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The Relationship Between Technology Threat Avoidance and Innovation in Health Care Organizations

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2017

Abstract

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MBA, Walden University, 2012

BS, The University of Southern Mississippi, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Information Systems Management

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Abstract

Most leaders of healthcare delivery organizations have increased their rate of technological innovation, but some still struggle to keep pace with other industries. The problem addressed in this study was that senior leaders in some rural ambulatory healthcare facilities failed to innovate, even with recent healthcare technological innovations, which could lead to increased medical errors and a loss of efficiency. The purpose of the study was to examine if a relationship exists between the avoidance of technology threats by senior leaders in ambulatory healthcare organizations and the innovation propensity of the organization. Technology threat avoidance theory served as the theoretical basis for this correlational study. The research questions were used to investigate the relationship between technology threat avoidance by senior leaders and the ways avoidance affects an organization's level of technological innovation. Data were collected from 90 respondents via an anonymous online survey, developed from the innovation culture measurement and the COPE measurement, and analyzed using multiple regression and Spearman's correlation. Organizations with senior leaders who actively avoided technology threats had significantly higher innovation propensity ($\beta = .51$, $p = .001$). The analysis also showed that rural healthcare delivery organizations tended to have lower innovation propensity ($\beta = -.18$, $p = .05$). The study social change implications enable the leaders of more health care delivery organizations to actively mitigate technology threats, rather than passively avoiding them. Properly handling these threats could allow management to make more informed decisions about technology implementations and thus increase their ability to provide meaningful, innovative care and to avoid one of the leading causes of death—medical errors.

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Dedication

This research is dedicated to my parents. My parents invested in the advancement of my education with every opportunity they had. My parents realized the potential in me and did everything they could do to help me explore my abilities and God-given talents. I dedicate this to my strong wife, who stood by my side through the long nights, early mornings, and writing retreats. Without her encouragement and understanding, I would have been unable to finish this milestone. I also dedicate this to my kids. They may not understand the sacrifices today, but hopefully they will appreciate them in the years to come.

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Chapter 1: Introduction to the Study

Introduction

Recent innovations in technology, such as electronic health record (EHR) systems, may be the key to reducing errors and streamlining medical services. Makary and Daniel (2016) indicated that deaths from medical errors topped 400,000 in 2013 and ranked as the third leading cause of death in the United States. Reducing medical errors and increasing meaningful care were the primary drivers for the Healthcare Information Technology for Economic and Clinical Health (HITECH) Act, a byproduct of the American Recovery and Reinvestment Act of 2009 (Jones, Swain, Patel, & Furukawa, 2014; Kruse, Bolton, & Freriks, 2015). Medical errors still occur in high numbers (Makary & Daniel, 2016), and patients are still hoping for a more connected and transparent care experience. For example, Koru, Alhuwail, Topaz, Norcio, and Mills (2016) studied patients in a qualitative study about home health care and cited issues with incorrectly prescribed medications. The use of a connected EHR might have prevented those incorrect prescriptions. The implementation of EHR systems has risen sharply over the past 6 years (Jamoom, Patel, Furukawa, & King, 2014). This increase is due to the demand provided by meeting regulatory guidelines in the HITECH Act (Kruse, Bolton, & Freriks, 2015), as well as the penalties levied for failing to meet Health Insurance Portability and Accountability Act (HIPAA) guidelines.

Although deaths caused by medical errors may not have a direct link to a lack of technology, the reduction of medical errors will occur at a slower rate without adequate technology (Escobar-Rodríguez & Romero-Alonso, 2014). Modern-day health care

information technology (HCIT) involves more than EHR systems, picture archiving, communication systems, provider order-entry systems, and other novel systems found in most health care delivery organizations. Health care technology now includes wearable internet-enabled medical devices and mobile applications, and many of these devices can communicate directly with an EHR system, thereby helping to prevent medical errors and perhaps save lives. To accomplish a deep level of integration, leaders of health care delivery organizations must be willing to use their EHR systems fully, which may create more security risks.

Security is a major factor surrounding HCIT. Management of health care delivery organizations and information technology leaders are constantly calculating the risk-reward associated with new HCIT (Enzmann, 2015). When attempting to innovate through an increased use of technology, senior leaders must assume a higher level of risk (Enzmann, 2015). An incorrect view or understanding of technology risk could lead to an overavoidance of risk, which could reduce the possibility of implementing life-saving HCIT. The primary findings of the study relate to the knowledge that management needs for health care delivery organizations to innovate, mitigate risk, and increase patient safety.

Chapter 1 covers the following topics: a brief background to describe the scope of the study, the problem statement and purpose, a summary of the gap in the literature, the independent and dependent variables, the research questions and hypotheses, a brief summary of the theoretical framework, the nature of the study, operational definitions,

assumptions, scope and delimitations, limitations, and an overview of the social change implications.

Background of the Study

Health care delivery organizations play a considerable social role in the United States. The North American Industry Classification System includes four separate codes for them: 621 for ambulatory health care services, 622 for hospitals, 623 for nursing and residential care facilities, and 624 for social assistance (Verizon Enterprise Solutions, 2015). All are important facets of health care in U.S. society. For this study, the emphasis is on the levels of innovation, realized or unrealized, in rural ambulatory health care services, also known as critical access hospitals.

A key element of HCIT implementations over the past several years has been the goal to remain compliant with HIPAA and to follow practices aligned with the HITECH Act (Herbert & Connors, 2016). HIPAA entities must implement certain technical and administrative controls. These checks often hinder—or organizational leaders perceive them to hinder—innovation and prevent technological growth. Although patient care benefits, such as clinical efficiencies and reduced medical errors, can result from technology use (Zhang et al., 2013), leaders of health care organizations have been remiss in expanding the use of innovative technology beyond federal requirements.

Acceptable levels of risk have been at the center of attention in the health care industry since the adoption of legislation such as HITECH and HIPAA. An inability to protect data within individual health care organizations has affected millions of people (Verizon Enterprise Solutions, 2015). The most cumbersome burden involved with HCIT

innovation is information security risk (van Deursen, Buchanan, & Duff, 2013). McAdams (2004) defined risk as intentional or unintentional negative events that could occur in an organization. Risk is inherent in HCIT due to the sensitive types of data maintained in health care. Risks in HCIT suggest that systems containing information such as medical records, social security numbers, photos, and other protected health information are susceptible to hardware breaches (van Deursen, Buchanan, & Duff, 2013).

Theories of innovation and the ways it affects organizations are a relatively longstanding topic. Innovation broadly refers to anything original and pertinent that enhances the effectiveness of an organization (Zaltman, Duncan, & Holbek, 1984). In the health care industry, Thakur, Hsu, and Fontenot (2012) defined innovation as implementing new tools and mechanisms for doctors and clinicians to provide higher quality of care to patients. The new tools and mechanisms created, such as internet-enabled medical devices, might introduce more technological risk—such as malware—for an organization, but they could decrease the risks associated with medical errors. Innovation is about much more than creating the next great tool. Innovation requires user adoption and organizational buy-in.

Several factors play into the implementation and adoption of technological innovations or lack thereof. Technology threats can hinder adoption (Xue et al., 2015) and come in many forms. They are human-related, environmental, or technological, and originate from both internal and external actors with either malicious or nonmalicious intent (Jouini, Rabai, & Aissa, 2014). Technology threats include viruses, malware,

phishing, and data breaches. Organizational leaders often implement measures to protect their organizations from threats, ranging from technological devices to intangible controls, such as written policies and procedures (van Deursen et al., 2013), to physical locks (Fenz, Heurix, Neubauer, & Pechstein, 2014). Even with what seem to be sufficient safety precautions, technology threats continue to be a key concern in HCIT.

New technology tools implemented in health care delivery organizations can provide the innovations necessary to prevent medical errors, save more lives and thus preserve the health of people in U.S. society. Researchers have provided several reasons why technology adoption is lacking within the health care industry, yet no one has provided a definitive answer about increasing innovation and adoption. The technology threat avoidance theory (Liang & Xue, 2009), which is an unused notion related to HCIT adoption, revealed the most glaring gap in knowledge thus far. Researchers have used the theory to explain technology-use decisions among individuals in fields unrelated to health care; this study could add to the list of countermeasures against technology adoption roadblocks, which are needed to increase successful innovation in health care delivery organizations.

Problem Statement

Technology-related innovation in most industries has flourished. The level of such innovation in the health care industry is behind nearly every other industry, which creates risks for patient safety and patient privacy (Mostashari, 2014**)**. The health care industry accounts for over 70% of electronic data breaches, which are likely to increase due to the type of data maintained (Verizon Enterprise Solutions, 2015). The general

problem is that while recent innovations in HCIT, such as EHR systems, have been beneficial for care management (Jamoom et al., 2014; Paulus, Davis, & Steele, 2008), they have not benefited as many patients in rural facilities (Gabriel, Jones, Samy, & King, 2014). The specific problem addressed in this study is that researchers have not fully explored the relationship between technology threat avoidance and innovation in health care organizations. Cresswell and Sheikh (2013) noted that a decrease in the use of technology directly affects the level of technology innovation in an organization. Liang and Xue (2009) indicated that, as technology threats hinder the performance and accessibility of information systems, individuals begin to avoid such threats by limiting its use or removing the technology. A general avoidance of technology, rather than mitigation of technological threats, creates a lack of innovation and leaves patients at risk (Mostashari, 2014). To understand the correlation between technology threat avoidance and innovation, this quantitative correlational study was conducted with retrospective data collected from information systems staff in ambulatory care facilities.

Purpose of the Study

The purpose of this quantitative correlational study was to examine the degree to which two variables are related: the independent variable, avoidance of technology threats by senior health care leaders, and the dependent variable, the innovative technology-use decisions of health care delivery organizations. Here are two examples that could explain why HCIT innovation falls short when compared to other industries: (a) human behavior to cope with a problem as it relates to threat avoidance and (b) there are barriers to innovation in the health care industry, which include financial barriers,

lack of fit, and loss of controls through the automation of tasks (Cresswell & Sheikh, 2013). The conclusion of this study is expected to add to the body of knowledge on management decisions about implementing innovative technology in health care. Connected care and easier information sharing—results of greater levels of innovation in the health care industry—could lead to a healthier and safer society.

Research Questions and Hypotheses

The focus of this study was on technology threat avoidance in health care and its effect on managerial decisions about technological innovation. The general research question was as follows: Why do senior leaders at some rural health care organizations innovate at slower rates than at other health care organizations? The following specific research questions were created based on my experiences and on background research: Research Question 1: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology?

$H1_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

$H1_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology

threat avoidance and their organization's propensity for innovation in healthcare information technology.

Research Question 2: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization)?

$H2_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

$H2_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

Theoretical Foundation

In this study, I used the technology threat avoidance theory (Liang & Xue, 2009) and a quantitative method to understand the relationship between avoidance of

technology threats and technological innovation in the health care industry. Liang and Xue (2009), who introduced the technology threat avoidance theory, stated that "Strong threat perceptions can lead to increased emotion-focused coping, which neutralizes employees' desire to cope with threats and hinders their adoption of safeguarding measures" (Liang & Xue, 2009, p. 86). HCIT along with the necessary safeguard adoptions, might be the technology innovation needed to operate a secure and successful health care delivery organization. Although the focus of the technology threat avoidance theory is individuals, the acceptance and use of technology in an organization requires a collective social process (Ward, 2013). If the collective of individuals faces challenges to innovation, so does the organization.

HCIT professionals understand that innovation involves risk. The actual threats and avoidance of them tend to slow the throughput of health care technology innovation. An understanding of technology threats often results from training, which can be ineffective on an individual level (Soomro, Shah, & Ahmed, 2016). According to the technology threat avoidance theory, an overly risk-averse individual will begin to avoid risks. Chapter 2 includes additional examples of the application of this theory from various industries and types of users.

In this study, I researched the effects of technology threats on innovation in rural ambulatory care facilities. Although the focus of the technology threat avoidance theory is primarily on individual computer use, other researchers have reliably extended the research to encompass organizations and organization-wide implementations. Technology threats were not under study here in the traditional aspect of risk levels with

technology. Rather, the study involved viewing technology threats through the avoidance theory, which included using longstanding psychological coping measures to understand how an individual handles threats. The technology threat avoidance theory served as the cornerstone of this study to understand how senior leaders balance technology threats and technology innovation.

Nature of the Study

This quantitative correlational study designed to explore what, if any, relationship exists between the independent variable, technology threat avoidance by senior leaders at health care delivery organizations, and the dependent variable, HCIT innovation, as measured by innovation propensity. A correlational study was most appropriate for this study, because it is an ex post facto method. Correlation studies involve capturing data after a phenomenon of innovation, or lack thereof, has already occurred (Neuman, 2011). Using a quantitative correlational method, I sought to determine how closely related were the independent and dependent variables.

Other methods considered but not chosen included a qualitative case study, a qualitative grounded theory study, and a quantitative causal-comparative study. A case study was not appropriate for this study because the focus would have been using defined parameters within one organization. A grounded theory study was not suitable because an underpinning theory already existed: the technology threat avoidance theory. A grounded theory study requires a hypothesis based on collected data to create a new theory (Milliken, 2010).

Remaining within the quantitative method and closely related to a correlational study, a causal-comparative study was a viable option. For example, a causal-comparative study is also nonexperimental and does not require manipulation of an independent variable (Brewer & Kubn, 2010). However, causal-comparative studies provide cause-and-effect type findings, which is the primary reason a causal-comparative study was not suitable for this study. Rather, the focus of this study was understanding the relationship between technology threat avoidance and HCIT innovation. The study did not include an explicit case that showed an irrefutable, direct cause-and-effect relationship.

For this correlational study, data came from HCIT staff members who met the criteria discussed in Chapter 3. Survey Monkey was used to collect data. Surveys provide ease of access for participants while requiring only limited resources of the researcher (Neuman, 2011). After data collection was complete, the next step involved loading survey data into IBM SPSS and analyzing it using Pearson's correlation coefficient.

Definitions

The following definitions are operationally defined for this study:

Electronic health record system: An electronic application consisting of physician order entry, patient records, images, laboratory results, and clinical notes (Jamoom et al., 2014).

Health care information technology: Health care information technology includes a collective of applications, tools (Herbert & Connors, 2016), and devices such as EHR

systems, sensing devices (such as wearable monitors), big data analytics, and cloud computing (Yang et al., 2015).

Health care information technology innovation: The implementation and use of technological tools new to a specific health care organization.

Innovation propensity: The measure of how much an organization is ready and willing to implement new processes, tools, and products to increase efficiencies or provide cutting-edge products for customers (Dobni, 2008; Ryan & Tipu, 2013).

Organizational innovation: Changing organizational practices to improve procedures using methods never before used within the organization (Camisón & Villar-López, 2014).

Risk: McAdams (2004) stated that, risk refers to "the possibility of suffering harm or loss; danger" (p. 38). Risk is more prevalent with early technology adopters and innovators (Enzmann, 2015).

Rural ambulatory care facility: Outpatient primary care settings located in nonurban areas and designated as having a shortage of available health care (Centers for Medicare & Medicaid Services, n.d.-a).

Technology threat avoidance: The action of adopting coping mechanisms to overcome perceived digital threats such as malware, viruses, and data breaches (Liang & Xue, 2009).

Assumptions

The first assumption of this study was that senior leaders of rural health care delivery organizations are avoiding technology risks associated with HCIT innovations.

A second assumption was that a significant reduction in medical errors could occur by using innovative technology. Although medical errors are the third leading cause of death in the United States (Makary & Daniel, 2016), research does not currently exist that indicates the cause of these deaths as technology use or a lack thereof. A third assumption was that the HCIT staff who took the survey would understand and appropriately interpret the intentions of senior leadership. For example, a staff member might perceive a senior leader as showing a high avoidance of technology threats, but there might be other innovation-inhibiting factors such as budget availability. While conducting the correlational study, I sought to show a relationship between senior managements' avoidance of technology threats and organizational innovation. As such, a fourth and final assumption was that management would play a major role in the decision to innovate.

Scope and Delimitations

This study sought to measure technology threat avoidance by senior leaders, as perceived by information technology staff at rural health care delivery organizations. I correlated the discovered level of technology threat avoidance with the amount of innovation propensity found at these facilities. Innovation propensity indicates the willingness and readiness of senior leaders to adopt new technology, processes, and procedures.

Senior leaders are those who make major purchasing, process, and policy decisions. Information technology staff members are those whose primary responsibilities involve the regular upkeep of the technology used in the organization. Survey

participants included information technology staff who had worked at their current organization for at least 2 years. To have a statistically valid sample size, a minimum of 75 participants was necessary. 90 participants were successfully obtained. This sample size allowed an effect size of 0.30, an alpha level of .05, and a power level of 0.80. A power level of 0.80, which equates to an 80% chance the statistical tests will have an effect, avoids statistical errors while reducing the need for larger sample sizes (Cohen, 2016). The effect size (r) is used the measure the relationship between two variables, with r = .30 being commonly used to represent a medium effect (Field, 2013). An alpha level of .05 would ensure that there is only a 5% chance of a probability error occurring (Field, 2013). The scope of technology threat avoidance measured consisted of the frequency at which an individual avoided common threats such as malware, viruses, and phishing. To prevent biased survey responses, senior leaders in the organizations did not take the survey. Instead, information technology staff answered questions that indicated their perception of how senior leaders handle technology threats and how much technological innovation occurs.

Innovation in health care is a well-researched topic. Researchers have used traditional theories, such as the unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003), the technology acceptance model (Davis, 1986), and the diffusion of innovation theory (Rogers, 2003). Yet innovation in health care still lags behind other industries. For this reason, none of the theories was used.

Limitations

A major limitation of this study was the population, which consisted of information technology staff at health care delivery organizations, a relatively smaller subset of information technology professionals. After data collection was complete, I tailored the results to match the focused group of organizations, which were rural health care facilities. Gabriel et al. (2014) ascertained that rural health care delivery organizations lack innovation and are therefore a prime target for further research. Studying only that pool of participants limits the generalizability of the study to other health care delivery organizations such as home-based care, convenience clinics, and hospital systems. To overcome that limitation, I used a broad sample of information technology staff members and asked organizational, demographic questions such as geographic location and organization size. Another limitation existed because this study consisted of random samples within the given organizational requirements. That limitation reduced the ability to obtain consistent results from a single organization. Since the results were anonymous, I had no way of knowing if the views of information systems staff members in the same organization conflicted.

Significance of the Study

Health care plays a vital role in the survival of society. Some countries provide free or reduced cost health care, whereas others, such as the United States, require forms of health insurance. The importance of health care places a substantial burden on the need to innovate quickly while also keeping PHI secure and out of the hands of malicious actors. In 2015, health care accounted for over 17% of the U.S. gross domestic product

and continues to grow (Centers for Medicare & Medicaid Services, n.d.-b). The leaders of some health care delivery organizations can overcome threats and successfully innovate in the way they deliver care and manage patient health. However, rural facilities—an important subset of health care delivery organizations— are not as successful (Gabriel et al., 2014). Research and derivations of original research show how technology threat avoidance and the knowledge about threats reduce the likelihood of attack (Herath et al., 2014; Liang & Xue, 2009). Understanding how to overcome risks and their threats may lead to greater innovation in the health care industry. This research could provide actionable items for HCIT professionals and executive leadership to consider when attempting to mitigate threats while at the same time innovating business processes.

Significance to Theory

Organizational culture plays a major role in the acceptance and use of technology. The technology threat avoidance theory highlights individuals' avoidance of technology threats (Liang & Xue, 2009) and therefore the theory limits the scope to exclude organizations. This study contributed to the theory by making it more applicable to organizations through the collective avoidance measurement of individuals. This study also included a more applicable theory for the health care field, that being the technology threat avoidance theory

Significance to Practice

Overcoming technology threats is a constant battle, particularly in the health care industry (Enzmann, 2015). However, the act of overcoming or mitigating technology

threats should not overpower organizational leaders' desire to innovate or adopt technological innovations. Technology threat avoidance should not prevent the improvement of health care for a health care delivery organization. Understanding how an overavoidance of technology threats affects the decisions of organizational leaders has the potential to enlighten policy makers, and such enlightenment is necessary to increase the level of innovation found in the health care industry.

Significance to Social Change

This study has implications for positive social change. If levels of innovation are increased, individuals may be able to receive high-quality care at a hospital, nursing home, or clinic. Health care in the United States has undergone a major shift in the past 7 years with the implementation of the Patient Protection and Affordable Care Act; access to health care has increased for many Americans (Torres et al., 2017). An increase in the number of patients means that staff members of health care organizations must maintain and protect more records. From a social change standpoint, the security and privacy of patient records are vital. Furthermore, the safety of the growing number of patients is essential. Research shows that a lack of technology in health care lessens the accuracy of providers (Waegemann, 2016). However, as the use of technology increases, so does the need for information security. The results of this study could be useful to managers in the health care industry, who may subsequently be better able to adopt life-saving technologies such as mHealth and data analytics while simultaneously avoiding technological threats such as malware and data loss.

Summary and Transition

The purpose of this quantitative correlational study was to examine the degree to which the independent variable, an avoidance of technology threats by health care senior leaders, and the dependent variable, innovative technology-use decisions of health care delivery organization leaders, relate. As noted above, health care delivery organizations trail other industries with regard to innovation. The lack of organizational innovation could be the result of an overavoidance of technology threats. Supporters of the technology threat avoidance theory use the theory to analyze various coping mechanisms used by individuals when attempting to avoid threats. No researchers have previously used this theory to identify the effects threat avoidance on an organization or, more specifically, the effects threat avoidance on a health care delivery organization. The necessity to overcome technology threats in health care while simultaneously providing effective care to patients through technology was a subject worthy of scholarly research.

This chapter included operational definitions to improve clarity in the terms used throughout this study. The chapter also included assumptions, limitations, and scope and delimitations. Even though quantitative research studies have limitations and delimitations, the results of this study provide an in-depth understanding of the reasons leaders of health care delivery organizations should mitigate technology threats rather than avoid them.

To delve deeper into the problem, Chapter 2 includes a literature review of relevant research, as well as more information about the technology threat avoidance theory. Chapter 3 further explains the method and procedures used to obtain and analyze

data. Chapter 4 explains the results of the study, and chapter 5 highlights my interpretations of the results along with recommendations to further the study.

Chapter 2: Literature Review

Some health care delivery organizations lack technology adoption and have a slower pace of innovation. Several researchers have highlighted the inability to predict technology innovation and adoption using traditional innovation models for HCIT (Cresswell & Sheikh, 2013; Ward, 2013). Although the implementation of EHRs has increased (Graham-Jones, Jain, Friedman, Marcotte, & Blumenthal, 2012), its use beyond basic functionality has remained relatively flat (Gabriel et al., 2014), particularly in rural ambulatory care facilities, also known as critical-access hospitals. There, HCIT lags even more behind other health care delivery organizations. The purpose of this quantitative correlational study was to examine the degree to which an avoidance of technology threats by health care senior leaders related to innovative technology-use decisions by health care delivery organizations.

Researchers have studied the reasons health care delivery organizations lag behind in innovation and technology adoption from numerous angles. Cresswell and Sheikh (2013) highlighted human factors, such as the feeling of losing control over a process, the fit of a technology into existing business processes, and financial burdens. Despite plentiful research about HCIT adoption, innovation and acceptance of new technology remain flat (Cresswell & Sheikh, 2013).

A less researched factor related to technology adoption and innovation is the desire to avoid technology threats. The purpose of this study was to examine the relationship between technology threat avoidance and technology-use decisions in health care delivery organizations. An overavoidance of technology threats by health care

information systems staff may adversely influence the use and implementation of innovative HCIT.

This chapter includes a review of the literature in the following four major categories: organizational innovation, technology acceptance models, general health care barriers to innovation, and the technology threat avoidance theory. Subcategories within each major theme include issues and opportunities.

Literature Search Strategy

In the search for relevant literature, I used the following databases: Academic Search Complete, Science Direct, and Sage Journals. ProQuest Central provided several useful databases including, ABI/INFORM Collection, Computing Database, Health & Medical Collection, Health Management Database, Nursing & Allied Health Database, Science Database, and Telecommunications Database. The search terms were *health care information technology, innovation, innovation propensity, innovation barriers* and *technology threat avoidance.* In several cases, a combination of the terms served to broaden the available material. The primary search objective, health care information technology, captured a broad range of scholarly material on health care, technology adoption, and innovation.

The scope of the literature review spanned the years 2012–2017 and included seminal works, such as a study by Zaltman et al. (1984), who described a key variable of this paper: organizational innovation. Other seminal works included the technology acceptance model created by Davis (1986), and the diffusion of innovation theory created by Rogers (2003). The sources used included peer-reviewed journal articles and books.

Theoretical Foundation

The theoretical foundation for this study was the technology threat avoidance theory, created by Liang and Xue (2009). This theory includes components of the coping orientations to problems experienced (COPE) framework created by Lazarus (1966). This study involved investigating the factors hypothesized to contribute to the technology threat avoidance theory and use of innovative technology in rural health care delivery organizations.

Technology threats have increased in sophistication and volume over the last 6 years. Liang and Xue (2009) stated that computer users tend to cope with technology-related threats naturally. Coping means the user will attempt to either overcome the threat or avoid it. For example, if the staff members of a health care organization believe that mobile devices used for electrocardiograms are susceptible to more viruses and data breaches, the staff might avoid using those devices. The technology threat avoidance theory was the basis of this paper and served to provide additional reasons why technological innovation is lacking within the health care industry. The technology threat avoidance theory entails well-researched psychology theories, as well as health disease analogies, to create an overarching theme.

The technology threat avoidance theory is contextual in two ways: as a process theory and as a variance theory. In either case, computer users seek to avoid malicious technology through coping techniques (Liang & Xue, 2009). Another term used to refer to encountering malicious technology is the “anti-goal or undesired end state” (Liang & Xue, 2009, p. 77). Psychologically, individuals in any scenario attempt to flee furthest

from the antigoal after an assessment of the threat (Lazarus, 1966). Attempting to separate from the threat has either a positive or an adverse effect.

The avoidance of malicious technology threats has a link to core human emotions and behaviors. Lazarus (1966) noted, “Any action which is aimed at interfering with the anticipated harmful confrontation by preventing contact with the agent of harm may be regarded as avoidance” (p. 262). Avoidance is a natural tendency regardless of the situation an individual faces. Lazarus believed that, avoiding a threat means that an individual recognizes and anticipates a threat. In health care delivery organizations, senior leaders recognize technology threats, as the number of data breaches has increased since 2011. However, avoiding the threat may not lead to a positive result for innovation in HCIT.

Avoidance is not the only human behavior associated with threatening situations. Other human behaviors in the realm of coping include attacking the threat and inaction against the threat (Lazarus, 1966). Using an attack mechanism is similar to avoidance, in that an individual anticipates the threat. For information technology professionals, attacking the threat means using preventative measures such as antimalware software, intrusion prevention systems, and other technology-related tools (Liang & Xue, 2009; Shastri & Sharma, 2016). On the opposite end of the spectrum is the mechanism of inaction. For humans, inaction simply means an individual has given up on attempting to overcome a threat (Lazarus, 1966). For HCIT, senior leaders should avoid inactivity to maintain growth and innovation.

Individuals face difficult decisions regarding how to handle stressful situations, particularly related to technology threats. Lazarus and Folkman (1984) indicated individuals cope with threats in two ways: through emotion-focused coping or problem-focused coping. Individuals use emotion-focused coping to trick themselves into thinking the situation is not as bad as it seems, and problem-focused coping involves using actions to overcome the threat (Liang & Xue, 2009). Actions related to dealing with technology threats could be the key to filling the knowledge gap between health care delivery organizations and increased innovation.

The technology threat avoidance theory has existed since 2009, so it has only a few uses compared to other technology-related theories. Xue et al. (2015) used the theory to correlate the lack of telemedicine adoption in Ethiopia due to coping mechanisms enacted in response to threats. In their literature, threats referred to "reduced autonomy, anxiety, and cost" (Xue et al., 2015, p. 538). Correlating resistance with their defined threat avoidance, Xue et al. supported the notion that the coping mechanism hindered the adoption of telemedicine. Avoiding threats was not a positive coping measure.

Technology has become pervasive, and so has the need to guard against malicious threats. In a study conducted to determine the desire of users to implement theft or loss prevention measures for their mobile devices, Tu, Turel, Yuan, and Archer (2015) employed the technology threat avoidance theory. Their mixed-methods study involved surveying 339 participants to measure how the knowledge of loss prevention measures, societal influences, and prior experience of a technology threat correlated with their coping mechanism. In the technology threat avoidance theory, it is stated that users who

are aware of countermeasures and believe they are useful will cope with the threats using the countermeasures (Liang & Xue, 2009). Also stated in the theory, if the threat seems too great to overcome, users will avoid the threat or ignore it (Liang & Xue, 2009). Tu et al. (2015) underscored the theory that users who are more aware of technology protections will use those protections and that those who have experienced a prior incident with a technology threat are more likely to believe they cannot avoid such threats. In yet another study, the technology threat avoidance theory emerged as applicable to understanding user avoidance habits.

Mobile devices such as smartphones and tablets are the most prominent topics of the technology threat avoidance theory, presumably due to their increased use for both personal and business-related matters. Tu et al. (2015) explored users' behaviors regarding the prevention of loss or theft of devices, and Steinbart, Keith, and Babb (2016) sought to explain how the coping behaviors continue throughout the process of technology use. The technology threat avoidance theory includes two models: the variance model and the process model (Liang & Xue, 2009). Steinbart et al. discovered that the process method of the technology threat avoidance theory is applicable when measuring the decision to keep strong credentials for mobile devices. Researchers have used the technology threat avoidance theory to explain how users cope with malicious threats and how users cope with threats on a continuous basis after an assessment has occurred.

Researchers have applied the technology threat avoidance theory to several industries and situations to explain the use of technology more effectively. Herath et al.

(2014) used the theory to understand users' intentions to employ additional security for authentication when accessing e-mails. Herath et al. found that users who felt they could deal with malicious e-mails were less likely to use the additional authentication, whereas those who felt less capable were more likely to use avoidance behaviors. The results of Herath et al.'s study aligned with the fundamental tenets of the technology threat avoidance theory.

The technology threat avoidance theory includes several suggestions for implementing and using technology. The purpose of this study was to correlate the threat avoidance by information systems staff and senior leadership in health care delivery organizations with the organization's level of innovation. This study represented a relatively research-scarce portion of the technology threat avoidance theory. The research question was as follows: Why do rural health care delivery organizations innovate at slower rates than other industries do? Numerous research articles exist in which researchers have explained technology acceptance models as well as measurements for innovation but have not yet resolved the problem fully. The technology threat avoidance theory specifically identifies the resistance observed toward HCIT through the lens of malicious technology avoidance. The specific area of research was different from those of previous threat avoidance studies in that this study involved investigating the collective behaviors found within an organization rather than individuals. This study also involved looking at health care delivery organizations, in which leaders have traditionally avoided more technology threats and innovated less compared to other industries.

Literature Review

Approaches to Innovation

Technology acceptance model and health care. A novel theory that spans multiple industries is the technology acceptance model. The technology acceptance model includes two barriers, perceived ease of use and usefulness, observed in organizations, which senior leaders should monitor during the implementation of new technology (Davis, 1986). Of those barriers, perceived ease of use was the most frequently recurring and most impactful (Kostopoulos, Rizomyliotis, & Konstantoulaki, 2015). Davis, Bagozzi, and Warshaw (1989) noted:

> TAM posits that two particular beliefs, perceived usefulness and perceived ease of use, are of primary relevance for computer acceptance behaviors. Perceived usefulness (U) is defined as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context. Perceived ease of use (EU) refers to the degree to which the prospective user expects the target system to be free of effort. (p. 985)

Perceived usefulness and perceived ease of use are heavily researched concepts in the field of information technology. Researchers have used the technology acceptance model to prove the adoption or lack thereof of several health care information-technology-related tools.

The two primary concerns of the technology acceptance model are perceived usefulness and perceived ease of use. Several researchers have attempted to show how perceived usefulness and perceived ease of use can apply to HCIT adoption. Unlike other

studies in which researchers looked at business users or students, HCIT adoption has not followed the common framework provided by the technology acceptance model (Gagnon, Nsangou, Payne-Gagnon, Grenier, & Sicotte, 2014; Ward, 2013). Researchers have repeatedly shown that healthcare staff have judged HCIT more on usefulness than on ease of use (Dias & Escoval, 2012; Marsan & Paré, 2013). Researchers often see physicians, the primary users of HCIT such as EHRs, as autonomous individuals with impactful perceptions about technology (Gagnon et al., 2014). Even when senior leaders implement a new technology to meet organizational objectives, researchers have observed resistance due to conflicting perspectives on the usefulness of said technology (Ward, 2013). The technology acceptance model is a powerful tool to predict use of new technology. For health care delivery organizations, however, exploring more variables is necessary to predict the use of innovation.

The adoption of HCIT is complex not only because of the technology but also because of the unique nature of its users. Executive leadership, information technology leaders, and medical providers within a given health care delivery organization often vet technology implementation decisions. Several researchers have studied adoption rates and the lack thereof from the perspective of medical providers such as doctors (Gagnon et al., 2014; Jamoom et al., 2014; Moxey et al., 2010; Xue et al., 2015), nurses (Waneka & Spetz, 2010), radiologists (Enzmann, 2015), pharmacists (Gagnon et al., 2014), and others. Providing sound reasoning as to why a doctor, nurse, radiologist, pharmacist, or other medical provider may or may not adopt a new technological innovation is important

for the health care industry. However, those individuals are only a portion of the adoption equation.

An important sector of decision makers within a health care delivery organization is the executive leaders and information technology leaders. Depending on the hierarchal structure of a health care delivery organization, information technology leaders may or may not have the authority and resources to implement new technology. As such, it is important to review not only the technology adoption of medical providers, but also the technology implementation decisions of executive leaders and information technology leaders. In a systematic literature review, Ross, Stevenson, Lau, and Murray (2016) identified six of 44 literature review articles that highlighted leadership as an important factor for successful technology implementations. Within health care delivery organizations, technology adoption research on the topic of adoption by executive leaders and information technology leaders has been scarce, presumably because using technology acceptance models aids in understanding perceived usefulness and perceived ease of use by specific technology users, not by implementers or purchasers. However, as noted previously, the technology acceptance research in health care delivery organizations requires a broader approach than other industries.

Researchers have overlooked the importance of leadership support when using the TAM to predict the use of new technological tools. For the few researchers who do discuss executive leadership's influence, leadership engagement at each stage of the technology implementation from planning to postimplementation maintenance is the most mentioned requirement for successful adoption (Moxey et al., 2010; Ross et al.,

2016; Waneka & Spetz, 2010; Yusof, Stergioulas, & Zugic, 2007). Leadership within a health care delivery organization plays a vital role in the success of innovation projects, particularly technological innovations affecting daily clinical routines and functions.

HCIT is only as powerful as the systems used to run the technology. As such, information technology leaders must be able to provide stable, effective, and secure technology infrastructure. Reviewing literature related to infrastructure and successful HCIT adoption, Ross et al. (2016) cited four prior literature reviews. Among the necessary information technology infrastructure required for successful acceptance and use of new technology innovations were bandwidth, reliable Internet connectivity, and access to a computer (Kilsdonk, Peute, Knijnenburg, & Jaspers, 2011; Oluoch et al., 2012; Saliba et al., 2012). The decision by information technology leaders to accept a new HCIT innovation could ultimately decide the success or failure of said innovation. Medical providers and executive leadership would be unable to implement technology innovations without a sound information technology department with staff members who understand the risks and benefits of new technology.

Diffusion of innovation. Substantial research exists that demonstrates how innovations occur within an organization. These models include the unified theory of acceptance and use of technology (Venkatesh et al., 2003), the technology acceptance model (Davis, 1986), and the diffusion of innovation theory (Rogers, 2003). Organizational innovation is still lacking within the health care industry despite ample research about innovation adoption (Cresswell & Sheikh, 2013; Ross et al., 2016; Ward,

2013). Researchers have used the diffusion of innovation theory in multiple research articles to explain how innovation occurs within health care delivery organizations.

The diffusion of innovation theory helps to explain how and why organizational leaders adopt certain technological innovations. Before organizational leaders implement an innovation, and before the adoption process begins, they look at five factors regarding the technology (Herbert & Connors, 2016). Those factors are the trialability, observability, complexity, compatibility, and relative advantage of said technology (L'Esperance & Perry, 2016; Marsan & Paré, 2013; Patel & Antonarakis, 2013; Rogers, 2003). Adopters of the diffusion of innovation theory use those five indicators as a preliminary marker of possible innovation diffusion. However, the theory continues to grow in breadth and depth.

Everett Rogers created the process of looking at trialability, observability, complexity, compatibility, and relative advantage, which are part of the diffusion of innovation theory. Since the theory's inception, several researchers have used those components in various ways, even interpreting the meaning of each slightly differently. Trialability, or the "opportunity to test" (Marsan & Paré, 2013, p. 733), reduces uncertainty and allows for use of the technology on a limited basis before full implementation (Patel & Antonarakis, 2013). Observability requires innovation to be apparent to others and leads to greater levels of adoption (L'Esperance & Perry, 2016; Marsan & Paré, 2013). Complexity is an increasing aspect of technology in the 21st century and refers to "the degree to which the innovation is perceived as being difficult to understand and use" (L'Esperance & Perry, 2016, p. 312). Innovations must meet the

requirements and desires of an individual or organization. Thus, compatibility could lead to greater adoption (Marsan & Paré, 2013). Relative advantage, which leaders of 21st-century organizations seek on a constant basis, is the amount an innovation increases an organization's superiority (Marsan & Paré, 2013) or is a better tool than its predecessor (L'Esperance & Perry, 2016; Patel & Antonarakis, 2013). Researchers have studied those five factors of the diffusion of innovations theory in several industries, including health care, yet health care continues to lag behind in innovation.

Researchers have used the diffusion of innovation theory extensively in health care. Recent use included a demonstration of the adoption of telemedicine (L'Esperance & Perry, 2016), teledentistry (Patel & Antonarakis, 2013), and open source software (Marsan & Paré, 2013). In their study of 17 nurse practitioners and 56 patients, L'Esperance and Perry (2016) sought a better understanding of the barriers that impeded the adoption of telemedicine. Although the use of telemedicine offered advantages such as the electronic monitoring of diets and medications, the relative advantage was not significant enough to increase adoption levels (L'Esperance & Perry, 2016). As originally noted by Rogers (2003), relative advantage, among other preliminary factors, does not always give clear indications why an innovation does not attain widespread adoption. For example, one can infer from the research by Marsan and Paré (2013) that relative advantage increased the adoption of open source software due to its possible lower cost of ownership over other innovation options. However, incompatibility was a leading factor that hampered adoption (Marsan & Paré, 2013). Although several researchers have used components of the diffusion of innovation theory, results have been conflicting. Due

to these conflicts, more research was necessary to understand additional factors leading to the widespread adoption of HCIT.

General Barriers to Innovation in Health Care

For decades, many health care delivery organizations have lagged behind organizations in other industries regarding technological innovation. The lack of innovation and lack of innovation adoption was due to several reasons. Researchers have suggested that innovation within the health care industry lags behind other industries due to the lack of fit with organizational practices (Dias & Escoval, 2012; Marsan & Paré, 2013), lack of user adoption (Escobar-Rodríguez & Romero-Alonso, 2014), and lack of financial (Davey, Brennan, Meenan, & McAdam, 2011; Ford, Hesse, & Huerta, 2016; Herbert & Connors, 2016; Marsan & Paré, 2013) or human (L'Esperance & Perry, 2016) resources. Xue et al. (2015) cited governmental inference as a primary factor for the lack of information technology innovation in health care. Davey et al. (2011) and Ben-Assuli (2015) cited governmental regulations and local laws as barriers. Those were some of the top obstacles, but other researchers have cited several more.

Location, whether urban or rural, has played a significant role in the adoption of innovative technology. Gabriel et al. (2014) noted that urban health care delivery organizations have greater financial standings and serve a population of patients that expect innovation. Innovation in health care is not solely for achieving patient satisfaction. Innovation in health care is primarily for the safety of patients, the efficiency of care, and prevention of sickness. Being a rural health care delivery organization should not preclude organizational innovation.

Health care delivery organizations are complex and heavily regulated and serve customers of varying age, intellectual ability, and socioeconomic status. Several other barriers have led to slower, or have hindered, technology innovations. Ease of use (Ben-Assuli, 2015), user resistance (Escobar-Rodríguez & Romero-Alonso, 2014), the relative advantage of the innovation (Patel & Antonarakis, 2013), a perceived increase in workload (L'Esperance & Perry, 2016), lacking technology support and training (Gabriel et al., 2014; Herbert & Connors, 2016; L'Esperance & Perry, 2016; Marsan & Paré, 2013), the size of an organization (Zhang et al., 2013), clinical knowledge (Davey et al., 2011), bureaucracy and communication challenges (Dias & Escoval, 2012; Ford et al., 2016), and privacy concerns (Ben-Assuli, 2015; Ford et al., 2016) are determining factors that have slowed or hindered the adoption of innovative technology. Researchers have applied the technology acceptance model, diffusion of innovations theory, and other technology use related models to derive their conclusions. Even after decades of research, health care delivery organizations continue to reside in the *laggards* region of the innovations bell curve created by Rogers (2003).

Risks of Innovation in Health Care

Implementing a new process or tool inherently creates new instances of risk. Levels of risk with innovation are higher in health care delivery organizations due to the sensitivity of the data they maintain (Enzmann, 2015). Health care delivery organizations often maintain data such as social security numbers, financial data, medical diagnoses and medical history, all of which is private information that most patients are not willing to share publicly. Although in common usage, the word *risk* can encompass various

meanings, with risk defined as technology threats. As innovation and new technology implementations increase, so will technology threats. The most basic example of an innovation increasing the likelihood of technology threats is the use of e-mail. E-mail has been a common communication tool since the late 1990s. E-mail has also become the primary entry point of technology threats.

Technology threats are prevalent in any industry, and senior leaders can mitigate them in various ways. This study included the technology threat avoidance theory as the theoretical framework and technology avoidance habits as an independent variable. Senior leaders can successfully mitigate technology threats rather than avoid them. For example, Fernández-Alemán, García, García-Mateos, and Toval (2015) suggested using endpoint security solutions for mobile devices, as well as encryption for e-mails, among many other possibilities. In smaller organizations such as rural ambulatory care facilities, however, the expertise necessary to adopt these measures may not always be available (Martin & Imboden, 2014). A void between innovative technology and mitigating technology threats could be increasing the gap between levels of innovation in rural ambulatory care facilities and other industries.

Linking the Research Variables

Innovation propensity. A longstanding function of business practices, innovation has been a relevant topic for decades and served as the primary dependent variable of this study. Innovation within health care is a broad term that required a more specific focus for this study. Researchers define innovation as adding technology or processes that improve existing functions within an organization (Wass & Vimarlund, 2016). Changes

to technology in health care delivery organizations are innovative by definition. The rate at which innovation has occurred, however, has been significantly slower than organizations in other industries (Zhang et al., 2013). In most industries, organizational leaders are constantly seeking ways to improve processes, increase efficiency, and reduce operating costs. For health care delivery organizations, patient care is a primary focus, which may or may not lend to desiring growth in innovation.

Innovation is a key contributor to organizational success. Innovation is not only a process or tool that improves business functions, but also any process or tool that is new to the organization, regardless of how new the process or tool is in society (Hu & Yu, 2008; Rogers, 2003). Adopting new technology and being innovative require a specific level of organizational adoption (Rogers, 2003). Among many factors, an organizational culture and norms must be in line for innovation to occur.

Organizational leaders understand the need to innovate for competitive advantages and increased efficiency. For years, researchers have studied the frequency of which organizations adopt an innovation (Riivari & Lämsä, 2017). Having the proper environment to start the innovation process is a less researched topic. Dobni (2008) created an innovation culture measurement to cover that gap. Within that measurement, innovation propensity is the specific measure I used to understand innovation in health care delivery organizations. Innovation propensity measures the willingness and decisiveness of organizational leaders to innovate (Dobni, 2008). In the scale, a low propensity is a clear indication that organizational leaders are not willing to look differently at processes, procedures, and tools.

Researchers have used the innovation culture measurement a few times in recent history. However, using the measurement tool within HCIT research is scarce. Jończyk (2014) sought to obtain the opinions of physicians about what a pro-innovation culture would contain. After obtaining 51 completed surveys from doctors in Poland, Jończyk concluded that openness to change and innovation had a connection to the level of innovation seen within an organization. Openness to change and innovation is a direct by-product of innovation propensity.

HCIT innovation**.** Since 2009, the availability of HCIT has increased more than ever. HCIT no longer consists solely of EHR systems or computerized provider order entry systems (Yang et al., 2015). Leaders of successful urban-based health care delivery organizations have successfully deployed HCIT involving intelligent mobile devices such as fall detectors, heart rate monitors, glucose monitors, and other networked devices (Yang et al., 2015). Modern HCIT also consists of data analytics and cloud computing (Yang et al., 2015). Telemedicine platforms have moved from site-to-site implementations (Ricketts, 2000) to site-to-patient implementations, which allows for instantaneous access to medical care (Yang et al., 2015). Health-care-specific innovations have increased and will continue to do so.

***Electronic health records*.** EHR systems are the key systems that maintain core patient data. Health care organizational leaders created the electronic medical record, which contains the details of patient visits, procedures, diagnoses, and other information about either inpatient or outpatient care (Yang et al., 2015). EHR systems minimize efficiency-related issues, increase decision-making abilities (Meyerhoefer et al., 2016),

and increase data-processing opportunities (Li & Slee, 2014), which leads to better analytics and trending (Wills, 2014). Increases in data analytics could decrease adverse medical events and thus improve health outcomes (Meyerhoefer et al., 2016). EHR systems have become pervasive in the health care industry and their adoption rates continue to increase (Jamoom et al., 2014).

Serving as the foundational tool for modern health care delivery organizations, EHR systems have continued to gain acceptance in the industry. Over 85% of surveyed health care delivery organizations use at least the basic elements of an EHR system (Yang et al., 2015). Before the HITECH Act, the use of EHRs was minimal. Due to both governmental incentives and possible penalties, use of EHRs in health care delivery organizations has significantly increased. For example, in 2009, only 3% of surveyed U.S. hospitals used a comprehensive EHR (Bossen, Jensen, & Udsen, 2013) compared to 85% in 2015 (Yang et al., 2015). EHRs often serve as the primary mediator between other HCIT such as picture archive communication systems.

The original intent for EHR implementations was to increase efficiency and reduce errors. Many EHRs have been far from useful (Zhang et al., 2013). For the implementation of an EHR to be successful, it must contain the necessary PHI (Li & Slee, 2014). Securing systems containing such sensitive data presents a challenge to both the organization maintaining the data and the patients providing the information (Li & Slee, 2014). Overcoming those security challenges could lead to greater levels of innovation and a better care experience for patients.

A key issue with using EHR systems has been the ability to share data between organizations. With over 78% of physicians using EHRs in meaningful ways (Thurston, 2014), the number of medical errors has been reduced, and the amount of available data about a patient has increased. The HITECH Act requires that a practice meet at least five of 10 criteria for meaningful use:

1. Performing drug formulary checks;
2. Incorporating clinical laboratory test results as structured data;
3. Generating lists of patients by specific conditions;
4. Sending reminders to patients per patient preference for preventive/follow-up care;
5. Providing patients with timely electronic access to their health information;
6. Using certified EHR technology to identify patient-specific education resources and provide to patient, if appropriate;
7. Conducting medication reconciliation;
8. Providing summary of care record for each transition of care/referrals;
9. Demonstrating the capability to submit electronic data to immunization registries/systems; (At least one public health objective must be selected.)
10. Demonstrating the capability to provide electronic surveillance data to public health agencies. (At least one public health objective must be selected.) (Thurston, 2014).

With providers and leaders of federally qualified medical facilities collecting or attempting to collect and process data that meet meaningful use criteria, silos of data now

exist. Sharing data between organizations is innovative yet risky, as more security parameters are necessary to pass electronic records from one siloed system to another. There is no doubt that sharing data would further increase the accuracy of care, decrease readmissions, and advance population health management.

Securing patient data and sharing it among multiple health care delivery organizations is only one of the common issues found with the use of EHRs. Process impediment is a matter that researchers have highlighted among the factors leading to failed EHR implementations. Other factors leading to failure include the quality of information inserted into patient charts (Bossen et al., 2013; Häyrinen, Saranto, & Nykänen, 2008), the quality of the system (Bossen et al., 2013; Ludwick & Doucette, 2009), and the quality of service received by the system. With a critical assessment of an EHR implementation, Bossen et al. (2013) concluded that EHRs have not yet fully replaced paper documents and most users do not strongly agree that the necessary information to perform their job is readily available. Of their 244 survey respondents, the average score for "It is easy to establish an overview in the EHR" was 3.32 out of 5-point Likert scale, from 1 (disagree very much) to 5 (agree very much).

***Health sensing*.** Health sensing technology has increased in use since 2012. Health sensing devices fit into two categories: physiological and motion. Health sensing technology includes gait analysis, fall detection, heart state sensing, sleep sensing, activity recognition, pedestrian location, and balance training (Yang et al., 2015). Some healthcare professionals considered mobile health sensing devices fundamental to the early detection and intervention of health-related ailments (Yang et al., 2015). For

example, heart state sensing devices include information about “the user’s heart rate, heart rate variability, RR [the time interval between consecutive heart beats], and P-QRS [a combination of three graphical deflections seen on a typical electrocardiogram] duration” (Yang et al., 2015, p. 5). Fall detection devices allow for quicker responses to fallen patients, which decreases the severity of injuries (Yang et al., 2015). Health sensing devices have increased in use and are readily available for consumers.

***Data mining and analytics*.** In every major industry, data analytics has become an essential tool for gaining competitive advantages, creating operating efficiencies, and better understanding the customer. In health care, data analytics is a relatively new discovery, as data have traditionally remained segmented (Belle et al., 2015). The amount of raw data captured by health care delivery organizations is growing exponentially (Belle et al., 2015; Wills, 2014; Yang et al., 2015). The “665 terabytes of data” (Wills, 2014, p. 255) created so far by the average health care delivery organization will create a collective total of “more than $300 billion each year” (Belle et al., 2015, p. 1) through the creation of efficiencies and better patient care. Data analytics has led the information revolution in several industry categories. Health care has begun to follow suit, but with caution, as the risk of compromising data security is high.

Large data sets have created issues related to storage and computing power for analysis. For health care delivery organizations, large data sets have provided the ability to uncover trends and connect what was once abstract data to manage population health more effectively (Wills, 2014; Yang et al., 2015). With the cost of receiving and administering health care, organizational leaders have viewed big data and data analytics

as a way to care for high-risk and high-cost patients (Bates, Saria, Ohno-Machado, Shah, & Escobar, 2014). Collecting, storing, and analyzing large data sets, however, requires full organizational adoption (Landi, 2016) due to the increased security risk and greater financial investment.

***Cloud computing*.** Maintaining and analyzing large data sets is both costly and risky. With lacking security controls and outdated infrastructure, leaders of health care delivery organizations have begun to look at service providers for solutions (Yang et al., 2015). Cloud computing is a primary service used by health care delivery organizations for data storage, computing, and analysis (Yang et al., 2015). As with the other technology innovations listed in this paper, cloud computing is not a new phenomenon, but rather a newer infrastructure tool for health care delivery organizations.

Leaders in several industries have leveraged cloud computing to offset the costs of new infrastructure, security tools, and data centers. Cloud computing is "the use of computing resources (hardware and software) that are shared as services over a network" (Khalid & Shahbaz, 2013, p. 348). Cloud computing comes in several forms but is available as Anything as a Service (XaaS; Liu, Wang, Liu, Peng, & Wu, 2017; Singh, Jeong, & Park, 2016). More specifically, cloud computing provides Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS; Khalid & Shahbaz, 2013; Khan, 2016; Liu et al., 2017; Singh et al., 2016). In any of those instances, an organization's resources could remain in a public cloud, private cloud, or hybrid cloud (Khalid & Shahbaz, 2013). The benefits of cloud computing are pervasive and continue to grow.

With the increased use of any technology, the associated malicious threats directly increase. Cloud computing, particularly public and hybrid cloud environments, involves sharing resources such as memory, storage, and networking across physical hardware (Khan, 2016). In most scenarios, the resources are virtually segmented using fine-grained user access, virtual operating systems (Khan, 2016), and network routing protocols (Singh et al., 2016). Cloud computing providers such as Amazon Web Services have several of these security measures to prevent data breaches (Khan, 2016), which relieves the data owners of those duties. Even though information systems staff have implemented security actions en masse for cloud computing, the number and sophistication of malicious threats have increased since 2011 (Khan, 2016). When looking at technology threats in cloud computing and the ability to overcome them, users might view the situation as insurmountable.

mHealth. The mobility of people and resources has increased since 2007. For health care delivery organizations, mobility has increased the ability to perform multiple tasks, access patient data, and provide more timely care (Nielsen & Mengiste, 2014). Mobile devices and sending information via wireless signals is not new. The idea of using mobile devices in health care has also existed for over two decades. In the early 1990s, the sole mission of creating Mobile Healthcare Alliance and Center for Phone Applications in Healthcare was to explore and advance the use of mobile devices in the health care industry (Waegemann, 2016). mHealth is a newer term for mobile health tools created by a new initiative to push more innovative uses of technology into daily health care practices.

mHealth initiatives have increased in quantity throughout the world. mHealth functions exist within health care delivery organizations and cover several processes, including “patient communication, access to web-based resources, point-of-care documentation, disease management, education programs, telemedicine, professional communication, administrative applications, financial applications, ambulatory/EMS services, public health, pharma/clinical trials, and body area networks” (Waegemann, 2016, p. 5). The use of mHealth tools can increase both the effectiveness and the efficiency of care (Hoque, 2016). For example, physicians often refer to decision support systems for diagnoses. Looking in a printed book instead of an online mHealth application could provide outdated information (Waegemann, 2016), and outdated information could lead to a misdiagnosis, which could be a potential negative outcome for both physicians and patients.

The volume of devices and level of sophistication found in mHealth, like any technical tool, will likely continue to increase. In a 2014 survey conducted among health care providers by the Healthcare Information and Management System Society, more than 68% of respondents stated they used a mobile device to access clinical information (Healthcare Information and Management System Society, 2014). As leaders of health care delivery organizations increased their use of mHealth, those tools quickly moved from being health-care-organization centered to being patient-centered (Waegemann, 2016) as patients enhance their desires for flexibility and mobility of care (Isaković, Sedlar, Volk, & Bešter, 2016; Wei, Kanthawala, Shupei, & Hussain, 2016). In a systematic literature review of the effect of mHealth on patient health, Müller, Alley,

Schoeppe, and Vandelanotte (2016) discovered that a consistently positive and significant effect occurred when using mHealth. Mobile tools increase patients' participation rate and increase desires to control their health outcomes. As with any technological tool, security concerns with the use of mobile tools in health care settings have increased.

Adopting mHealth is a decision that involves several facilitating factors, as well as common inhibitors. In a systematic literature review of 4,223 articles, 48 of which were acceptable for the study, the primary inhibitor for not adopting mHealth was the concern of the privacy and security of patient data (Gagnon, Ngangue, Payne-Gagnon, & Desmartis, 2016). The publication dates of most of the articles used in the study were between 2005 and 2014. While conducting a systematic literature review, Gleason (2015) concurred that the security and privacy of patient data were the largest barriers preventing broader adoption of mHealth. Despite having multiple benefits for both patients and health care delivery organizations, security is an overwhelming concern that denies an innovation such as mHealth.

Summary and Transition

The health care industry plays a pivotal role in the management of care within the United States. From disease management to population health management and everything in between, health care delivery organizations are the societal gatekeepers of good health. The fact that many health care delivery organizations could help to save more lives if leaders adopted the appropriate technological innovations continues to plague the industry, with no single answer why the industry is in such a position. Although several researchers have correlated, hypothesized, and posited reasons why so

many health care delivery organizations are laggards, there is still room to make plenty of progress in the field. This literature review has highlighted that innovation within an organization is a complex event. The health care industry includes another set of complexities not well accounted for during the strict application of theories, such as the technology acceptance model and diffusion of innovations theory. To fill the research gap, more attention toward users' technology threat avoidance and habits related to coping with technology threats is necessary. Related to innovation within health care delivery organizations, particularly those in rural settings, filling that research gap could be critical.

This chapter included the theoretical context to the problem of organizational innovation within health care delivery organizations. The chapter included the purpose and the nature of the study, as well as a review of relevant empirical and theoretical literature. Chapter 3 includes a description of the methods and the data analyses used to address the research questions stated in Chapter 1.

Chapter 3: Research Method

The purpose of this quantitative correlational study was to explore the possible relationship between an overavoidance of technology threats by senior health care leadership and the innovative technology-use decisions of health care delivery organizations. This chapter includes (a) the research questions and hypotheses, (b) a review of the method design, (c) sampling process, (d) sampling procedures, (e) data collection, (f) data analysis, (g) threats to validity, and (h) ethical safeguards.

Research Design and Rationale

The general research question was as follows: Why do senior leaders at some rural health care organizations innovate at slower rates than at other health care organizations. The research questions and hypotheses for this study were the following:

Research Question 1: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology?

$H1_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

$H1_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat

avoidance and their organization's propensity for innovation in healthcare information technology.

Research Question 2: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization)?

$H2_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

$H2_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

The independent variable in this study was the level of technology threat avoidance of senior leaders as perceived by information systems staff. The dependent variable was the innovation propensity of the organization. To find the answer to these research questions, I used a quantitative correlational design. Neuman (2011) stated that, researchers use quantitative designs to connect abstract notions using empirical data.

Researchers also use quantitative methods to test a hypothesis to discover if it is true, false, or conditional (Neuman, 2011). A correlational approach was suitable for providing more information about the relationship between the independent and the dependent variables.

HCIT and innovation are complex notions, particularly when paired together. Previous researchers have successfully demonstrated the successful use of correlational studies in HCIT when attempting to understand the various roadblocks and inhibitors to adoption. Although other research methods such as case studies or causal-comparative studies were available, they would not provide the types of generalizable answers and synthesis needed to add more to the body of knowledge regarding HCIT innovation in rural ambulatory care facilities. Qualitative methods can be highly subjective and provide a singular point of view that generates a hypothetical proposition (Simon & Goes, 2012). Qualitative methods can also become inductive, which involves requiring researchers to reorient the focus constantly and increase the time of study completion (Neuman, 2011). Using a quantitative method in my research allowed for testing the technology threat avoidance theory. The relationships discovered using a quantitative method are predictive and objective (Neuman, 2011). Furthermore, using a quantitative method reduces time constraints and requires limited resources compared to qualitative methods. For this correlational study, I used surveys as the sole method of data collection. Surveys further decrease the time and resources needed to conduct the study. A further discussion of the methodology appears in the next section.

Methodology

Population

The target population was individuals who were 21 years of age or older who worked at least 30 hours a week and who had been employed at their current organization for at least two years with duties related to information technology services. Having duties related the information technology services was defined for the participants as "having responsibilities related to the strategy, maintenance, implementation and/or support of information technology." The online survey provider was Survey Monkey. Online surveys allow convenient access by participants (Rea & Parker, 2014) and an efficient download of survey data.

Sampling and Sampling Procedures

To maintain the validity of the research method, a minimum of 75 participants was necessary. This sample size allowed an effect size of 0.30, an alpha level of .05, and a power level of 0.80. Having a power level of .80 avoids statistical errors while reducing the need for larger sample sizes (Cohen, 2016). Larger sample sizes place a strain on the available resources. To calculate the necessary sample size, the statistical analysis used was the G*Power application.

I used simple random sampling to provide an anonymous self-administered online survey to information technology staff members who worked at health care facilities in the United States. Random sampling is cost efficient, is accurate, and provides generalizable results (Neuman, 2011). The survey consisted of questions adapted from the COPE (Carver, Scheier, & Weintraub, 1989) instrument to measure perceived

technology threats and coping habits. The survey also contained adapted questions from the innovative culture measurements created by Dobni (2008), to measure innovation propensity.

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

The primary data collection method was a closed-ended questionnaire self-administered via Survey Monkey. Upon receiving approval from the Walden University Institutional Review Board (IRB, Approval No. 06-16-17-0285390), participants recruitment took place using LinkedIn Groups of information technology professionals in the health care industry. Using a social platform such as LinkedIn to obtain participants allows quick access to a large population throughout the United States. Using an online platform to administer the surveys allowed easier access by participants, as well as more convenience with downloading the data (Rea & Parker, 2014). Using online surveys is common for researchers and is more cost effective than traditional mailings or face-to-face survey administration.

Within the participant pool, I sampled individuals 21 years of age or older who worked at least 30 hours a week in an ambulatory health care facility, had worked at the facility for at least 2 years, and had duties relating to information technology. Screening questions helped to ensure the sample was appropriate. The initial screening questions were as follows: “Are you 21 years of age or older?” “Do you currently work at least 30 hours a week at the healthcare organization?” “Are your primary responsibilities related to the maintenance, implementation and/or support of information technology?” Potential participants needed to answer yes to all those questions for the participant to become a

valid sample. To contact the participants, I sent an e-mail or message via LinkedIn explaining the purpose and benefit of the study. Within the invitation, I also provided my contact information and the contact information for Walden University's IRB. Before beginning the survey, participants had to acknowledge informed consent.

At the start of the survey, I collected basic demographic information such as age, gender, ethnicity, the geographical region of the individual's organization, and years of employment at current organization. The survey was complete when the participants clicked *submit*. There were no debriefing or follow-up procedures conducted with the participants after completion of the survey. Furthermore, I did not collect any identifying information from the participants, which ensured their complete anonymity. Due to such anonymity, this prevented any harm to all participants.

Instrumentation and Operationalization of Constructs

I designed this study to determine the level of technology threat avoidance displayed by senior leaders as perceived by information systems staff and correlated that measurement against the propensity for the organization to innovate through the use of HCIT. As stated in Chapter 2, actively avoiding technology threats can mean an individual works to overcome the threat or ignores the threat. Organizational innovation is a complex process, particularly for health care delivery organizations. In Chapter 2, I also discussed the technology acceptance model and the diffusion of innovation theory, which are two constructs widely used to measure innovation adoption. In this study, I looked beyond those models to have a better understanding of another potential roadblock in the innovation process: technology threat avoidance.

Technology threat avoidance. The survey consisted of questions adapted from the COPE instrument, created by Carver et al. (1989), to measure perceived technology threats and coping habits. The instrument includes a section that includes active coping measures:

1. I take additional action to try to get rid of the problem.
2. I concentrate my efforts on doing something about it.
3. I do what has to be done, one step at a time.
4. I take direct action to get around the problem.

The instrument also includes a section that includes passive coping measures:

1. I learn to live with it.
2. I accept that this has happened and that it can't be changed.
3. I get used to the idea that it happened.
4. I accept the reality of the fact that it happened.

Both measures related to the amount of technology threat avoidance or lack thereof. Xue et al. (2015) used an adaptation of this survey to measure the perceived threat of technology use among doctors in Ethiopia. In a study conducted to determine the desire of users to implement theft or loss prevention measures for their mobile devices, Tu et al. (2015) used an adaptation of the COPE measurement through the technology threat avoidance theory. Herath et al. (2014) used an adaptation of the COPE measurement to understand users' intention to employ additional security for authentication when accessing e-mails, also through the technology threat avoidance theory.

In this study, information systems staff answered four questions to measure the perceived level of active coping by senior leaders. Information systems staff answered four additional questions to measure the perceived level of acceptance of technology threats by senior leaders. Measuring each set of questions involved on a 5-point Likert-type scale, with 1 being the lowest amount of threat avoidance, and 5 being the highest. The original author, Carver et al. (1989) ensured the reliability of the COPE measurement through a test–retest method. Carver et al. (1989) tested the measurements with 89 students in one test and 116 students in another test. Cronbach's alpha reliability coefficients remained above .60, which showed consistent reliability. The Copyright Clearance Center provided permission to use portions of the COPE measurement (see Appendix B).

Organizational innovation propensity. The survey also contained questions from the innovative culture measurements created by Dobni (2008). Innovation is an organizational process, particularly in health care. Researchers have indicated that the innovation process in health care is particularly complex due in part to the complex nature of their organizations. Researchers use the innovative culture measurements created by Dobni to understand if an organization is supportive of innovation through its display of cultural norms, beliefs, and levels of risk taking, among other variables. The measurement can also provide insight into the propensity of organizations to innovate. In this study, I collected the perceived coping habits of senior leaders related to avoiding technology threats from the viewpoint of information systems staff and correlated that

measurement against organizational leaders' propensity and willingness to innovate using HCIT.

The innovation culture measurement has gained increasing popularity among researchers seeking to understand the innovation readiness of an organization. Ryan and Tipu (2013) collected data from 543 participants to understand the effects of leadership on innovation propensity. To measure innovation propensity, Ryan and Tipu used a portion of the innovation culture measurement. Dobni (2008) noted, "The ability to successfully achieve a state of innovativeness will ultimately depend on the propensity of management, the strategic architecture in place to support innovation, and the constituency of employees to whom these efforts are focused on" (p. 545). Similar to the work of Ryan and Tipu (2013), I correlated the actions of senior leaders with the innovation propensity of the organization.

My study involved using nine questions from the innovative culture measurement to measure the innovation propensity of the organization and measured the nine questions on a 5-point Likert-type scale, with 1 being the lowest propensity to innovate and 5 being the highest. The innovation culture measurement scale items were as follows:

1. Innovation is an underlying culture and not just a word.
2. Our business model is premised on the basis of strategic intent.
3. Our senior managers are able to effectively cascade the innovation message throughout the organization.
4. We have an innovation vision that is aligned with projects, platforms, or initiatives.

5. This organization's management team is diverse in their thinking in that they have different views as to how things should be done.
6. There is a coherent set of innovation goals and objectives that have been articulated.
7. Innovation is a core value in this organization.
8. We have continuous strategic initiatives aimed at gaining a competitive advantage.
9. Our strategic planning process is opportunity oriented as opposed to process oriented.

To ensure participants understand the types of innovations referred to, I provided a summary before the questions. Dobni (2008) achieved reliability of the original instrument by maintaining a Cronbach's alpha reliability coefficient of at least .71 after an electronic survey conducted with 509 participants. Dobni (2008) provided permission to use the innovative culture measurements (see Appendix B).

Data Analysis Plan

To ensure the integrity of the collected data, I created the directions and summaries using vocabulary and language suitable for the participants. The survey contained simple check boxes for participants to choose their level of agreement with a specific question. For example, one question was as follows: "Innovation is an underlying culture and not just a word." Participants were able to choose Box 1 through Box 5 to indicate the level to which they agreed that their organizational leaders embraced innovation as a culture. I discarded any incomplete surveys from the downloaded data

after meeting the required participant count. Data analysis involved using IBM Statistical Package for Social Sciences (SPSS), Version 24. Using the electronic data captured from Survey Monkey, I uploaded a copy to SPSS to avoid any duplication errors. A copy of the original download from Survey Monkey will remain in an encrypted format for at least 5 years.

The research questions for this study were as follows:

Research Question 1: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology?

$H1_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

$H1_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

Research Question 2: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information

technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization)?

$H2_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

$H2_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

In the second research question, I controlled for additional independent variables including age, gender, years of information systems work experience, and region and locale of the organization. This study included correlational statistics to measure the relationship between the stated independent variables and the dependent variable, which was innovation propensity. Using Pearson's correlation coefficient (r), which has a range of -1.0 to +1.0, I was able to uncover the degree of relationship between the independent and the dependent variables. Correlation coefficients closer to -1.0 indicate a lack of correlation, whereas a coefficient closer to +1.0 indicated a strong correlation. As the hypothesis for the second research question contained more than one independent variable, I conducted a multiple regression analysis. Multiple regression is a common

analysis when researchers use multiple independent variables with a single dependent variable (Clow & James, 2014; Neuman, 2011). Measuring the bivariate correlation (β) helped to demonstrate the degree to which the control variable affected the dependent variable. If the beta between a control variable and the dependent variable is small, then the control variable has little or no effect on the dependent variable.

Threats to Validity

External Validity

Common threats to the external validity of quantitative research include population generalization, naturalistic generalization, mundane realism, reactivity, the Hawthorn effect, theoretical generalization, and experimental realism (Neuman, 2011). The primary concern of external validity is whether the research results are generalizable from the smaller sample size to the entire population. In this study, population generalization was a component of concern. To ensure the results would be generalizable among a larger population, I employed control variables such as age, gender, number of years as an information systems staff member, size of the organization, and geographic location of the organization. To ensure population generalization would be possible, I used simple random sampling, as suggested by Wolf, Joye, and Smith (2016). Random sampling technique also increases external validity. Additionally, having an appropriately sized sample and using a statistical power of .80 will ensure construct validity.

Internal Validity

Internal validity threats occur when variables other than the independent variable affect the dependent variable. Neuman (2011) noted that 12 threats against internal

validity exist: selection bias, history, maturation, testing and unreliable measures, instrumentation, experimental mortality, statistical regression effect, diffusion of treatment or contamination, compensatory behavior, experimenter expectancy, demand characteristics, and the placebo effect. Although unlikely, the internal threat to this research was the instrumentation and measures. If measures are unreliable, outcomes can become indistinguishable (Mathison, 2005). This was not likely, as the original authors and other researchers have previously validated the measures (Dobni, 2008; Lazarus, 1966) using an exhaustive literature review and pretest samples.

Ethical Procedures

Few ethical concerns arose from this study. Although the target population was information systems staff members at ambulatory health care facilities, the study included no PHI. The demographics collected about the organizations were only their type of organization and their region within the United States. The demographics about the individual participants were their age, gender, and years of employment at current organization. All participants had to be 21 years of age or older and provided informed consent at the start of the survey. Without receiving initial demographic requirements and placing a check in the informed consent box, participants would have been unable to proceed with the survey. Within the informed consent process, participants received information about their right to anonymity and their ability to withdraw from the study at any time during the survey. Before the survey responses were available to the public, Walden University's IRB provided the necessary permissions to proceed (approval

number 06-16-17-0285390). The data collected will remain in its original format for at least 5 years, encrypted and stored in a cloud application.

Summary

Chapter 3 included a combination of constructs that assisted in understanding if a correlation existed between active coping of technology threats, avoidance of technology threats, and the innovation propensity of ambulatory health care organizations. For this quantitative correlational study, the basis of the survey constructs included the work of Dobni (2008) for innovation propensity, along with Carver et al. (1989) and Liang and Xue (2009) for active coping and technology threat avoidance measures. The data collected represented the perspectives of information systems staff regarding the senior leaders of their organization. This chapter included a description of how the operationalization of variables and the collection, analysis, and interpretation of the data. This chapter also included details about the validity of the study, as well as any ethical concerns. Chapter 4 includes a detailed analysis of the survey results and Chapter 5 contains a summary of the findings, limitations, and positive social change implications.

Chapter 4: Results

Introduction

The purpose of this quantitative correlational study was to explore the possible relationship between an overavoidance of technology threats by senior health care leadership and the innovative technology-use decisions of health care delivery organizations. Researchers have highlighted the barriers to innovation in the healthcare industry—financial barriers, lack of fit with exiting process, and loss of controls through the automation of tasks (Cresswell & Sheikh, 2013). These barriers could explain why innovation in healthcare information technology falls short when compared to other industries. In this study, I sought to measure the effects of another barrier: technology threat avoidance. Survey Monkey was used to gather data from 90 information systems staff in ambulatory care facilities. Through statistical analysis of the responses, I determined the degree of correlation between technology threat avoidance of senior leaders and the innovation propensity of their organizations.

Shown a few pages below, Table 1 displays the frequency counts for the demographic variables in the study. Table 2 provides the psychometric characteristics for the three summated scale scores. Table 3 displays the Pearson intercorrelations for the three summated scale scores to answer Research Question 1. Table 4 provides the Pearson correlations for the predictor variables with the three summated scale scores. Table 5 displays the results of the multiple regression analysis model that predicted innovation propensity based on the predictor variables to answer Research Question 2.

The research questions are foundational for this study and were as follows:

Research Question 1: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology?

$H1_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

$H1_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology.

Research Question 2: What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization)?

$H2_0$: There is no statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

$H2_a$: There is a statistically significant relationship between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

In Chapter 4, I provide additional information about the use of the social media platform, LinkedIn, for the sampling selection process. I discuss the analysis of the sample, describe the demographic characteristics, and discuss of the results. Details about the following topics are also discussed: (a) data collection, (b) demographics of the survey participants, (c) data cleaning and outcomes of assumption testing, (d) analysis and results of the data with respect to each research question, and (e) a summary of the findings.

Data Collection

Upon receiving IRB approval on June 15, 2017, I began data collection. The survey went out to a national audience. Using healthcare information technology related user groups on LinkedIn, a professional social media platform, I targeted information technology staff members of healthcare delivery organizations. This study was centered around the idea that healthcare information technology innovation is lacking in rural ambulatory care facilities more than other types of healthcare delivery organizations. As such, participants were asked to identify the type of organization they worked at so that a random sampling of qualified participants could be used. After the Walden IRB approved my study (Approval No. 06-16-17-0285390), I posted an invitation to participate in

multiple LinkedIn user groups. The invitation provided a summary of the research purpose. The invitation provided a link to the consent form. For the participants who agreed to the informed consent, a link to the survey was provided.

At the start of the survey, participants provided information regarding their gender, age, United States geographical region of their organization, information technology role within their organization, length of time at their current organization, as well as the type of healthcare delivery organization. To maintain the validity and generalizability of the study, 75 participants were needed. Having 75 participants would have also helped maintain a power level of .80. With 90 successful samples to study, the minimum requirement was adequately met.

Recruitment and Response

After receiving IRB approval, I posted the invitation to participate in the study in the LinkedIn Group called Health 2.0. After 3 days, I received zero responses. This was not atypical to the responses rates discussed by Dusek, Yurova, and Ruppel (2015) for hard to reach participants. A more popular group on LinkedIn at the time of this study was hosted by the Health Information and Management Systems Society (HIMSS). That group contained over 170,000 members. All members of that group did not qualify due to lack of employment time at their current organization or not having a role directly related to the maintenance, implementation, or support of information technology systems. After sorting through the members, I invited 1500 healthcare information technology staff members from various healthcare delivery organizations who were also a member of the HIMSS LinkedIn Group. Of the 1500 invitations, 353 respondents began the survey. The

survey was available for 2 weeks, closing on June 30, 2017. Among the total invitations sent, 90 results were used in the final study, providing a 6% successful response rate.

Baseline Characteristics

Rural ambulatory care facilities were the primary target to study. After analyzing the demographics of participants who completed the survey, I discovered a low yield of rural facility participants. The most frequently represented types of healthcare delivery organizations were critical access hospital associated with a health system, urban hospital associated with a health system, and teaching hospitals. There are several reasons why fewer participants were from rural facilities. Those reasons are explained more in the limitations section of Chapter 5. Ages of participants ranged from 21 to 60 or older, with a median age of 54.50 years. Fifty-three of the respondents were female, and 37 were male.

Data Cleaning

Initially, 353 respondents began the survey. After answering the three screening questions (age 21 or older, information technology job in a healthcare delivery organization and work at least 30 hours a week), the sample was reduced to $n = 117$. The number of missing answers was then calculated, and those ranged from zero to nine missing answers. Respondents with either zero or one missing answer were retained further reducing the sample to $n = 98$. For those with one missing answer, their missing answer was imputed using the mean response for the entire sample.

Results of the Study

Table 1 provides the frequency counts for the demographic variables. All respondents worked at least 30 hours per week at their healthcare organization (100.0%). Ages ranged from 21 to 60 or older, with a median age of 54.50 years. Fifty-three of the respondents were female, and 37 were male. The most frequently represented regions of the United States were West South Central (16.7%), South Atlantic (14.4%), and Pacific (14.4%). The most frequently represented types of healthcare delivery organizations were "Critical access hospital associated with a health system" (16.7%), and "Urban hospital associated with a health system" (11.1%). Time worked for current healthcare delivery organization ranged from a year or less (10.0%) to more than eight years (42.2%) with a median of five years. The most frequently represented job levels were "Senior level with no management responsibilities" (34.4%) and "Middle management" (20.0%) (see Table 1).

Table 1

Frequency Counts for Selected Variables (N = 90)

Variable	Category	*n*	%
Do you work at your healthcare organization at least 30 hours a week?			
	Yes	90	100.0
What is your age? [a]			
	21-29	9	10.0
	30-39	15	16.7
	40-49	17	18.9

	50-59	30	33.3
	60 or older	19	21.1
What is your gender?			
	Female	53	58.9
	Male	37	41.1
In which region of the United States is the healthcare delivery organization of which you are employed, located?			
	New England	8	8.9
	Middle Atlantic	12	13.3
	East North Central	11	12.2
	West North Central	6	6.7
	South Atlantic	13	14.4
	East South Central	4	4.4
	West South Central	15	16.7
	Mountain	8	8.9
	Pacific	13	14.4
Which option best describes the type of healthcare delivery organization at which you work?			
	Rural Ambulatory Care Facility associated with a health system	4	4.4
	Independent Critical Access Hospital	4	4.4
	Critical Access Hospital associated with a health system	15	16.7
	Urban Hospital associated with a health system	10	11.1
	Teaching Hospital	9	10.0
	Independent Family Practice	4	4.4
	Independent Specialist Clinic (Ortho, Gyno, Endo, etc)	4	4.4
	Other	40	44.4

[a] *Mdn* = 54.50 years.

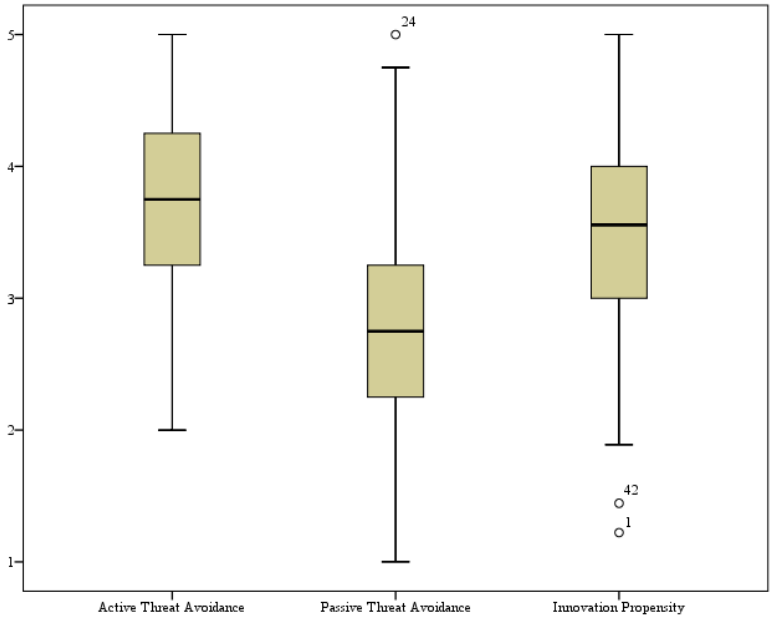
(table continues)

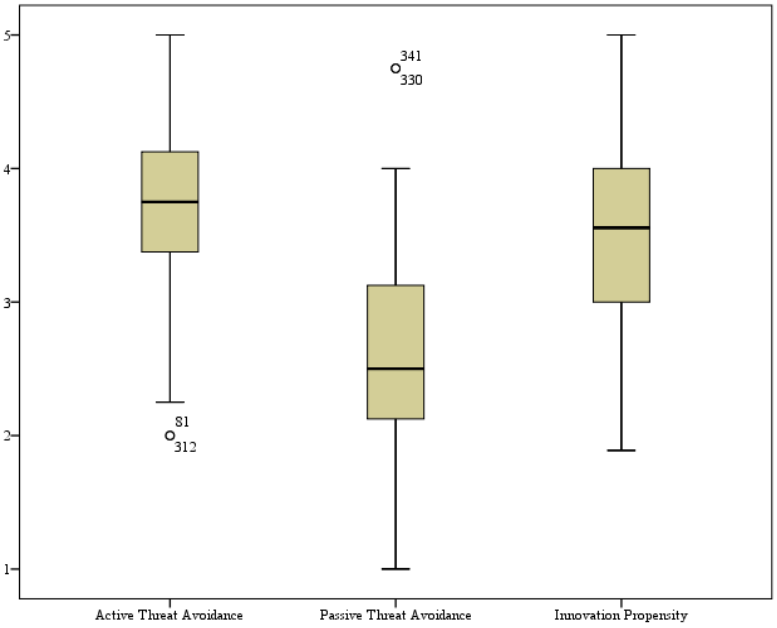
Variable	Category	*n*	%
How long have you worked at your current healthcare delivery organization? [b]			
	1 year or less	9	10.0
	More than 1 year, but less than 2 years	5	5.6
	2 to 4 years	20	22.2
	4 to 6 years	11	12.2
	6 to 8 years	7	7.8
	More than 8 years	38	42.2
Which of the following best describes your current job level?			
	Executive/C-Level (CIO, CTO, COO, CISO, etc.)	10	11.1
	Senior Management (Director, Asst. Director, etc.)	12	13.3
	Middle Management (Manager, Team Lead, etc.)	18	20.0
	Senior level with no management responsibilities (Senior Analysts, Senior Developer, etc.)	31	34.4
	Intermediate (Junior Analyst, Junior Developer, etc.)	7	7.8
	Entry Level (Support Technician, Analyst, etc.)	12	13.3

[b] *Mdn* = 5 years.

Assumption Testing

Boxplots were used to identify univariate outliers (see Figure 1). After four rounds of boxplots, the sample was reduced from $n = 98$ to $n = 90$. Inspection of the final boxplots suggested the assumption of univariate normality was met. Using the Mahalanobis distance statistic, no multivariate outliers were identified. Bivariate scatterplots and Pearson correlations were used to assess the linearity between the two predictor variables and the criterion variable (see Figure 2 and Table 3). Inspection of the scatterplot found linearity was clearly evident between active threat avoidance and innovation propensity ($r = .51$, $r^2 = .260$, $p = .001$). For passive threat avoidance with innovation propensity, the linear pattern was not as evident ($r = -.20$, $r^2 = .040$, $p = .056$) but inspection of the scatterplot found no discernable non-linear pattern (see Figure 2). The Durbin-Watson autocorrelation statistic ($DW = 1.19$) suggested that assumption was met. No multicollinearity was evident based on the variance inflation factor (VIF) scores. Figure 3 displays the multiple regression residual analyses to assess normality, linearity, and homoscedasticity among the residuals. These assumptions were also met. Taken together, the assumptions for the multiple regression model in Table 5 were adequately met.


5
4
3
2
1
24
42
1
Active Threat Avoidance
Passive Threat Avoidance
Innovation Propensity


5
4
3
2
1
341
330
81
312
Active Threat Avoidance
Passive Threat Avoidance
Innovation Propensity

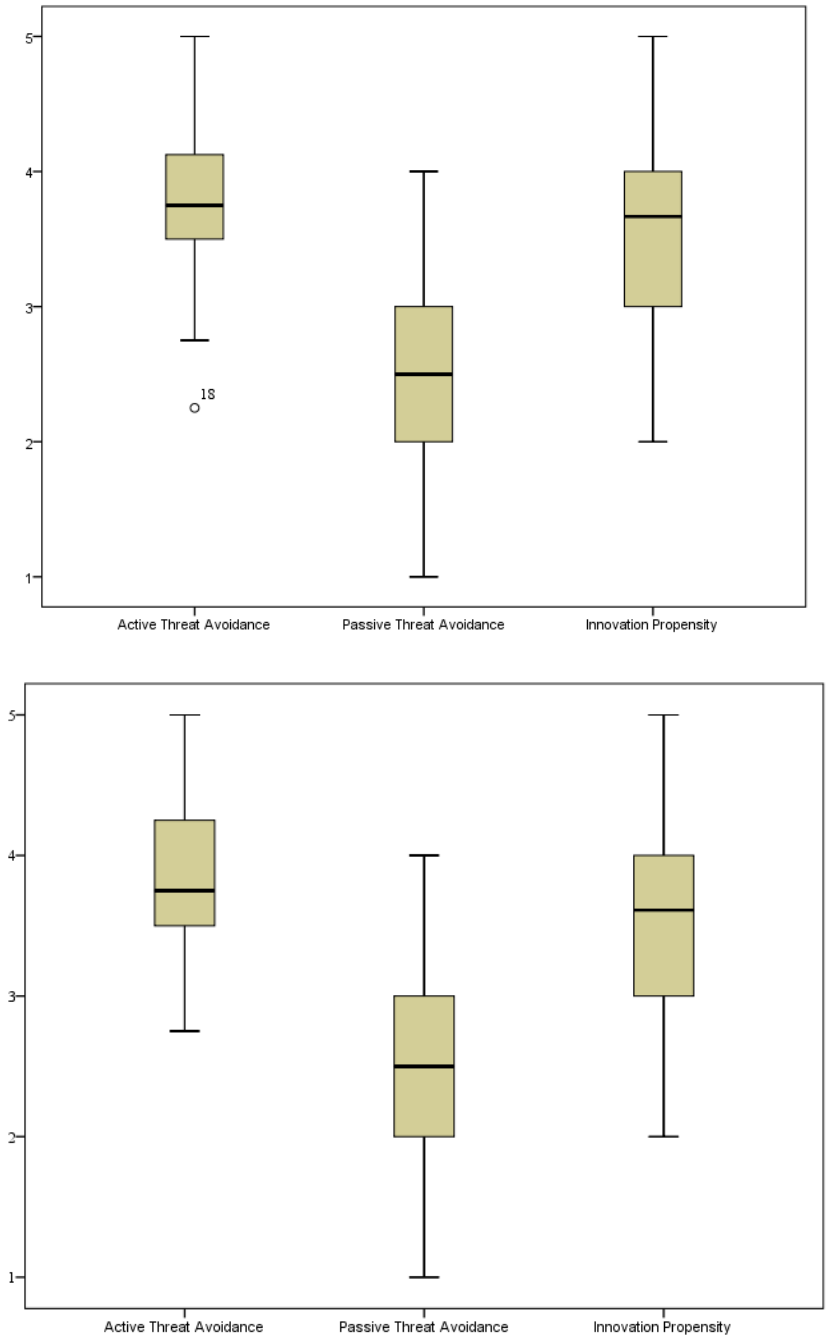
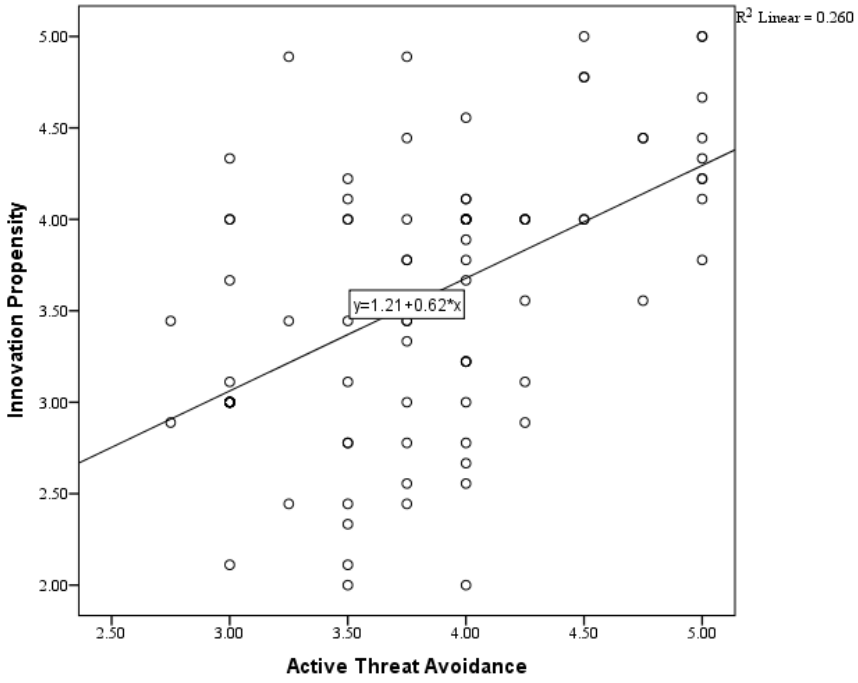
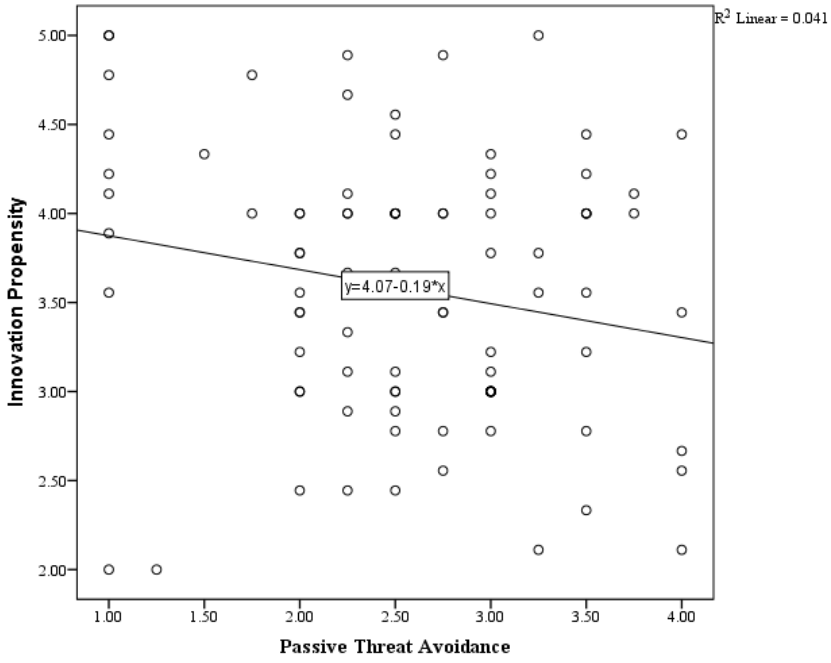


Figure 1. Four rounds of boxplots to identify univariate outliers and assess normality. *Note*. Round 1 (*n* = 98), round 2 (*n* = 95), round 3 (*n* = 91), and round 4 (*n* = 90).


R² Linear = 0.260
y=1.21+0.62*x
Innovation Propensity
Active Threat Avoidance
5.00
4.50
4.00
3.50
3.00
2.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00


R² Linear = 0.041
y=4.07-0.19*x
Innovation Propensity
Passive Threat Avoidance
5.00
4.50
4.00
3.50
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2.50
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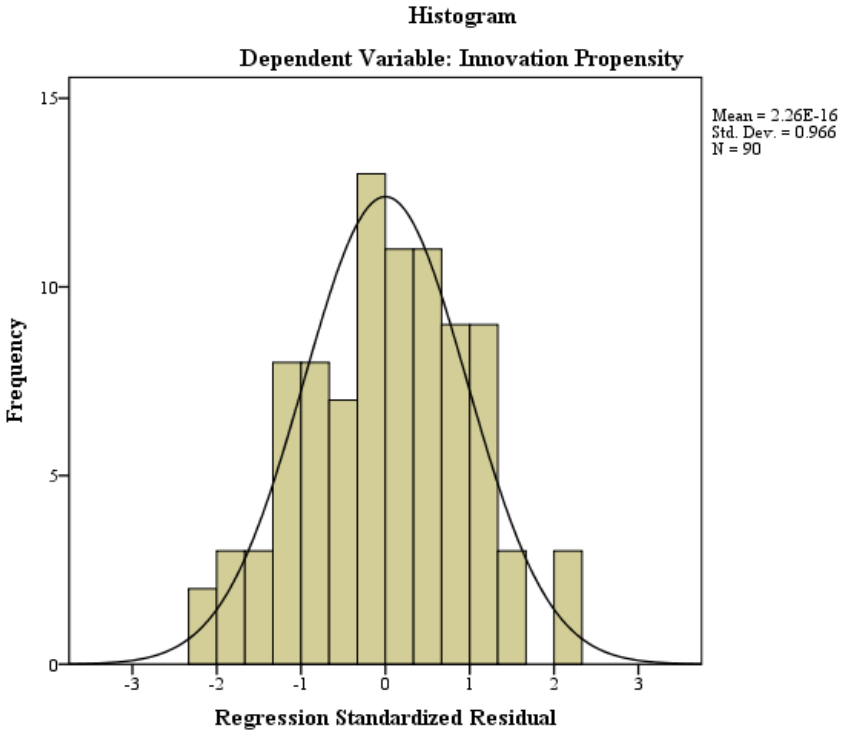
Figure 2. Scatterplots between predictor variables and criterion variable to access linearity (*N* = 90).



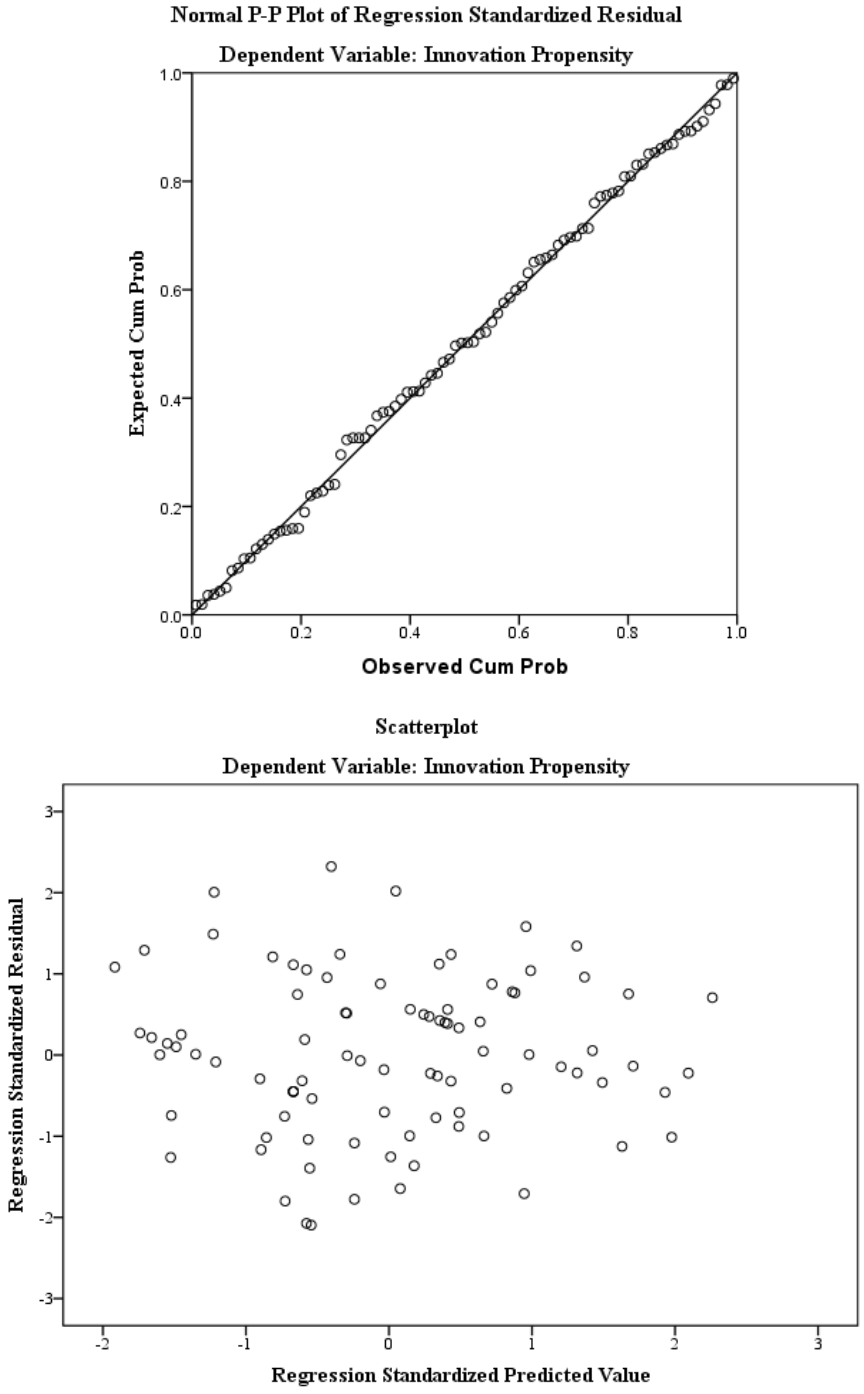


Figure 3. Residual analysis to access normality, linearity and homoscedasticity (N = 90).

Reliability Analysis

Table 2 displays the psychometric characteristics for the three summated scale scores: active threat avoidance, passive threat avoidance, and innovation propensity. The Cronbach's α reliability coefficient ranged from $r = .76$ to $r = .92$. This suggested that all three scales had adequate levels of internal reliability (Field, 2013) (see Table 2).

Table 2

Psychometric Characteristics for Summated Scale Scores (N = 90)

Score	Number of items	*M*	*SD*	Low	High	α
Active Threat Avoidance	4	3.83	0.62	2.75	5.00	.78
Passive Threat Avoidance	4	2.57	0.80	1.00	4.00	.76
Innovation Propensity	9	3.58	0.75	2.00	5.00	.92

Research Questions and Hypothesis Findings

Research Question 1. Research Question 1 asked, What is the relationship, if any, between the perception of Information Systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology? The related null hypothesis predicted $H_0 1$: There is no statistically significant relationship between the perception of Information Systems staff about their senior leadership's level of technology threat avoidance and their

organization's propensity for innovation in healthcare information technology. To test this, Table 3 provides the Pearson intercorrelations for active threat avoidance, passive threat avoidance, and innovation propensity. A significant negative correlation was found between active threat avoidance and passive threat avoidance (r = -.34, p = .001). Active threat avoidance was positively related to innovation propensity (r = .51, r^2 = .260, p = .001). Passive threat avoidance tended (r = -.20, r^2 = .040, p = .056) to be negatively related to innovation propensity. In general, r values of + or -.300 represent a moderate relationship. Field (2013) suggests that the correlation values be reviewed in the context of the research. My research is explorative and therefore allows for more variance. This combination of findings provided partial support to reject the null hypothesis for Research Question 1 (see Table 3).

Table 3

Pearson Intercorrelations among the Summated Scale Scores (N = 90)

Score	1		2	3
1. Active Threat Avoidance	1.00			
2. Passive Threat Avoidance	-.34	***	1.00	
3. Innovation Propensity	.51	****	-.20	1.00

* p < .05. ** p < .01. *** p < .005. **** p < .001.

Research Question 2. Research Question 2 asked, What is the relationship, if any, between the perception of information systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in

healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization)? The related null hypothesis predicted $H2_0$: There is no statistically significant relationship between the perception of Information Systems staff about their senior leadership's level of technology threat avoidance and their organization's propensity for innovation in healthcare information technology after controlling for the information systems staff's demographic characteristics (age, gender, years of employment at current organization).

Control Variables. As a preliminary analysis, Table 4 displays the Pearson correlations for the control variables (age, gender, time worked at current organization, and rural organization) with active threat avoidance, passive threat avoidance, and innovation propensity. For the resulting 12 correlations, none were significant at the $p < .05$ level. However active threat avoidance tended ($r = .18$, $r^2 = .032$, $p = .09$) to be higher in rural organizations (see Table 4).

Table 4

Pearson Correlations for Control Variables with Summated Scale Scores (N = 90)

Variable	Active threat avoidance	Passive threat avoidance	Innovation propensity
Age	-.14	-.11	-.05
Gender [a]	-.12	-.06	-.16
Time worked at current organization	-.02	-.01	.14
Rural organization [b]	.18	-.07	-.08

* $p < .05$. [a] Coding: 1 = *Female* 2 = *Male* [b] Coding: 0 = *No* 1 = *Yes*

To test the hypothesis, Table 5 provides the results of the multiple regression analysis model that predicted innovation propensity based on age, gender, time worked at current organization, rural, active threat avoidance, and passive threat avoidance. The six-variable model was statistically significant (p = .001) and accounted for 32.6% of the variance in the dependent variable. Specifically, higher scores for innovation propensity were related to higher scores for active threat avoidance (β = .51, p = .001), and not working in a rural organization (β = -.18, p = .05). Also, innovation propensity was not related to passive threat avoidance (β = -.05, p = .61). These findings provided partial support to reject the null hypothesis for Research Question Two (see Table 5).

Table 5

Prediction of Innovation Propensity Based on Selected Variables using Multiple Regression (N = 90)

Variable	*B*	*SE*	β	*p*
Intercept	1.38	0.72		.06
Age	-0.02	0.06	-.04	.72
Gender [a]	-0.15	0.14	-.10	.30
Time worked at current organization	0.07	0.04	.16	.10
Rural Organization [b]	-0.32	0.16	-.18	.05
Active Threat Avoidance Scale	0.62	0.12	.51	.001
Passive Threat Avoidance Scale	-0.05	0.09	-.05	.61

Final Model: F (6, 83) = 6.69, p = .001. R^2 = .326. [a] Coding: 1 = *Female* 2 = *Male* [b] Coding: 0 = *No* 1 = *Yes. Note*. Durbin-Watson autocorrelation statistic: 1.91.

Summary

In summary, this study used survey responses from 90 information systems staff in ambulatory care facilities to determine the relationship between avoidance of technology threats by healthcare senior leaders and innovative technology-use decisions of healthcare delivery organizations. Hypothesis 1 (threat avoidance with innovation) received partial support (see Table 3). Healthcare delivery organizations with senior leaders who actively avoided technology threats significantly show a higher propensity to innovate. Healthcare delivery organizations with senior leaders who passively avoided technology threats tended to show a lower propensity to innovate. Hypothesis 2 (threat avoidance with innovation controlling for demographics) also received partial support (see Table 5). Healthcare delivery organizations in non-rural settings tended to show a higher tendency to innovative, while healthcare delivery organizations in rural settings such as rural ambulatory care facilities and critical access hospitals tended to show a lower level of innovation.

In the Chapter 5, these results will be interpreted. These findings will be compared to the literature, social implications and conclusions will be drawn, and a series of recommendations will be suggested.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative correlational study was to explore the possible relationship between an overavoidance of technology threats by healthcare senior leadership and innovative technology-use decisions of healthcare delivery organizations. Researchers have studied the reasons why health care delivery organizations lag in innovation and technology adoption from numerous angles. Cresswell and Sheikh (2013) highlighted human factors, such as the feeling of losing control over a process; the fit of new technology into existing business processes; and financial burdens. Despite plentiful research about HCIT adoption, the innovation and acceptance of new technology remain flat (Cresswell & Sheikh, 2013). I proposed that another reason might contribute to the lack of innovation in some healthcare delivery organizations. To understand the potential correlation, I surveyed information systems staff who worked in healthcare delivery organizations in the United States.

Survey participants for this correlational study were not only dispersed throughout the country, but also varied in their job level, length of employment at their current organization, number of years working in the information technology field in general, and age. Although those demographic factors did not significantly affect the correlation between the independent variable, technology threat avoidance, and the dependent variable, innovation propensity, they did help ensure generalizability of the study. To better understand the correlation, the participants' 90 surveys were analyzed. I discovered that a significant positive correlation exists between actively coping with technology threats and innovation propensity. In other words, it appears that organizations with

senior leaders who work towards dealing with technology threats, such as spam, phishing, data breaches, and data loss, are more likely to be innovative.

Interpretation of Findings

Rural Facilities and Innovation

Gabriel et al. (2014) noted that urban health care delivery organizations have greater financial capabilities and serve a population of patients that expect innovation. This study confirmed that nonrural facilities showed a higher propensity to innovate. Other researchers have demonstrated that leaders of successful urban-based health care delivery organizations have successfully deployed medical information technology involving intelligent mobile devices, such as fall detectors, heart rate monitors, glucose monitors, and other networked devices (Yang et al., 2015). Modern HCIT also consists of data analytics and cloud computing (Yang et al., 2015). Telemedicine platforms have moved from site-to-site implementations (Ricketts, 2000) to site-to-patient implementations, which allow for instantaneous access to medical care (Yang et al., 2015).

Correlating the technology threat avoidance theory and innovation propensity only adds one data element to the larger discussion of innovation within healthcare IT. Threat avoidance covers 36% of the reasons why innovation is lacking. The other 74% likely consists of ease of use (Ben-Assuli, 2015), user resistance (Escobar-Rodríguez & Romero-Alonso, 2014), the relative advantage of the innovation (Patel & Antonarakis, 2013), a perceived increase in workload (L'Esperance & Perry, 2016), a lack of technology support and training (Gabriel et al., 2014; Herbert & Connors, 2016;

L'Esperance & Perry, 2016; Marsan & Paré, 2013), the size of an organization (Zhang et al., 2013), clinical knowledge (Davey et al., 2011), bureaucracy and communication challenges (Dias & Escoval, 2012; Ford et al., 2016), and privacy concerns (Ben-Assuli, 2015; Ford et al., 2016).

Rural ambulatory facilities and critical access hospitals play a pivotal role in the continuity of care for patients in nonurban areas. Hence the term “critical,” these facilities are often the link between remote communities and major cities. In this study, I determined that rural organizations tended to have lower innovation propensity measurements and higher active threat avoidance measurements. It is important that senior leaders at those types of organizations understand the necessity to innovate for safer care of patients.

Technology Threat Avoidance Theory

The technology threat avoidance theory has existed since 2009, so it has only a few uses compared to other technology-related theories. Xue et al. (2015) used the theory to correlate the lack of telemedicine adoption in Ethiopia due to coping mechanisms enacted in response to threats. In their literature, threats referred to “reduced autonomy, anxiety, and cost” (Xue et al., 2015, p. 538). Correlating resistance with their defined threat avoidance, Xue et al. supported the notion that the coping mechanism hindered the adoption of telemedicine. Passively avoiding threats was not a positive coping mechanism for the surveyed organizations. With the findings in this dissertation, I agree that the avoidance of technology threats, or passive threat avoidance, negatively impacts an organizations ability to innovate.

The technology threat avoidance theory states that, users who are aware of countermeasures and believe they are useful will cope with the threats using the countermeasures (Liang & Xue, 2009). Coping using countermeasures is considered active coping, which my research findings proved to be beneficial. Also, as stated in the theory, if the threat seems too great to overcome, users will avoid the threat or ignore it (Liang & Xue, 2009). Tu et al. (2015) underscored the theory that users who are more aware of technology protections will use those protections and that those who have experienced a prior incident with a technology threat are more likely to believe they cannot avoid such threats.

Coping with Technology Threats

Active coping of technology threats had a significant positive correlation with innovation propensity. That finding is in line with existing research in that security and privacy of data can be a sizeable hindrance to innovation. In a systematic literature review of 4,223 articles, 48 of which were acceptable for the study, the primary inhibitor for not adopting mHealth was the concern of the privacy and security of patient data (Gagnon, Ngangue, Payne-Gagnon, & Desmartis, 2016). The publication dates of most of the articles used in their study were between 2005 and 2014. While conducting a systematic literature review, Gleason (2015) concurred that the security and privacy of patient data were the largest barriers preventing broader adoption of mHealth. Despite having multiple benefits for both patients and health care delivery organizations, security is an overwhelming concern that denies an innovation such as mHealth. Research findings that specifically cover the effects of technology threat related risks are relatively

scarce. The results in this study should become a major indicator that technology threats need to be actively dealt with to avoid hindering innovation.

Limitations of the Study

Surveying healthcare information technology professionals represented a limitation. That subset of healthcare related employees is relatively scarce when compared to information technology employees of other industries. Using random sampling further limited the study. In general, survey participants of academic surveys are declining (Dusek, Yurova, & Ruppel, 2015). Because of the decline of participants, it is suggested that "innovative methods such as social media" be used to collect samples (pg. 280). Using social media presents additional limitations as well. In the case study highlighted within their article, Dusek, Yurova, and Ruppel (2015) discussed an academic study about hotel employees. The researcher originally used a LinkedIn group that did not yield the intended participants. Having a low yield of participants was a similar scenario I encountered.

Obtaining the perspective of information technology staff members within a healthcare delivery organization presented an additional limitation. Some participants may not have an adequate depth of knowledge about the decisions of senior leaders to provide an accurate response. In larger organizations, several levels of supervision often shield entry level and junior level employees from senior leaders. Varying job levels increased the likelihood that survey participants may have been from the same organizations, but expressed varying opinions. Being anonymous, I would have no way

of grouping responses to gain a comprehensive view of the innovation propensity of a particular organization.

Participants were asked about their organization's latest encounter with technology threats. The incident in question could have happened months or years ago, requiring the participant to rely on a distant memory of the circumstances. Also, the coping measures do not account for the severity of the technology threat. For example, a data breach might be considered more severe than a spam-related email. As such, the handling of the threat by senior leaders might be interpreted differently.

An original requirement for successful participation was to be an employee of their current organization for 2 or more years. This presented a challenge with data collection as many healthcare information technology professionals within the sample population were new to their role. Nearly 16% of the participants had been at their current organization less than 2 years. After reviewing their LinkedIn profile, it could be noted that they were not new to information technology, just new to their current organization. Because of that limitation, the requirement was removed from the sampling process.

Recommendations

Technology threat avoidance and innovation propensity were the central tenants of this study. After successfully collecting and analyzing 90 samples, I have discovered that rural healthcare delivery organizations tended to be less innovative. I have also discovered that organizations with senior leaders who actively avoid technology threats have a higher propensity to innovate. These findings account for only a portion of the

reasons why a healthcare delivery organization might implement innovative technology. Several recommendations could further the results of this study, therefore furthering the potential for healthcare delivery organizations to be innovative.

Attempting to understand the entire innovation culture of a healthcare delivery organization is worthy of scholarly research and serves as my first recommendation. Analyzing the entire culture would have increased the scope of my study beyond a reasonable point for a dissertation. Innovation Propensity is one of seven factors in the Innovation Culture measurement. The culture measurement combines seven factors to create four overall themes, Innovation Intention, Innovation Infrastructure, Innovation Influence, and Innovation Implementation. In this study, I considered one factor related to Innovation Intention, that being Innovation Propensity. The intent to innovate is the starting line of having an innovative culture.

With a strong intent to innovate, an organization might be better positioned to overcome the subsequent factors of innovation infrastructure, influence, and implementation. Within innovation infrastructure, an organization might provide educational opportunities that are associated with innovation objectives, after obtaining a better understanding of how creative employees are (Dobni, 2008, p. 551). Within innovation infrastructure, the level of empowerment for employees to create and release products or services related to the innovation objectives is also important. The innovation influence dimensions contain factors related to both market orientation and value orientation. Both factors are relative to employees understanding of the organization's position in their respective market segment, as well as the value provided to the

customers. The last dimension measured for innovation culture is the innovation implementation. Within the innovation implementation dimension, the level of innovation execution is of primary concern. In the healthcare industry, several inhibitors can affect an organization's ability to innovate, with an intention to innovate being the starting point. Broadening the scope of research relative to innovation culture is recommended for future research.

A minimal cross section of employees was surveyed. I recommend that future researchers account for job levels as another controlling variable. The criteria were healthcare information technology professionals. Within that domain, different levels of employees were surveyed. Each participant was asked if they were at the executive level (CIO, CTO, COO, CISO, etc.), senior management (Director, Assistant Director, etc.), middle management (Manager, Team Lead, etc.), senior level with no management responsibilities (Senior Analyst, Senior Developer, etc.), intermediate level (Junior Analyst, Junior Developer, etc), or entry level (Support Technician, Analyst, etc). Understanding the controlling variable of employee levels helped guide the study. Participants with higher management levels sometimes understand innovation objects better than entry-level employees. Although the position levels were not used in this study as a controlling variable, it might be prudent to do so in future research.

LinkedIn was used to obtain participants, which became one of the most limiting factors of the study. It would be prudent for future researchers to use other platforms to obtain participants. Reaching out directly to members of healthcare related organizations such as HIMSS could provide researchers a broader set of participants. Using LinkedIn

also created an additional layer of asynchronous communication in that some participants do not view their LinkedIn messages in real-time. Several invited participants did not respond to the invitation until after the survey had closed. As such, researchers might benefit from an extended survey period, allowing one to two months for survey collection.

Only the perspective of IT staff was obtained. As a recommendation, the point of view of nurses, physicians, and other employees should be obtained, then compared to the survey results of senior leaders. Additionally, correlating other factors that might affect propensity such as funding, fit, and features are also recommended. Having the foresight to innovate but not having the infrastructure is different from not having foresight at all. Recommended research questions could include, what is the correlation between innovation propensity of healthcare delivery organizations and technology threat avoidance when controlling for employee demographics, organizational funding, and features of new technology?

Implications

Social Change

With study, I have highlighted the notion that actively avoided technology related threats leads to a higher level of innovation. Increased levels of innovation leading to positive social change mean individuals may be able to receive high-quality care at a hospital, nursing home, or clinic. As the number of patients in medical facilities increases, in part due to an aging Baby Boomer population and large Millennial population, the staff members of health care organizations must maintain and protect

more records. From a social change standpoint, the security and privacy of patient records are vital. Furthermore, the safety of the growing number of patients is essential. Research shows that a lack of technology in health care lessens the accuracy of providers (Waegemann, 2016). However, as the use of technology increases so does the need for information security.

Organizational

At the organizational level, innovation is a cornerstone of success. The results of this study have the potential to be useful to managers in the health care industry, who may subsequently be better able to adopt life-saving technologies while simultaneously actively avoiding technological threats. Active avoidance, meaning using tools and resources to overcome the threat, should be at the center of attention when attempting to innovate. The findings of this study revealed that active avoidance tended to occur more in rural healthcare facilities. Urban healthcare facilities showed a higher innovation propensity. From an organizational standpoint, it is paramount that senior leaders at rural healthcare delivery organizations follow the lead of their urban counterparts by providing a better balance of active threat avoidance and innovation. Placing too many restrictions on the use of technology due to the fear of threats can become a hindrance. Several hindering factors slow the innovation process in rural organizations, with technology threat avoidance being revealed as one of them. I believe this is a mindset issue that can be changed more easily than other innovation roadblocks such as finances and governmental regulations.

Policy

Governmental policies such as the HITECH Act and HIPAA have driven more healthcare delivery organizations towards innovative technology use such as the implementation of EHR systems. Some healthcare delivery organizations, such as those found in rural settings are not keeping pace with the growing use of technology in healthcare. Being 17 years into the 21st century, innovation of healthcare delivery has reshaped an organizations ability to provide timely care to needy patients. Innovations such as data analytics have increased the decision support ability of healthcare providers. Innovations such as cloud computing have increased the security and availability of patient data. Innovations such as mHealth have allowed patients and physicians to share critical data elements regarding one's health status. Innovations beyond EHR systems have not become a policy or mandate but should be considered to further pressure organizations to provide more avenues for patient care.

With any new technological advancement comes the possibility of increased threats. Innovation creates a new risk which then creates a new decision for senior leaders, actively avoid the threat or passively avoid it. Actively avoiding threats was shown to be a significantly positive correlation to innovation propensity. As such, policies should be written that not only requires additional beneficial innovations but also how to actively mitigate and avoid the technology threats associated with the innovation. A policy such as that could align healthcare delivery organizations to a higher level of innovation, and help them remain safe doing so.

Theory

Technology threat avoidance. In this study, I used the technology threat avoidance theory as the foundation. The theory posits that "strong threat perceptions can lead to increased emotion-focused coping, which neutralizes employees' desire to cope with threats and hinders their adoption of safeguarding measures" (Liang & Xue, 2009, p. 86). In summary, the theory explains that users who feel that threats cannot be overcome will passively or actively avoid them. Passive avoidance means users will ignore the threats and act as if they either do not exist or do not matter. Active avoidance means users understand that the threat exists and implements countermeasures to overcome the threats. Through the findings of this dissertation, we now have a better understanding of how individuals threat coping measures affects an organization. As stated in chapter four, healthcare delivery organizations with senior leaders who passively avoided technology threats tended to be less innovative. Not only does this study reveal the impact of passive technology threat avoidance, but it also reveals the impact that senior leadership has on an overall organization.

Innovation propensity. Innovation propensity is a single component of a larger innovation culture measurement. Although the measurement does not currently stand as a theory in the traditional definition, the measurement is a critical tool used to uncover the areas of deficiency that organizational leaders should focus on while attempting to become more innovative. Using the entire innovation culture measurement could be a monumental task for a researcher. My use of a single section builds onto the reliability and generalizability of the measurements. The findings of this study add to the body of

knowledge concerning innovation as a whole, while creating implications for senior leaders and researchers to explore more ways the innovation culture measure can benefit healthcare delivery organizations.

Method

In this study, I used a quantitative correlational method to determine that active technology threat avoidance led to higher levels of innovation. Using that method also allowed me to confirm that rural organizations tend to be less innovative. These findings imply that quantitative research is a valuable method as it relates to uncovered correlations among seemingly abstract topics. There are other quantitative methods such as experimental control groups that might reveal similar results. An experiment would have been outside the scope of this study. Nonetheless, this study implies the continued reliability of quantitative research when valid survey instruments are used.

Conclusions

Innovations have been a driver for change within organizations for decades. The healthcare industry has traditionally lagged behind other industries as it relates to innovation. Since 2010, however, some healthcare delivery organizations have increased their pace of change and innovation. The same cannot be said about all healthcare delivery organizations. A lack of technology in health care lessens the accuracy of providers (Waegemann, 2016). With the leading cause of death in the United States being attributed to medical errors, it is vital that senior leaders at healthcare delivery organizations increase their rate of innovation to not only keep pace with other industries but also to reduce the mortality caused by errors.

With this study, I did not uncover all possible reasons why some healthcare delivery organizations do not innovate as quickly as others. However, I have presented more facts about two correlations, rural organizations tend to be less innovative, and organizations with senior leaders who more passively avoid technology threats tend to be less innovative. Senior leadership often drives the vision of an organization. Having senior leaders who passively avoid technology threats in the 21st century is proving to be detrimental to an industry such as healthcare, an industry that has traditionally lagged behind nearly every other industry with regards to the innovative use of technology.

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Appendix A: Research Survey

An Examination of the Relationship between Technology Threat Avoidance and Innovation in Healthcare Organizations

Screening Questions

This study focuses on a specific subset of Healthcare Information Technology professionals. Please answer the following questions before continuing the survey.

* 1. Are you 21 years of age or older?

- ◯ Yes
- ◯ No

* 2. Are your primary responsibilities related to the strategy, maintenance, implementation and/or support of information technology at a Healthcare Delivery Organization?

- ◯ Yes
- ◯ No

* 3. Do you work at your healthcare organization at least 30 hours a week?

- ◯ Yes
- ◯ No

1

An Examination of the Relationship between Technology Threat Avoidance and Innovation in Healthcare Organizations

Demographics

To better understand the problem I am attempting to solve, I'll need some basic demographic information about you and the healthcare delivery organization at which you work.

* 4. What is your age?

- ◯ 21-29
- ◯ 30-39
- ◯ 40-49
- ◯ 50-59
- ◯ 60 or older

* 5. What is your gender?

- ◯ Female
- ◯ Male
- ◯ Other

* 6. In which region of the United States is the healthcare delivery organization, of which you are employed, located?

- ◯ 1. New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
- ◯ 2. Middle Atlantic (New York, New Jersey, Pennsylvania)
- ◯ 3. East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)
- ◯ 4. West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)
- ◯ 5. South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)
- ◯ 6. East South Central (Kentucky, Tennessee, Alabama, Mississippi)
- ◯ 7. West South Central (Arkansas, Louisiana, Oklahoma, Texas)
- ◯ 8. Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)
- ◯ 9. Pacific (Washington, Oregon, California, Alaska, Hawaii)

* 7. Which option best describes the type of healthcare delivery organization at which you work?

- ◯ Independent Rural Ambulatory Care Facility
- ◯ Rural Ambulatory Care Facility associated with a health system
- ◯ Independent Critical Access Hospital
- ◯ Critical Access Hospital associated with a health system
- ◯ Independent Urban Hospital
- ◯ Urban Hospital associated with a health system
- ◯ Teaching Hospital
- ◯ Independent Convenient Care Clinic
- ◯ Convenient Care Clinic associated with a health system
- ◯ Independent Family Practice
- ◯ Family Practice associated with a health system
- ◯ Independent Specialist Clinic (Ortho, Gyno, Endo, etc)
- ◯ Specialist Clinic associated with a health system (Ortho, Gyno, Endo, etc)
- ◯ Other

* 8. How long have you worked at your current healthcare delivery organization?

- ◯ A year or less
- ◯ More than one year, but less than two years
- ◯ Two to four years
- ◯ Four to six years
- ◯ Six to eight Years
- ◯ More than eight years

9. Which of the following best describes your current job level?

- ◯ Executive/C-Level (CIO, CTO, COO, CISO, etc.)
- ◯ Senior Management (Director, Asst. Director, etc.)
- ◯ Middle Management (Manager, Team Lead, etc.)
- ◯ Senior level with no management responsibilities (Senior Analysts, Senior Developer, etc.)
- ◯ Intermediate (Junior Analyst, Junior Developer, etc.)
- ◯ Entry Level (Support Technician, Analyst, etc.)

An Examination of the Relationship between Technology Threat Avoidance and Innovation in Healthcare Organizations

Threat coping measures

* 10. Below are statements on how you perceive your senior leaders (generally non-IT employees who make major purchasing, process, and policy decisions for the entire organization such as C-Suite Executives and Directors) handle or handled the latest incident of technology threats such as malware, spyware, viruses, email phishing, loss of data, etc.

The Senior Leaders:

	I strongly disagree with the statement	I disagree with the statement	I neither agree nor disagree with the statement	I agree with the statement	I strongly agree with the statement
Take additional action to try to get rid of the problem.	○	○	○	○	○
Concentrate their efforts on doing something about it.	○	○	○	○	○
Do what has to be done, one step at a time.	○	○	○	○	○
Take direct action to get around the problem	○	○	○	○	○

* 11. Below are statements on how you perceive your senior leaders (generally non-IT employees who make major purchasing, process, and policy decisions for the entire organization such as C-Suite Executives and Directors) handle or handled the latest incident of technology threats such as malware, spyware, viruses, email phishing, loss of data, etc.

The Senior Leaders:

	I strongly disagree with the statement	I disagree with the statement	I neither agree nor disagree with the statement	I agree with the statement	I strongly agree with the statement
Learn to live with it.	○	○	○	○	○
Accept that this has happened and that it can't be changed.	○	○	○	○	○
Get used to the idea that it happened.	○	○	○	○	○
Accept the reality of the fact that it happened.	○	○	○	○	○

4

An Examination of the Relationship between Technology Threat Avoidance and Innovation in Healthcare Organizations

Innovation Propensity

* 12. For the purposes of this study, Healthcare Information Technology includes a collective of applications, tools, and devices such as electronic health record systems, sensing devices such as wearables, data analytics, and cloud computing just to name a few. Think about your organization's latest innovation efforts and consider your senior leaders' (generally non-IT employees who make major purchasing, process, and policy decisions for the entire organization such as C-Suite Executives and Directors) mindset when answering the following questions:

	I strongly disagree with the statement	I disagree with the statement	I neither agree nor disagree with the statement	I agree with the statement	I strongly agree with the statement
Innovation is an underlying culture and not just a word	○	○	○	○	○
Our business model is premised on the basis of strategic intent	○	○	○	○	○
Our senior managers are able to effectively cascade the innovation message throughout the organization	○	○	○	○	○
We have an innovation vision that is aligned with projects, platforms, or initiatives	○	○	○	○	○
This organization's management team is diverse in their thinking in that they have different views as to how things should be done	○	○	○	○	○
There is a coherent set of innovation goals and objectives that have been articulated	○	○	○	○	○
Innovation is a core value in this organization	○	○	○	○	○
We have continuous strategic initiatives aimed at gaining a competitive advantage	○	○	○	○	○
Our strategic planning process is opportunity oriented as opposed to process oriented	○	○	○	○	○

6

Appendix B: Permission Letters

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AMERICAN PSYCHOLOGICAL ASSOCIATION

Title:	Assessing coping strategies: A theoretically based approach.
Author:	Carver, Charles S.; Scheier, Michael F.; Weintraub, Jagdish K.
Publication:	Journal of Personality and Social Psychology
Publisher:	American Psychological Association
Date:	Feb 1, 1989

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Melvin Fenner Jr <melvin.fennerjr@waldenu.edu>

Your seven-factor model for innovation culture

Dobni, Brooke <dobni@edwards.usask.ca> Tue, Oct 18, 2016 at 5:36 PM
To: Melvin Fenner Jr <melvin.fennerjr@waldenu.edu>

Hello Melvin,

Thank-you for your email. That paper was the initial model that has since evolved to InnovationOne. Please see our website at www.innovationone.us

It is a proprietary model and a copy-right protected model as it represents our IP for our organization. It has proven to be a robust and discriminatory assessment of innovation behavior amongst employees. We have a 72 question version and a lighter 22 question version. We charge a fee for the use of the IP through a licensing agreement. For educational purposes, that fee is $1,000 US, which would grant you the ability to use it for academic research – one time – for your current project. The reason we need to charge is that we incur overhead costs and management time.

You can use the 7 factor model to the extent that you find it useful for no cost as it is in the academic domain. You would have to cite it obviously.

Best regards,

C. Brooke Dobni

From: Melvin Fenner Jr [mailto:melvin.fennerjr@waldenu.edu]
Sent: Friday, October 14, 2016 5:06 PM
To: Dobni, Brooke <dobni@edwards.usask.ca>
Subject: Your seven-factor model for innovation culture

Good day, Professor Dobni.

My name is Melvin Fenner Jr. I am a Ph.D. Candidate at Walden University in the College of Management. I am working on my dissertation, and I have become quite intrigued by your measurement of innovation culture shown in your 2008 research paper.

The purpose of my dissertation is to examine if a relationship exists between healthcare information technology innovation and the avoidance of technology threats by both healthcare information systems staff and executive leaders.

Using your measurements for innovation culture, along with measuring the coping habits of staff faced with technology threats via the Technology Threat Avoidance Theory, I hope to provide more research to the field of innovation and technology adoption.

Please let me know what procedure is required to use your seven-factor model as an instrument in my dissertation.

Thank you for your consideration and I look forward to hearing from you soon.

Respectfully,

Melvin R. Fenner Jr, MBA

Ph.D. Candidate in Management

Concentration: Information Systems Management

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