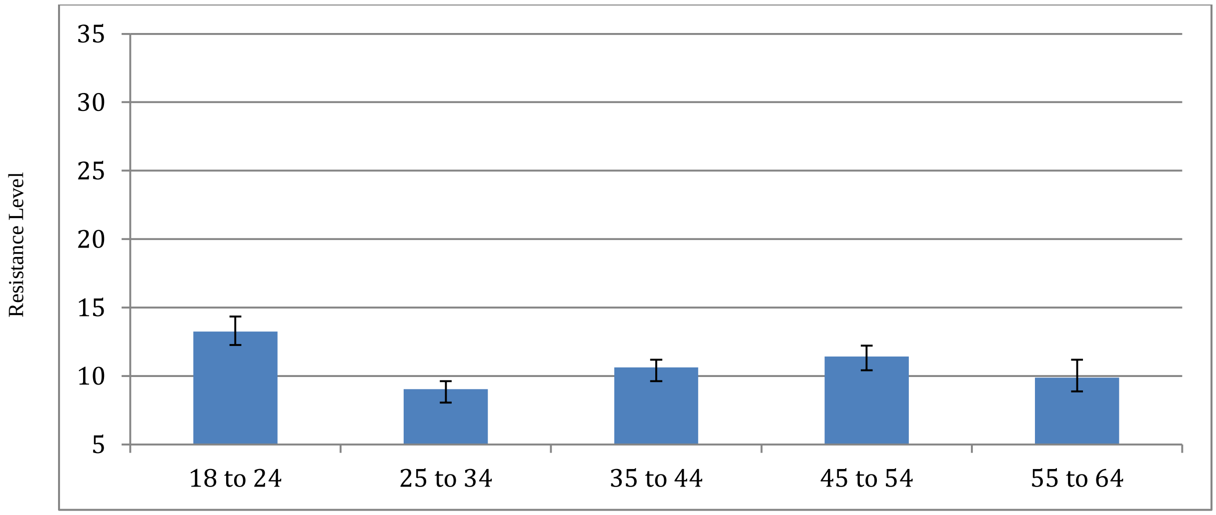

Figure 11. Resistance by Age

$H_0$7b: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their gender.

To address hypothesis 7b, an ANCOVA was conducted to determine if a significant relationship existed in the mean of RES by of RES by ATE, AXY, PP, CSE, PC controlling for Gender. The overall model was found to be significant ($F(63,194) = 53.39$, $p < .001$), which means the null hypothesis was rejected. With an R^2 value of .95, indicating that 95% of the variance in RES was explained by the collective effect of the independent variables and covariates. The test statistic for Gender was above .05 ($F(1,194) = 0.05$, $p = .827$), indicating that the study failed to reject the null hypothesis and that the proportion of variability in RES accounted for by Gender was not significant as depicted in Figure 12.

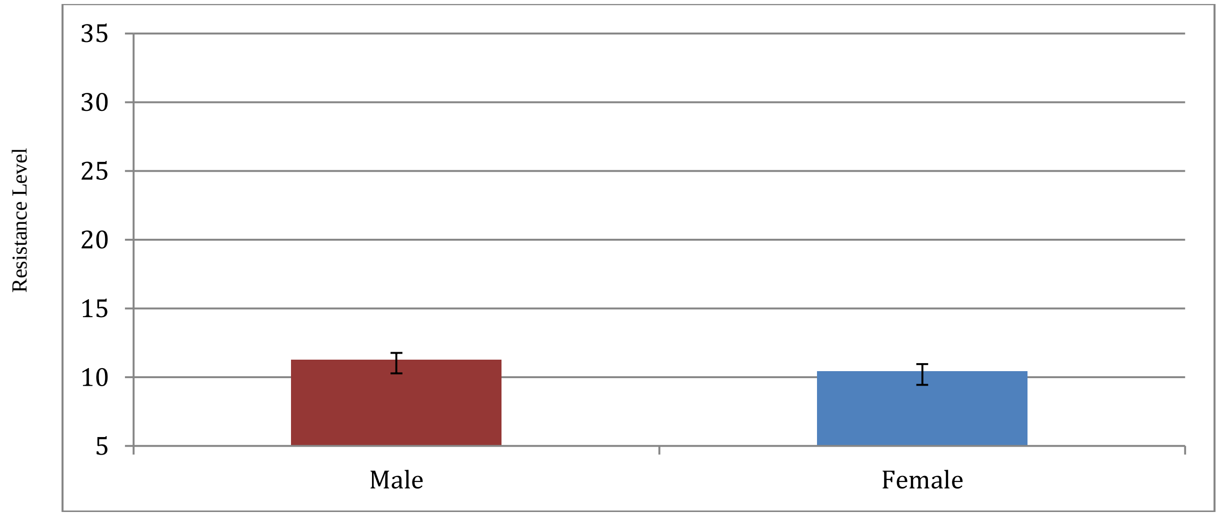

Figure 12. Resistance by Gender

$H_0$7c: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their role in healthcare.

To address hypothesis 7c, an ANCOVA was conducted to determine if a significant relationship existed between the mean of RES by ATE, AXY, PP, CSE, PC controlling for Specialty. The overall model was found to be significant (F(63,194) = 53.39, $p < .001$), which means the null hypothesis was rejected. With an R^2 value of .95, indicating that 95% of the variance in RES was explained by the collective effect of the independent variables and covariates. The test statistic for Specialty was above .05 (F(1,194) = 0.77, $p = .380$), indicating that the researcher failed to reject the null hypothesis and that the proportion of variability in RES accounted for by Specialty was not significant as depicted in Figure 13.

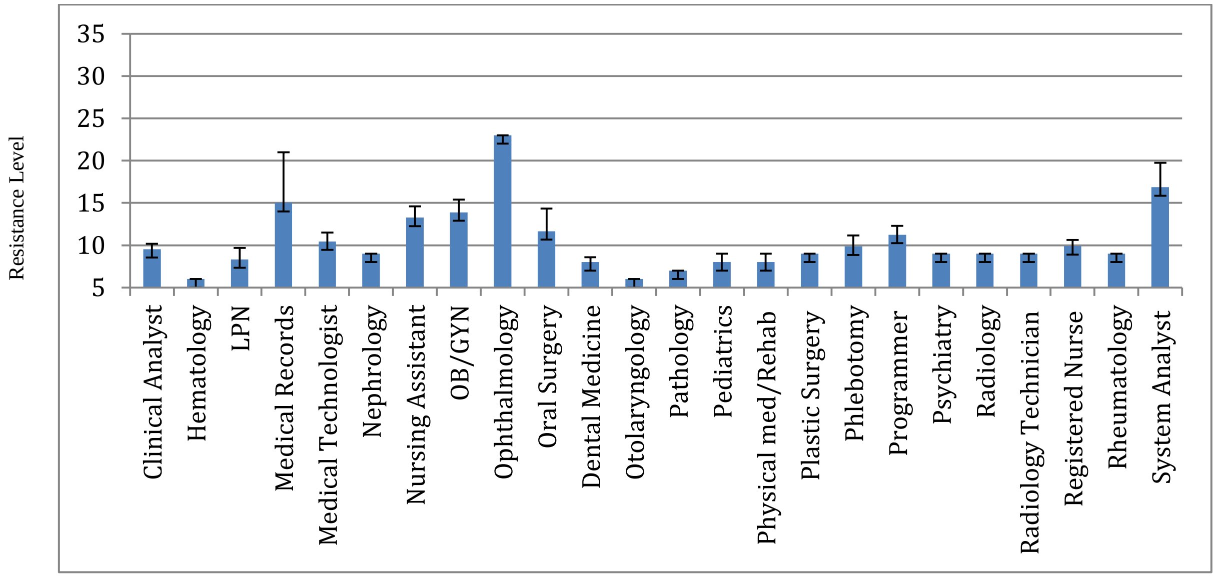

Figure 13. Resistance by Specialty

$H_0$7d: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years in healthcare.

To assess hypothesis 7d, an ANCOVA was conducted to determine if a significant relationship existed between the mean of RES by ATE, AXY, PP, CSE, PC controlling for Years in Healthcare. The overall model was found to be significant (F(61,196) = 54.02, p < .001), which means the null hypothesis was rejected. With an R^2 value of .94, indicating that 94% of the variance in RES was explained by the collective effect of the independent variables and covariates. The test statistic for Years in Heathclare was above .05 (F(1,196) = 0.02, p = .894), indicating that the researcher failed to reject the null hypothesis and that the proportion of variability in RES accounted for by Years in Healthcare was not significant as depicted in Figure 14.

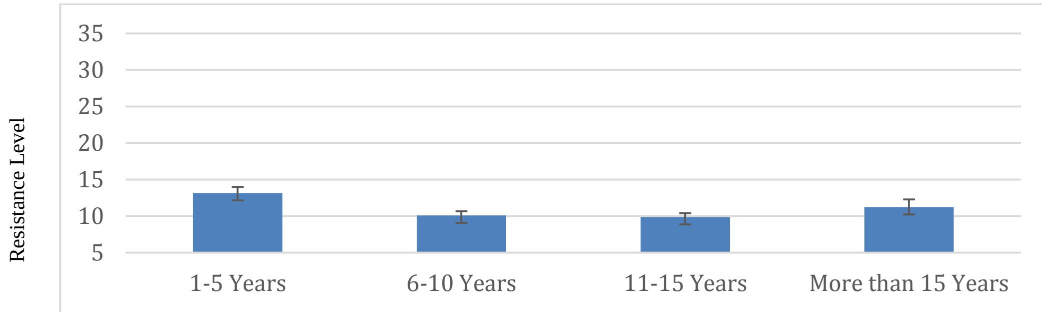

Figure 14. Resistance by Years Using EMR Systems

$H_0$7e: There will be no significant mean differences on medical professionals' resistance to using EMR systems when controlled by their years of computer use.

To assess hypothesis 7e, an ANCOVA was conducted to determine if a significant relationship existed between the mean of RES by ATE, AXY, PP, CSE, and PC after controlling for years of computer use. The overall model was found to be significant ($F(56, 201) = 60.40$, $p < .001$), which means the null hypothesis was rejected. With an R^2 value of .94, indicating that 94% of the variance in RES was explained by the collective effect of the independent variables and covariates. The *p* statistic for years of computer use was greater than .05 ($F(1, 201) = 1.81$, $p = .180$), indicating that this study failed to reject the null hypothesis and that the proportion of variability in RES accounted for by years of computer use was not significant as depicted in Figure 15.

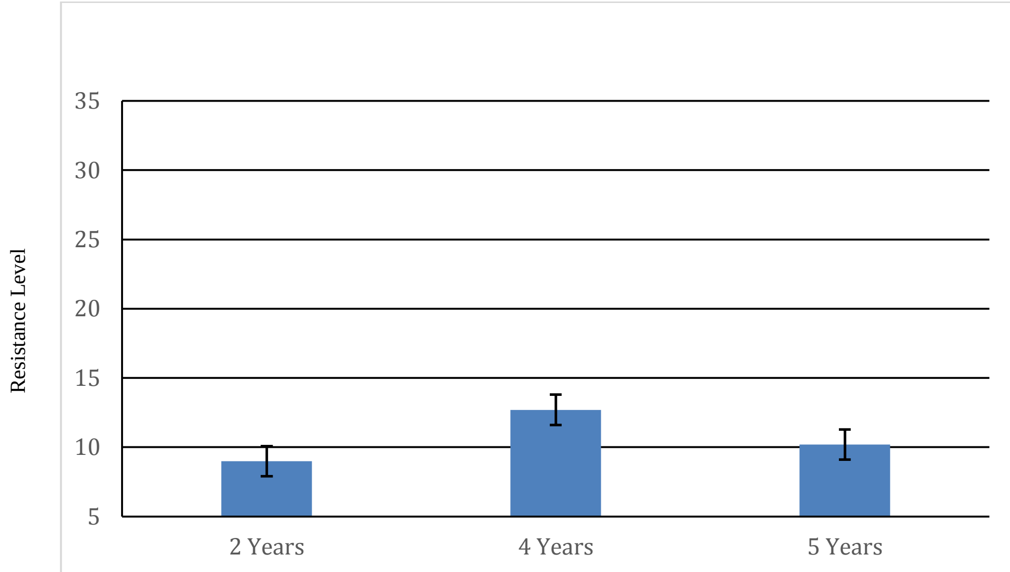

Figure 15. Resistance by Years of Computer Use

Table 15.

Support for Proposed Hypotheses

Hypothesis	**Support**
1	No
2	No
3	No
4	No
5	**Yes**
6a	**Yes**
6b	**Yes**
6c	**Non-linear Only**
6d	No
6e	**Yes**
7a	No

7b	No
7c	No
7d	No
7e	**Yes**

Summary

This chapter presented the results of the data analysis for this study including the statistical analysis performed on the constructs as well as the testing for the proposed hypotheses. With a survey instrument consisting of 45 items, data was collected from 310 healthcare professionals across the United States. After data cleaning, 258 of the responses were found to be viable for analysis. Analysis of the study's proposed model was done using R and model fit testing was done based on Structural Equation Modeling (SEM). The research goal of empirically testing Resistance with respect to CSE, ATE, AXY, PC and, PP was accomplished as the Table 15 above depicts the hypotheses that have are supported based on the results.

Chapter 5

Conclusions, Implications, Recommendations and Summary

Conclusions

This research was designed to develop a greater understanding of the problem of healthcare professional resistance to the use of EMR systems. EMR systems are medical record systems which store patient information and make access and transfer of patient information easier. Current research on the problem informs that the use of EMR systems can generally improve the healthcare experience of patients; however, there is still substantial resistance from many healthcare professionals (Bleich & Slack, 2010; Fisher, 2011; Li & West-Strum, 2010). In order to design a solution for this problem, it was important to understand what factors significantly contributed to the problems that physicians have with EMR system use. This research investigated Computer Self-Efficacy (CSE), Perceived Complexity (PC), Attitudes toward EMR Systems (ATE), Peer Pressure (PP), and Anxiety (AXY) to determine whether these constructs as individuals, or as a group, or coupled together with some other factors could significantly explain resistance to EMR systems. Quantitative examination of self-reported survey results was performed to understand the strength and significance of the relationships, while these relationships were investigated to test the strength of model fit.

The relationships were modeled in a covariance-based structured equation model. The findings provided support for some research, differed from some research and also presented new results of testing that had not been performed by researchers previously. The evidence presented in these findings contribute to a greater understanding of the phenomenon of EMR system resistance by medical professionals. Ultimately the findings support a new take on the problem of EMR system resistance that may contribute to the ways in which scholars investigate the problem of EMR resistance in general. This may also help with the way practitioners approach EMR systems, and articulate value of the systems to medical professionals investing record-keeping systems in the workplace.

The purpose of this research was to identify the factors which significantly relate to the problem of EMR system resistance. This purpose was met by testing the hypotheses in this study. As mentioned above, medical professionals responded to self-rating surveys measuring for the constructs investigated in this study. The hypotheses in this study proposed relationships between the factors of CSE, PC, ATE, PP, and AXY along with the problem of EMR system resistance. Some of the hypotheses were supported by the results of this study, and some were rejected. The construction of a data model of the relationships in this study could not meet thresholds that would be evidence of a good fit of the relationships identified in the study.

This chapter will present a discussion of the findings, the implications of the findings, recommendations of what should be done in the future based on these findings and a conclusion of the research performed. The hypotheses investigated in this research were informed by previous studies and theoretical relationships established by other scholars investigating the variables in this study. The findings of this research do not support all findings by previous researchers, and there are multiple relationships which had been established as being significant that were identified as being insignificant in the current research. Generally, because of the inconsistency of previous findings and the current study there may be elements related to the sample examined or other contextual factors which may contribute to the inconsistency that exists. Ultimately, it is suggested that there be further research done on the problem of resistance to EMR system use, and this is discussed further in the recommendations section of this chapter. This section discusses the findings of the hypotheses and how it is that these findings are related to previous research, with reasons for discrepancy discussed.

The first hypothesis tested the relationship between CSE and the resistance to EMR systems by management. The inclusion of this hypothesis was based on suggestion from Morton (2008), Nixon (2009) and Price (2010) who all indicated that the role of CSE as an influencer of resistance to EMR system use should be investigated further. The finding indicate that CSE is an insignificant influencer of EMR system resistance (r=.02, p=.42). This finding does not coincide with previous research. Ilie, Seha, and Sun (2009) previously identified that CSE could potentially play a significant role in resistance to EMR system use. The findings of research by Morton and Wiedenbeck (2009) indicated that there is a significant relationship between CSE and resistance to EMR system use by medical practitioners. The inconsistency of the findings of the current research, theoretical propositions by previous researchers and work by Morton and Wiedenbeck (2009) is confounding. The hypothesis is theoretically linked and previous empirical investigation established the relationship exists; however, the current study results indicate a lack of significance. The examination of these factors was controlled by multiple personal and job-related factors, hence it is difficult to explain what contextual factors would account for this lack of significance. Proposals of what this means and how this finding should be approached in the future by practitioners and researchers is explained in the recommendations and implications sections which follow.

The second hypothesis proposed that there was a significant relationship between PC and resistance to EMR systems. This proposition is not supported by the findings (r=.05, p=.33). Prior research had found that there is a relationship that exists between PC and the resistance to EMR systems. The finding in the current study is therefore not aligned with previous findings or propositions in previous research. Ilie, Courtney and Van Slyke (2007) indicated that PC is related to the problem of EMR system resistance, and that professionals in healthcare feel that the typical system is too robust, therefore it is too hard for them to learn to use EMR systems. The challenge of learning how to use the systems as a tool is something that may act to preclude people from using EMR systems in practice because the main focus of practice is to help people, and administrative duties are generally considered to be activities that make work more difficult, and do not streamline operations. This is not true, because while there is some complexity associated with the use of an EMR system in medical care facilities, EMR systems are not entirely complex to the point where they should preclude use. The current research does not support the conceptual proposition of Ilie, Courtney and Van Slyke as there is a lack of significance that exists between PC and the outcome of EMR system use resistance.

Empirical findings in research by Anderson (2007), Boostra and Broekhuis (2010), and Grevier et al., (2011) all indicated that there was significance in the relationship between complexity and resistance to EMR systems, however this is not supported in this study. It may be that these studies are at least 4 years old, and findings in the published research could be older, and that in the time between data collection of these studies and data collection in the current research that there had been a decrease in the amount of complexity in EMR system tools, therefore it is easier for medical professionals to make use of these tools than what had been in the past.

The third hypothesis dealt with the relationship between attitude and resistance to EMR systems. The relationship between ATE and resistance to EMR system implementation is incredibly weak (r=.00, p=.98). The proposal by Burt and Sisk (2005) was that a clunky, large system and the time it takes to process information were factors that would influence attitude and subsequently lead to a resistance to the use of an EMR system. The nature of EMR systems is such that developers have sought to design them to be user friendly, hence changes in EMR systems and computer systems overall over the course of the past 10 years could have influenced attitudes of medical care practitioners in such a way that they may not have an attitude that is associated with resistance to the use of EMR systems. Morton and Wiedenbeck (2009) found that EMR system adoption was significantly related to the attitude of individuals. It could be that in the difference between the affirmative nature of adoption and the negative nature of resistance there are conceptual elements which would lead to a significant relationship between EMR system use adoption and an insignificant relationship with EMR system resistance.

The fourth hypothesis examined the relationship between PP and medical professional’s resistance to EMR systems. The findings in the study indicate that medical professionals report responses that do not support the hypothesis (r=.03, p=.41). PP was therefore not an influential factor. This finding differs from the findings of Ludwick and Doucette (2009) and Venkatesh, Morris, Davis and Davis (2003). This is because PP was found to be an influencing factor in the adoption of EMR systems in these research studies. Again, the reason for the lack of significance in the relationship in the current research may be based on the prior research being older and more importantly, the prior research being based on

The fifth hypotheses tested the influence of AXY on resistance to EMR systems. AXY was expressed to be significantly related to resistance (r=.87, p<.001). This finding supports the hypothesis that anxiety with the EMR system will lead to medical care professionals rejecting use of the system. Unlike the findings of the first four hypotheses, the findings of the current study support previous research. Angst and Agarwal (2009) indicated that AXY is a factor which is significantly related to the problem of EMR system resistance. The researchers proposed that this finding may be because healthcare professionals are anxious about the nature of their current workflow, and that there is a risk that the EMR system would not be capable of meeting their needs. This research supports the findings of Nov & Schecter (2012) and the suggestion of the researchers that there needs to be a greater understanding of what factors significantly relate to EMR system resistance. Based on the empirical findings of previous research, the present research and conceptual propositions and conclusions in previously written scholarly articles, there is a great deal of support for the finding that AXY is significantly influenced by EMR resistance.

This finding is a significant, positive finding, which posits that a relationship between AXY and EMR resistance exists where the more anxious a person is, the more the person will resist EMR systems. Less anxious healthcare professionals will therefore be more capable of dealing with changes that come from the implementation of an EMR system in the workplace than those with anxiety. Based on this finding, there are recommendations for practitioners with regard to the management of healthcare professionals who suffer from anxiety that are going to face the implementation of a new EMR system in the workplace. These recommendations are presented in the following section on recommendations. Recommendations with regard to AXY and EMR system resistance rely on research by Kumar and Aldrich (2010) and Beiter et al. (2008).

The sixth hypothesis investigated corollary relationships between the independent variables in the study. There are many components of this hypothesis, and some were found to exhibit strong correlations while a few were found to be weak. Both the Pearson and Spearman correlation coefficients were investigated. Pearson correlation coefficients are expressed in this section in all hypotheses, except for instances where the use of the Spearman correlation coefficient resulted in the identification of a significant relationship where the Pearson correlation coefficient did not. The significance of these factors is indicative of the problem of EMR system resistance being more robust in nature than the study of only a few levels of relationships. The discussion of these findings supports recommendations for future research and some of the implications proposed in this chapter.

The relationship between CSE and AXY was found to be significant (r=.22, p<.001). This finding is interesting in that it means that the greater the self-efficacy a person feels with the use of a technology, the greater the anxiety the person feels with using it. This finding could be evidence that a healthcare professional with a greater deal of self-efficacy is anxious about their use of the technology because they have a great deal of respect for the ramifications of misuse. Theoretically there does not seem to be support for this finding, and that if there was such a relationship, the correlation should be negative in nature.

The relationship between AXY and ATE was found to be significant, however negative ($r=-.19$, $p<.001$). This finding indicates that when people have a poor attitude towards the implementation of the EMR system, then they will also have higher anxiety about the system being implemented. Recommendations regarding what this means are given later in this chapter in the recommendations section.

The relationship between PP and PC was found to be insignificant ($r=-.03$, $p=.60$). While the relationship was insignificant through the use of the Pearson correlation, the Spearman correlation coefficient was significant at -.14 ($p<.05$). This finding indicates that there is a monotonic relationship that exists between PP and PC where increase in one will lead to an increase in the other. This is indicative of a non-linear, yet significant relationship. What this means is that there is a significant social aspect to the development of PC in that when medical care professionals perceive complexity in a tool such as an EMR system, there is PP involved driving the feelings that people have that the technology is complex. Suggestions on addressing this are made in the recommendations section of this chapter.

The relationship between PP and ATE was found to be insignificant ($r=.07$, $p=.28$). PP and ATE do not correlate, therefore trying to use peer pressure to improve attitude with regard to the implementation of the EMR system would have an insignificant impact.

The relationship between ATE and PC was identified as significant ($r=.79$, $p<.001$). The effect size in this relationship is strong, with 62.4% of variance being explained in the relationship. These are both personal feelings, hence the value that management may have from understanding more about them would come from determining how to manipulate one of these factors with a social factor. Both ATE and PC are significantly related with resistance to EMR systems, therefore determining a social factor which is significantly related to PC, ATE and resistance to EMR systems would inform on how to effectively manage and mitigate resistance to EMR systems.

The final hypothesis investigated the controlling variables to understand if there were mean differences in resistance to EMR systems according to the controls of age, gender, role in healthcare and years working in healthcare. Age was not identified as significantly influencing resistance to the use of EMR systems ($F_{(1,198)}$=.09, p=.77). Gender was found to be an insignificant influencer of resistance to EMR systems ($F_{(1,198)}$=.12, p=.73). The nature of the work that people do in the medical profession was identified as being an insignificant influencer of resistance to EMR system use ($F_{(1,198)}$=.10, p=.75).

The current research informs that the influence of resistance to EMR systems is a complicated sociotechnical and psychological problem with multiple layers and moving pieces. Successfully responding to the problem of EMR system resistance cannot be answered through the utilization of simple models where the problem is responded to by a single factor, and the analysis of the impact of multiple factors will only support a limited quantitative understanding. Theoretical construction of robust data models can contribute to an understanding of how it is that the multiple factors which influence the problem of EMR resistance may be responded to by managers. The findings from this study cannot be applied by management without understanding the mechanisms for manipulating the elements investigated.

As technology continues to evolve and the value of technology design becomes increasingly salient in organizations, the problem of technological implementation will increasingly be one where management and product development teams will be focused on avoiding the implications of technological change. What this means is that the problem of EMR system resistance may be a problem that organizations and EMR system developers may be effectively managing. The mean of EMR system resistance was 10.93, with a standard deviation of 5.79. This finding is evidence that there is a great deal of enthusiasm for the use of EMR systems generally as the range of responses for EMR system resistance was 2-14.

The findings of this research indicate that there may be a need to investigate technological advancement as playing a role in influencing whether people resist new a new technology. Research performed prior to 2011 indicated that factors investigated in this research significantly related to resistance or adoption of EMR system technology, however there is a lack of significance for these factors now, however there is generally a high level of enthusiasm for the use of EMR system technology. It is important to understand if this is a problem that management and information system development firms have determined how to effectively manage this problem.

The findings from this research only indicate significance in one relationship involving resistance to EMR system use, however findings related to the examination of the independent variables inform that there may be a role for exploiting the indirect effect of management and organizational resources on the mental state of the worker. It is important to influence anxiety, and determining the technological, organizational and social factors which have an impact on EMR system resistance can effectively contribute to understanding how to approach the problem.

The purpose of this research was not entirely met. This research sought to identify factors which would contribute to reduction of resistance to EMR system use in healthcare organizations by healthcare professionals. This research was not able to accomplish this goal, however the findings of this research do support future investigation of the problem and indicate that quantitative methods designed to investigate the problem should be more vibrant in nature than in the current study. The findings support multiple proposals for future research and the identification of gaps in the current body of knowledge. While the goals of this research were not ultimately met, the performance of this research did support the refinement of the objective of study of this problem in future research, hence while the goals and purpose were not met, the findings were indicative of the problem being more fecund than what was first identified from the findings of prior research.

Strengths

A strength of this study is that it was performed on an issue that appears to be changing. This research identified findings which are different than what previous research had found. Because technology is dynamic in nature and the implications of technology will be different over time as technologies become increasingly capable of dealing with problems people may have, these findings may support the understanding of the problem as changing. Another strength of the study is that it was able to identify a lack of direct effects, however there was the identification of the potential that there are multiple indirect effects present. What this means is that the problem resistance to new technologies may be more complex than what had been considered.

Weaknesses

There are a few weaknesses in this study. One weakness is that there is a lack of significance in the elements investigated. While this finding identifies changes from prior research, there is a lack of understanding of why and what the change has been to. In addition, the design itself did not take into consideration organizational or technological factors. There is also a lack of social factors as peer pressure is the only social factor investigated. Peer pressure did not mean much in this study and there was a lack of significance in its role as an influencer of resistance to EMR systems.

Limitations of the study

This study was limited in that it only sought to understand the problem in the context of professional healthcare workers. In addition, the study is limited in that it only sought to understand this problem within a cross-section of time, and did not investigate the problem in a longitudinal manner. Future research needs to understand the influence that technological change over time will have on the nature of how it is that change happens in the organization.

Implications

There are a few implications which can be drawn from the current research. The findings of this study primarily have implications within the scope of organizational studies, with relatedness to social theories present that are tied to organizational and information system research. These implications are primarily associated with what the results of this study mean and how it is that they may be applied in future studies. Implications may also be drawn with regard to how it is that they may be applied by practitioners in the field of management and information systems.

One implication of the current research is that research dealing with the resistance to EMR systems is tied to affective and cognitive processes. There is a complex relationship that exists in the current relationship where affective and cognitive processes will contribute to the EMR system resistance of a user. Resistance to the use of the EMR system is a decision that people come to, and their cognitive and affective mental nature are factors which will support whether or not an individual will seek to resist the use of the technology. The findings of this research indicate that cognition and affect are related, hence understanding factors which have an impact on both cognition and affect as well as resistance to technology implementation will result in the determination of how to effectively manage and plan for the human relations aspects of the implementation of a new technology. Such findings will have an impact on the organizational plan for implementation. This has implications for management through the evidence gained by scholarly activities.

While there is a distinct link between the resistance that people may have to information systems and the psychological aspects of affect and cognition, these are factors that management cannot simply order to change; organizational elements need to support the affect and cognition of the worker in order to reduce resistance to the use of the new technology.

In this study, the EMR system is the technology at the focus of the research of feelings of healthcare professionals. EMR systems are identified as generally adding value by being a means of effectively keeping records on patients and being a means of quickly transmitting data on a patient from one place to another (Moineddin, & Harvey, 2011). The problem however, is that people have a personal reaction to the implementation of the system and their emotions and thoughts about the new technology will contribute to whether the system will be resisted or not. The implication is that the decisions that people make with regard to whether they will choose to resist change will be based on their emotions and beliefs of the difficulty of the system, rather than what the system will do for the service they provide. For this reason, there needs to be effective management that encourages people to not resist the implementation of the new system in order to support the success of the system.

One implication for future research is that the role of management needs to be better understood. The self-reporting of the healthcare professionals of their feelings and perceptions is useful for understanding what they think about EMR systems and how they approach their use and implementation, however for there to be change, there needs to be a catalyst for change. Management needs to understand the organizational resources that would effectively respond to the problem in order to determine the factors that would effectively contribute to the organization being more successful with regard to mitigating resistance to new technologies. In this study the factor of anxiety is a condition that is the means by which resistance to EMR systems can be influenced, however without knowledge of how to manipulate anxiety or prepare for it, there is a gap which needs to be filled in order to understand how to most effectively manage the problem of EMR system resistance. Understanding how this happens will have implications for different types of technology implementations that organizations may engage in, leading to the organization effectively dealing with the problem of technology implementation through policies designed to mitigate resistance to new technologies.

The final implication is that future research must seek to design robust data models investigating this problem because there is a complex social psychological relationship impacts resistance to EMR systems. This relationship should seek to understand both how it is that technological, organizational and social factors influence resistance and how it is that these factors may be inter-related in elegant data models. Covariance-based structured equation models with multiple levels may be appropriate to understand the nature of how it is that the mind of the worker could be changed in such a way that they would not resist the implementation of the EMR system.

Recommendations

Practical Recommendations

For practitioners, there are several recommendations which emerge from the current research. These practical applications are developed through the use of evidence-based management in the scope of determining how to approach the problem of resistance to EMR systems from the findings of research. The practical recommendations address how it is that the current research findings and prior findings contribute to the development of plans for addressing the problem of EMR system resistance by medical professionals.

With regard to the relationship between anxiety and the problem of EMR system resistance, there are a few things that should be done. This relationship is a significant, positive relationship, therefore the greater the anxiety, the greater the resistance to EMR systems. In order to manage this, management should seek to identify healthcare professionals in their workplace who have anxiety, and prepare these people for the implementation of the EMR system. Embi (2007) identified that users with anxiety is typically less than adequate, therefore people with anxiety should be the focus of early training programs. While early training can support preparation for the task, it can also be an emotionally preparatory element as Kumar and Aldrich (2010) noted that there is a perceived lack of support among people who have anxiety for the period after implementation. Early training can mitigate the perception of a lack of support in the training and development program for the implementation of the EMR system, supporting both the emotional and intellectual growth of the healthcare professional being trained for the use of the new technology. The design of the training program should be focused on informing on the use of the new software and applications of the software. Beiter et al (2008) and Coffin and Mackintyre (2000) have identified that anxiety will make workers reluctant to learn and that workers will resist new software and applications when they suffer from anxiety. Management should work to limit this.

In terms of the monotonic, non-linear relationship between peer pressure and perceived complexity, it is recommended that management seek to develop a positive stigma around the technology being implemented. What may be key in this instance would be the use of change management principles. Kotter’s model of change could be a benefit in that management can take a leadership role and make the change “infectious” through the organization (Kotter, 2010). The development and articulation of a vision to personnel selected to be a guiding coalition could give the implementation of the EMR system a great deal of social inertia. The solidification of the EMR system into the processes of the organization and making it a preferred way of communicating with key people or accessing key information can relieve peer pressure, and with lower peer pressure there will be a lower level of perceived complexity. This is valuable because while perceived complexity is not significantly related to resistance to the EMR system, anxiety is, therefore a reduction in perceived complexity can support the reduction of anxiety, and a reduction in anxiety will reduce resistance to the EMR system.

Future Research

One direction that future research should approach is the determination of social or organizational factors, which would significantly impact factors such as PC, ATE, AXY and resistance to EMR systems. The factors or PC, ATE and AXY are cognitive and affective elements of the phenomenon of EMR system resistance. Understanding the social and organizational elements that would effectively influence cognitive and affective elements would be key to understanding how it is that management would be able to effectively manage EMR system resistance. It is important that management understand how to manipulate resistance to EMR system use, therefore researchers will effectively bridge the gap between practice and scholarly activity by identifying the elements of management and the organization that manipulate PC, ATE, AXY and resistance to EMR systems.

Another direction for future study should be determining the theoretical differences between adoption and resistance, and how there can be a significant, positive urge to adopt, however an insignificant, negative urge to resist. Multiple researchers have approached the problem of EMR system adoption and found significance in the relationship between factors such as ATE, PC and PP, however these factors are not significantly related to resistance (Anderson, 2007; Boostra & Broekhuis, 2010; Grevier et al., 2011). Research should determine how users could potentially be both resistant and adoptive or not resistant and not adoptive. This is because if there is an insignificant relationship with resistance and a significant relationship with adoption, it is possible to be both resistant and adoptive or not resistant and not adoptive.

Future research should investigate the problem of EMR system resistance from the approach of a meta-analysis to understand if technological change and refinement has had an impact on the significance of several different factors on the problem. A temporal moderating variable should be implemented in order to understand the impact of time passing on the significance of factors as predictors of EMR system resistance. A meta-analysis could support the determination of a point in time where the effect size of the relationship between factors investigated and the outcome variable of EMR system resistance becomes weak. The current research is evidence that the relationship is now week between EMR system resistance and CSE, PP, PC, and ATE, however, conceptual propositions and empirical findings supported the relationship in previous research. It is important to understand if time played a part in this in order to determine if it is the trajectory of technological advancement that caused the lack of significance.

If this research supports the proposition that time plays a part in the effect of factors on EMR system resistance, then change that comes with the passage of time should be investigated. One way that this could be performed would be to investigate the relationship between medical care professional perceptions of technological advancement and improvement over time and EMR system resistance. Significance would indicate that it is possible that the factors that had influenced adoption in the past have been rectified, and people's attitude, self-efficacy with computers, peer pressure or perceived complexity influence EMR system resistance in terms of how medical care professionals approach the issue of EMR systems. As technologies become increasingly simple to use, these factors may no longer be a problem for people, therefore, it is possible that the sociotechnical phenomenon of resistance to EMR system technology has matured to the point where problems that influenced people in the past will no longer have an influence.

Summary

This research informed on how it is that resistance to EMR systems may be influenced by social psychological factors. The problem was investigated through the use of a quantitative methodology and a cross-sectional corollary research design measuring the self-rated responses of medical care practitioners. The findings from prior research on the problems of EMR system resistance and adoption and conceptual propositions by scholars addressing the problem of EMR system use in organizations were the basis of the design of the model utilized in this study. The findings of this study only support a direct relationship between AXY and the problem of EMR system resistance; however, the research also identified relationships between factors associated with anxiety which may have an indirect effect on resistance to EMR system implementation. Based on the results of quantitative analysis recommendations of future directions for research and management are proposed.

In this study, CSE was defined as being "an individual's perception of his or her ability to use a computer in the accomplishment of a job task" (Compeau & Higgins, 1995, p. 193). PC was understood to be when healthcare professionals believe that there are more components to a system than what could be easily understood, hence growing the learning curve of dealing with the system. ATE was understood as having a perception of the system as taking a great amount of time to process information. PP was defined as pressure from fellow professionals to use EMR systems, and Anxiety was defined as healthcare professionals' anxiousness when it comes to using EMR systems.

EMR systems are important tools for medical professionals to use as they will support medical professional's efforts to consult, educate and treat patients in an efficient and effective manner. This is because EMR systems will maintain medical records, keeping a digital record of patient's historical data. As the number of people reliant on medical interventions continues to grow at an accelerating rate, the utilization of these tools can support the care given to patients. Further supporting the implementation of strong EMR systems is the implementation of the Patient Protection and Affordable Healthcare Act (PPAHCA), which is legislation which supports the design and implementation of medical information systems. EMR systems are a medical information system which support the storage and easy distributed access to the medical records of patients (Ackerman, Filart, Burgess, Lee, & Poropatich, 2010). The PPAHCA supports the use of EMR system by advocating for the implementation of EMR systems and standardization of medical software in order to grow efficient and effective access to medical care (Li & West-Strum, 2010). While there is a benefit and the government expresses support for EMR system implementation, 30% of healthcare providers were not knowledgeable or did not want to adopt the use of EMR systems in 2007, meaning that it is important to understand the factors related to the problem of resistance in order to address the problem (Galt et al., 2007).

The power of EMR tools to support medical treatment and the resistance to use tools in treatment can be best understood through the scope of the perceptions of the users of these tools, hence the need to investigate the problem of resistance to EMR systems through the scope of user feelings of CSE, PC, ATE, PP, and AXY. This problem has not yet been investigated thoroughly and researchers in the field had concluded that the problem of resistance to EMR systems by healthcare professionals is a phenomenon that is not yet completely understood (Ayatollahi, Bath, & Goodacre, 2009; Ilie, Van Slyke, Parikh, & Courtney, 2009). The main goal of the research was to understand the significance of the relationships between these five factors and the problem of resistance to EMR systems. This research contributes to the understanding of resistance to EMR systems by determining psychological factors that significantly explain the outcome of resistance to EMR system use.

The hypotheses designed to respond to the problem of resistance to EMR system use through the scope of CSE, PC, ATE, PP, and AXY examined correlations, path coefficients, parameter estimates and mean differences. Investigation of these hypotheses as limited by the nature of how it is that the problem was investigated in this study. This study relied on the use of self-report surveys as a means of investigating the problem. Because of the use of self-report surveys, the scope of the response was one where different EMR systems received a response and were a part of the overall pool of cases investigated. While EMR systems may be similar in function, EMR systems are not designed in an identical manner. The investigation of these hypotheses is novel as there has yet to be research, which has investigated these problems at the same time and the lack of research on the problem of resistance; a problem that the government has begun to seek solutions to. Understanding the factors, which are antecedents to the problem will contribute to prescription of a cure to the problem of resistance to EMR system use.

These five factors each can have a potential impact on the resistance to EMR systems. CSE involves computer literacy and liking. Prior experience with computers can have an influence on the level of efficacy that people feel with the use of other computer systems. These experiences of an individual will contribute to their self-efficacy. PC can be a barrier to the use of computer systems, however experience, literacy and training can eliminate complexity in some instances. ATE can contribute to resistance to EMR systems, and will be a highly effective contributor to resistance when the user has a negative attitude towards the EMR system. PP may support or be detrimental to resistance to EMR systems, depending on whether others support the implementation of the EMR system or not. AXY can support resistance; however, a lack of anxiety will not necessarily support the implementation of the EMR system; hence, resistance is likely to only be supported not debilitated by anxiety being present.

The problem of resistance to EMR system use was investigated using a quantitative methodology. PLS-SEM, ANCOVA, and ANOVA were the analysis procedures that were employed in the study. PLS-SEM using the R statistical package is considered an effective approach to examine causal relationships between independent and dependent variables (Chin, 1998; DesRoches et al., 2008). SEM is a broader version of the general linear model (GLM), thus making it a second-generation data analysis technique. First generation techniques such as linear regression and logistic regression are only able to test the relationship between the independent variables (IVs) and dependent variable (DV) without inter-IVs relationships. However, SEM is capable of examining all the relationships including the inter-IVs relationships in one procedure (Arbuckle, 2010). Moreover, Analysis of Covariance (ANCOVA) via SPSS was used to measure indirect effects of the IVs through control variables; in the case of this study, these control variables consist of: age, gender, role in healthcare, and years in healthcare.

All the items in this study were modified from questions from Aldosary (2003), Cork et al. (1998), along with Laumer and Eckhardt (2012) to retain validity by maintaining the standard format for measuring the items. The survey instruments were constructed using the four-step process of identifying construct validity and reliability, content and face validity, and performing a pilot study. Construct validity and reliability was identified through consultation with six subject matter experts, content and face validity was identified through the use of the Delphi technique, the pilot study surveyed 20 participants using a questionnaire, measuring internal consistency through the use of Cronbach's alpha. A total of 310 surveys were collected, and 258 responses were used as the rest were screened out, supporting the generalizability of the results of the research. 52 of the removed responses were taken out of the study based on the Mahalanobis distances suggesting that there was non-normality in the data. The data was removed in order to satisfy the assumption of error variances being drawn from multivariate normal distribution. In order to support the reliability of results it was necessary to remove these cases from the dataset.

Descriptive statistics inform that 59% of those included in the study were female, while 41% were male. There were more Caucasians in this study than other races, with 46% of respondents identifying as Caucasian, while 22% were African American. All respondents held a degree of some kind, with 57% of respondents held either a

Bachelor's or a Master's degree, and 62% were between 35-54 years old. The initial results of confirmatory factor analysis performed indicated that the measurement model did not have good fit for the observed data indicating that there were significant differences between the implied and observed covariance matrices. A total of nine iterations were conducted, removing problematic items each time until acceptable factor loadings were achieved. The results of the last iteration showed significantly improved fit, although still poor overall.

Correlation analysis identified significance at $p < .05$. The analysis found that there was a significant relationship that existed between resistance to EMR systems and CSE, PC, ATE, PP, and AXY. AXY was also found to significantly relate to CSE, PC and ATE. PP was found to significantly relate to CSE, while ATE and PC were found to relate. An analysis of covariance examined the relationship between the five independent variables in this study and resistance, with years of experience using computers, years of experience using EMR, hours of EMR use, and gender as covariates. The model explained 92.9% of variance in resistance to EMR use. ATE, PC, AXY and years using computers were found to be significant influencers in the ANCOVA model. Null hypotheses 1-4 were accepted, while null hypothesis 5 was rejected. These findings indicate that the standardized regression path estimates of the influence of CSE, PC, ATE and PP are insignificant, while AXY is significant, with the model explaining 78% of resistance to EMR system use. Null hypotheses 6a, 6b, 6d, and 6e were rejected, while null hypothesis 6c was accepted. These findings are evidence that there is a significant correlation at $p < .05$ between CSE and AXY, AXY and ATE, PP and ATE and ATE and PC, however, there is no significance in the relationship between PP and PC.

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Appendix A

Survey Instrument

SURVEY

Electronic Medical Records (EMR):

An Empirical Testing of Factors Contributing to Healthcare Professionals' Resistance to Use EMR Systems

Purpose of the study: This study will look at reluctance or resistance on the part of some healthcare professionals to use Electronic Medical Record systems (EMR). EMR systems are a type of clinical information system dedicated to the collection, storage, manipulation of clinical data. They are considered integral for the delivery of patient care. Completing this survey will help us identify specific components that are contributing to resistance on the

All questions contained in this survey are strictly confidential and will remain

Computer Self-Efficacy (CSE)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I feel confident pulling patient records from EMR systems	☐	☐	☐	☐	☐	☐	☐
I feel confident with deleting of files when they are no longer needed.	☐	☐	☐	☐	☐	☐	☐
I feel confident troubleshooting computer problems.	☐	☐	☐	☐	☐	☐	☐
I feel confident understanding terms/words relating to computer software.	☐	☐	☐	☐	☐	☐	☐
I feel confident retrieving files from a shared network environment.	☐	☐	☐	☐	☐	☐	☐
I feel confident learning to use a variety of programs (software packages).	☐	☐	☐	☐	☐	☐	☐
I feel confident explaining why a program (software) will or will not run on a given computer)	☐	☐	☐	☐	☐	☐	☐
I feel confident describing the function of computer hardware (e.g. keyboard, monitor, disc drives, central processing unit)	☐	☐	☐	☐	☐	☐	☐
I feel confident adding and deleting information patient records from EMR systems	☐	☐	☐	☐	☐	☐	☐
I feel confident installing software correctly	☐	☐	☐	☐	☐	☐	☐

Perceived Complexity (PC)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
EMR systems are too difficult to use	☐	☐	☐	☐	☐	☐	☐
I feel confident following the workflow/navigation presented in the EMR systems	☐	☐	☐	☐	☐	☐	☐
I can easily find my patients in the EMR system	☐	☐	☐	☐	☐	☐	☐
I find it difficult to understand the technical aspects of EMR applications	☐	☐	☐	☐	☐	☐	☐
Any healthcare professional can learn EMR systems if they are motivated	☐	☐	☐	☐	☐	☐	☐
I think that I can keep up with the fast pace of	☐	☐	☐	☐	☐	☐	☐

changes in EMR systems.							
I am confident that I can learn to use ERM systems	☐	☐	☐	☐	☐	☐	☐
EMR systems take too much time to learn	☐	☐	☐	☐	☐	☐	☐
I definitely need formal training to use EMR systems	☐	☐	☐	☐	☐	☐	☐
There is too much information on the EMR system screen making difficult to follow	☐	☐	☐	☐	☐	☐	☐

Attitude Toward EMR systems (ATE)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I do not think EMR systems are really necessary for patient care	☐	☐	☐	☐	☐	☐	☐
The paper-based record are more efficient than EMR systems	☐	☐	☐	☐	☐	☐	☐
More vendor training is needed for me to become comfortable with EMR systems	☐	☐	☐	☐	☐	☐	☐
I would prefer to have the option to use paper-based records or EMR systems	☐	☐	☐	☐	☐	☐	☐
EMR system implementations take much too long	☐	☐	☐	☐	☐	☐	☐
EMR systems can same me time when writing my medical notes	☐	☐	☐	☐	☐	☐	☐
I have no plan to implement ERM systems until the deadlines are near	☐	☐	☐	☐	☐	☐	☐
EMR can eliminate errors that result from misinterpreting handwritten notes.	☐	☐	☐	☐	☐	☐	☐
Using EMR system would enhance my effectiveness as healthcare professional	☐	☐	☐	☐	☐	☐	☐
I would encourage my colleagues to use EMR systems	☐	☐	☐	☐	☐	☐	☐

Peer Pressure (PP)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I am pressured by my peers to use EMR systems	☐	☐	☐	☐	☐	☐	☐
I am pressured by my patients to use EMR systems	☐	☐	☐	☐	☐	☐	☐
I feel pressured to learn new skills that I do not have the time for	☐	☐	☐	☐	☐	☐	☐
I feel pressured by management expectations once I learn EMR systems	☐	☐	☐	☐	☐	☐	☐
There will be an unreasonable expectation for record errors if I use EMR Systems	☐	☐	☐	☐	☐	☐	☐
I am afraid I will become obsolete in my field if I do not use EMR Systems	☐	☐	☐	☐	☐	☐	☐
My colleagues use EMR systems so, I too will start using them	☐	☐	☐	☐	☐	☐	☐
My colleagues think EMR systems easy to use	☐	☐	☐	☐	☐	☐	☐
People whose opinion matter to me find EMR system useful	☐	☐	☐	☐	☐	☐	☐

My colleagues think EMR is useful, but I am not convinced	☐	☐	☐	☐	☐	☐	☐

Anxiety (AXY)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I look forward to using my computer at work.	☐	☐	☐	☐	☐	☐	☐
I am a bit apprehensive about using EMR systems	☐	☐	☐	☐	☐	☐	☐
I have hesitation to use EMR systems fearing that I will make a mistake that I cannot correct	☐	☐	☐	☐	☐	☐	☐
I am a little intimidated by the application screens of ERM systems	☐	☐	☐	☐	☐	☐	☐
I avoid using EMR systems whenever I can	☐	☐	☐	☐	☐	☐	☐
I find the challenge of learning ERM systems exiting	☐	☐	☐	☐	☐	☐	☐
I am anxious that we are not going to achieve meaningful use	☐	☐	☐	☐	☐	☐	☐
I am anxious that the implementation is not going to be completed on time to get the government incentives	☐	☐	☐	☐	☐	☐	☐
I am anxious about the financial liabilities that come with implementing EMR systems	☐	☐	☐	☐	☐	☐	☐
It scares me to think that I could cause the computer to destroy a large amount of information by pressing the wrong key.	☐	☐	☐	☐	☐	☐	☐

Demographic Information

Gender: ☐ M ☐ F	**Age**: ________	**What is your racial/ethnic background:** a) Caucasian b) African-American c) Hispanic d) Asian e) Pacific Islander f) Middle Eastern g) Native American Other (Please specify)____________________________	**What is your highest level of academic qualification?** a) Professional degree b) Bachelor's degree c) Master's degree d) Ph.D.

How many years do you have using EMR systems? a) None b) 1-5 years c) 6-10 years d) 11 – 15 years e) More than 15 years	How many hours have you attended formal training in the previous five (5) years? _________ hours	How many years have you used computers for any purpose? __________ year(s).

Please select your specialty:

☐ Allergy & Immunology	☐ Endocrinology	☐ Nephrology	☐ Otolaryngology	☐ Radiation oncology
☐ Anesthesiology	☐ Family/general practice	☐ Neurology	☐ Pathology	☐ Radiology
☐ Cardiology	☐ Geriatrics	☐ Neurosurgery	☐ Pediatrics	☐ Registered Nurse
☐ Cardiothoracic surgery	☐ Hematology/Oncology	☐ Nursing Assistant	☐ Physical med/Rehab	☐ Rheumatology
☐ Clinical Analyst	☐ Infectious disease	☐ OB/GYN	☐ Plastic Surgery	☐ Surgery, general
☐ Dermatology	☐ Licensed Practical Nurse	☐ Oncology	☐ Phlebotomy	☐ System Analyst
☐ Diagnostic imaging	☐ Medical Records	☐ Ophthalmology	☐ Programmer	☐ Trauma surgery
☐ Digestive disease	☐ Medical Technologist	☐ Oral surgery	☐ Psychiatry	☐ Urology
☐ Emergency medicine	☐ Medicine, general	☐Orthopedics	☐ Pulmonary medicine	☐ Vascular

Other/Not listed, please specify:

Appendix B

Healthcare facilities granting permission to collect data from employees

Urban Family Practice Associates, P.C.

Miles Eli Brett, M.D.
Steven B. Kraus, M.D.
Cedrice N. Davis, M.D.
Jeffrey M. Reznik, M.D.
Andrea S. Videlefsky, M.D.
Godfrey Mark, M.D.

Patrick R. Kneer
Practice Administrator

01/16/2014

Dear Emmanuel,

I approve your request to conduct an employee survey at the Urban Family Practice upon IRB approval. I wish you the best in your dissertation process.

If you have any questions or concerns, please feel free to contact me at the office. -

Sincerely,

Jeffrey M Reznik, MD
Urban Family Practice Associates, PC

2520 Windy Hill Road - Suite 301 - Marietta, GA 30067
(770) 952-1032 - FAX (770) 952-3208
www.urbanfamilypractice.org

21st Century Oncology

- Image Guided Radiation Therapy (IGRT)
- Intensity Modulated Radiation Therapy (IMRT)
- Stereotactic Radiosurgery and Cyberknife
- Partial Breast Brachytherapy
- HDR Brachytherapy
- Prostate Radioactive Seed Implantation
- Radioisotope Therapy
- Volumetric Arc Therapy (VMAT)

December 5, 2013

Dear Emmanuel;

I fully support your request to conduct an employee survey on EMR here at 21st Century Oncology. I wish you good luck with the dissertation.

If you have any question, please feel free to call our office at: 954-370-7555

Sincerely,

Dr. Eduardo Fernandez M.D. PhD. F.A.C.R.O.
Radiation Oncologist

Antwan L. Treadway, DMD
Oral & Maxillofacial Surgery

Facial and Sports Injuries *Reconstructive and Dental Implant Surgery* *Pain and Anxiety Control*
Sedation and General Anesthesia *Corrective Jaw and Orthognathic Surgery* *TMJ*
Wisdom Teeth *Snoring and Sleep Apnea Surgery* *Denture Surgery*
Tumors and Cysts of the Jaws *Lip and Mouth Cancer Detection* *Maxillofacial Diseases*

Diplomate, American Association of Oral and Maxillofacial Surgeons
Diplomate, National Dental Board of Anesthesia

Dear Emmanuel,

I am open and supporting of your desire to question employees at Atlanta Oral and Facial Surgery regarding your dissertation subject matter. We look forward to assisting in the procurement of data and contributing in any way we can. If there are any questions or concerns please contact me at 770-941-2476.

Sincerely,

Antwan L. Treadway, DMD